B.E. (Civil Engineering)

2015 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE - Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)

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REGULATIONS 2015

(CHOICE BASED CREDIT SYSTEM)

(Common to all B.E./ B.Tech. Degree Programmes)

Regulation 2015 has been prepared in accordance with the guidelines given by the University Grants Commission, All India Council for Technical Education and affiliating University incorporating the features of the Choice Based Credit System (CBCS). The Regulation 2015 is applicable to the candidates admitted to the Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) Degree Programmes of the Institution in the academic year 2015-2016 for Regular admission (Academic year 2016-2017 for Lateral Entry) and subsequently.

The regulations hereunder are subjected to amendments as may be decided by the Academic Council of the Institution from time to time. Any or all such amendments will be effective from such date and to such batches of students (including those already in the middle of the programme) as may be decided by the Academic Council.

1. ADMISSION

Candidate, seeking admission to the B.E./B.Tech. Programme, shall satisfy the conditions of admission prescribed by the Directorate of Technical Education and Anna University, Chennai as given below.

1.1 RegularAdmission

Candidates, for admission to the first semester of the eight semesters B.E./B.Tech.
Degree Programmes, shall be required to havepassed:

- Higher Secondary Examination (10 +2) of Curriculum (Regular Academic Stream) prescribed by the Government of Tamil Nadu with Mathematics, Physics, and Chemistry as three of the four subjects of the study prescribed under Part-III or any other examinations of any Board or University or authority accepted by the Syndicate of the University / Directorate of Technical Education (DoTE), Chennai as equivalent there to.

(or)

- Should have passed Higher Secondary Examination of Vocational Stream (Engineering/Technology), prescribed by the Government of TamilNadu.

1.2 Lateral EntryAdmission

1.2.1 The candidates who possess Diploma in Engineering / Technology awarded by the State Board of Technical Education and Training, Tamil Nadu or its equivalent are eligible to apply for Lateral Entry admission to the third semester of B.E. / B.Tech. Programmes in the branch of study as per the eligibility criteria prescribed by the Directorate of Technical Education from time totime.

(or)

1.2.2 The candidates who possess the Bachelor Degree in Science (B.Sc.) (10+2+3 stream) with Mathematics as a subject in B.Sc. iseligible to apply for Lateral Entry admission to the third semester of B.E./B.Tech. Programmes, as per the eligibility criteria prescribed by the Directorate of Technical Education from time to time. Such candidates shall undergo two additional Engineering subject(s) one each in third and fourth semesters, as bridge courses.

2. PROGRAMMES OFFERED

A candidate may be offered admission to any one of the programmes offered by the Institution for the candidates specified in Clause 1.1 and as per the eligibility criteria of DoTE for the candidates under Clause 1.2 from the list given below:

B. E. Programmes

i. Aeronautical Engineering
ii. Agricultural Engineering
iii. Automobile Engineering
iv. Civil Engineering
v. Computer Science and Engineering
vi. Electrical and Electronics Engineering
vii. Electronics and Communication Engineering
viii. Electronics and Instrumentation Engineering
ix. MechanicalEngineering
x. Mechatronics

B. Tech.Programmes

i. Biotechnology

ii. FashionTechnology

iii. InformationTechnology

iv. Textile Technology

v. FoodTechnology

3. STRUCTURE OF THE PROGRAMME

3.1 Every programme shall have a distinct curriculum with syllabi consisting of theory, laboratory, mini-project, life-skills and personality development courses, as prescribed by the respective Boards of Studies, broadly categorizedunder:

(i) **Basic Science** courses including Mathematics, Physics, Chemistry and further specialization in thesesubjects

(ii) **Basic Engineering c**ourses includingEngineering Graphics, Workshop Practices, Basics of Electrical, Electronics, Civil, Mechanical Engineering, Engineering Mechanics and ComputerProgramming.

(iii) **Humanities and Social Science**courses including Language Courses, Management Courses, Life Skills and ProfessionalEthics.

(iv) **Professional Courses** include Discipline Core Courses, Professional Electives, Core Electives and OpenElectives.

(v) **Employability Enhancement Courses (EEC)** includes Project Work and /or Internship, Seminar, Industrial /Practical Training, Value Added and Certificate Courses.

The assortment of different courses shall be designed that the student, at the end of the programme, would be able to be trained not only in his / her relevant professional field but also as a socially mindful human being.

The medium of instruction is English for all the Courses, Examinations, Seminar Presentation, Projects and any other courses that a student registers for.

3.2 Each course is normally assigned a certain number of credits, with 1 credit per lecture period per week, 1 credit for 2 periods of tutorial, 1 credit for 2 periods of laboratory courses, and 1 credit for 2 periods of seminar/project work perweek.

3.3 A Diagnostic Test will be administered to all the B.E. / B.Tech. students after the admission to assess the proficiency in English and based on the score they will be brought under two streams namely, Stream A and Stream B. Students under Stream A will study **Communicative EnglishI** and Stream B will study **Basic English I** under Language Elective I in the First Semester. In the Second Semester, Stream A will be further divided into two categories based on their English language proficiency assessed in the Continuous Assessment, while the upper segment can enroll and study **German / Japanese / French / Chinese /Hindi** and the remaining students of that Stream will study **Communicative English II**. The students under Stream B will study **Basic English II** or may opt for **Communicative English II** based on the assessment carried out at the end of the semester I.

3.4 Every student shall be required to opt for **Nine** electives from the list of electives. Students can opt for the electives (Core / Professional / Open Elective) from any branch of B.E/B.Tech. Programmes, besides his / her own discipline courses, during V to VIII Semesters, if he/she satisfies the prerequisite for that particularcourse.

3.5 However, out of nine electives, every student shall be required to opt for, a minimum of three electives as open electives from the list of open electives of the branch / branches other than his / her branch of specialisation. There shall be no pre-requisite course(s) for such open electives.

3.6 Students can also opt for **one-credit courses** of 15 to 20 hour duration, which will be offered by the experts from the industry on specialised topics. Students can opt for such **one-credit courses** during the semesters I to VII as and when these courses are offered. A student will also be permitted to register the **one-credit courses** offered by other Departments, provided the student has fulfilled the necessary pre-requisites or the courses that may not require any pre-requisites. Under no circumstances, the same one credit course shall be repeated in subsequent semesters in any Department / Centre and a maximum batch size for a given course shall not exceed 40. In the case of disciplines with multiple divisions (intake more than 60) different course(s) shall be offered to other batch(es) ofstudents.

On successful completion of one credit courses, Credits will be indicated in the Grade Sheet, but will not be considered for computing the Cumulative Grade Point Average (CGPA). However, if a student wishes to avail the exemption from any one of the Electives (other than open elective) of the Semester VIII, he / she can do so by exercising his / her option in writing to the respective Head of the Department during the beginning of the VIII Semester, following the equivalence norm, that **one regular elective (**in the **VIII Semester)** is equivalent to **three one- credit courses** completed by the student during the previous semesters, IV to VII. Details of the one credit courses offered by the department shall be forwarded to the Office of the Controller of Examinations. However one credit courses completed during I to III semesters shall be maintained in the Grade sheet as "Additional credits earned" (not considered for the computation of GPA/CGPA).

3.7 Fast Track System shall enable students to undergo a semester-long Internship or Special Training during Semester VIII. A student who secures a minimum CGPA of 8.50 in Semester IV with no current arrears, as on that date and maintain the CGPA of 8.50 till VI Semester without any arrears shall be eligible to opt for Fast Track System and such student is required to complete three elective courses satisfactorily, while completion of Semester VII, as additional Credits during the semesters V to VII.

3.8 Every student shall be required to carry out a Project Work in the Department / Industry or by exercising Fast track during VIII Semester in consultation with the Faculty Guide and submit the project report, in the prescribed format, at the end of the VIII Semester for thevaluation.

3.9 A student can register for Self-Study Elective(s) over and above the electives from any branch of Engineering / Technology at the rate of one per semester starting from V semester onwards provided he/she maintains a Cumulative Grade Point Average (CGPA) of 8.50 or above till the previous semesters with no current arrears. Credits will be indicated for such courses in the grade sheets (additional credits) but will not be considered for computing theCGPA.

3.10 A Student may be permitted to credit online courses with the approval of the Departmental Consultative Committee constituted by the Head of the Department, subject to a maximum of three credits. Such students may be exempted from attending the classes, if such course(s) are offered in the semester. Summary of such on-line courses, taken by the students, along with the offering agency shall be presented to the Academic Council for information and further suggestions. However, those students need to obtain certification from the agency / agencies offering the course, to become eligible for writing or seeking exemption (core elective course) from the End Semester Examination. In case of credits earned through online mode, from the other Institute /

University, the credits may also be transferred directly after due approval from the Departmental Consultative Committee and the Office of the Controller of Examinations. A student can get exemption for a maximum of 3 credits during the entire programme (in lieu of Discipline elective or Open elective).

4. VALUE ADDED COURSES / ADD-ONCOURSES

A Student can opt for the Value Added Courses / Add-on Courses offered by the various Department / Centres for which the batch size will not exceed 40 per course from Semester II to VII.Head of the Department / Centre shall submit the list of such courses, duly approved / ratified by the Academic Council, to the Controller of Examinations to administer the examination process. A separate Certificate will be issued on successful completion of the course by the Office of the Controller of Examinations.

5. DURATION OF THEPROGRAMME

5.1 A regular student (admitted after 10+2) or equivalent is normally expected to satisfactorily fulfil the requirements for award of the degree B.E. / B.Tech. within four academic years (8 semesters) from the date of admission but in any case not more than 7 years (14 Semesters); lateral entry students shall fulfil such requirements within three academic years (6 semesters) from the date of admission but in any case not more than six years (12 Semesters) leading to the award of Degree of Bachelor of Engineering (B.E.) / Bachelor of Technology (B.Tech.) of Anna University,Chennai.

5.2 The total period for completion of the programme from the commencement of the semester, to which the student was admitted, shall not exceed the maximum period (Clause 5.1), regardless to the break-of-study (vide Clause 15) or period of prevention in order.

5.3 Each semester shall consist of minimum 90 working days or 450 periods of 60 minutes each or equivalent. Head of the Department shall ensure that every faculty member teaches the subject / course as prescribed in the approved curriculum andsyllabi.

5.4 Special Theory / Practical Sessions may be conducted for students who require additional inputs over and above the number of periods normally specified (Remedial Classes), as decided by the Head of the Department, within the specified duration of the Semester /Programme.

6. COURSE ENROLLMENT AND REGISTRATION

6.1 Each student, on admission shall be assigned to a Faculty Advisor (vide Clause 8) who shall advise / counsel the student about the details of the academic programme and the choice of course(s) considering the student's academic background and career objectives.

6.2 Every student shall enroll for the courses of the succeeding semester, in the current semester. However, the student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the semester concerned.

6.3 After registering for a course, a student shall attend the classes, satisfy the attendance requirements, earn Continuous Assessment marks and appear for the End Semester Examinations.

6.3.1 Each student, on admission to the programme, shall register for **all the courses prescribed in the curriculum in** the **first Semester of study (III Semester** for students admitted under **lateral entrystream).**

6.3.2 The enrollment for all the courses of the Semester II will commence 10 working days prior to the last working day of Semester I. The student shall confirm the enrollment by registering for the courses within the first five working days after the commencement of the Semester II. In the case, if a student fails to register in the course(s), he/ she may be permitted to register the same, as specified in the Clause 6.5, in the subsequent semesters or when it isoffered.

6.3.3 The enrollment for the courses of the Semesters III to VIII will commence 10 working days prior to the last working day of the preceding semester. The student shall enroll for the courses with the guidance of the student's Faculty Advisor. If a student wishes, the student may drop or add courses (vide Clause 6.4) within **five** working days after the commencement of the semester concerned and complete the registration process duly authorized by the FacultyAdvisor.

6.4 Flexibility to Add or Dropcourses

6.4.1 A student has to earn the total number of credits specified in the Curriculum of the respective Programme of study in order to be eligible to obtain the degree. However, if a student wishes, the student is permitted toearn more than the total number of credits prescribed in the curriculum by opting for one- credit courses, self study electives or additionalcourses.

6.4.2 From the III to VIII semesters (from IV to VIII Semesters in case of lateral entry students), the student has the option of registering for additional courses or dropping existing courses. Total number of credits of such courses cannot exceed 6 in a given Semester. However the maximum number of credits that a student can register in a particular semester shall not exceed 30 credits (regardless to the reappearance credits). In such cases, the attendance requirement as stated Clause 7 ismandatory.

6.4.3 The minimum number of credits that a student can register in a particular semester shall not be less than 18 credits (except VII / VIIIsemester).

6.4.4 The student shall register for the project work in the VIII semesteronly.

6.5 Reappearance Registration

6.5.1 If a student fails in a theory course, the student shall do reappearance registration (Examination) for that course in the subsequent semesters or when it is offerednext.

6.5.2 On registration, a student may attend the classes for the reappearance registration courses, if the student wishes, and the attendance requirement (vide Clause 7) is not compulsory for suchcourses.

6.5.3 However, if a student wishes to improve his/ her continuous assessment, in the second attempt during reappearance, shall satisfy the Clause 6.5.5 and appear for continuous assessment as given for that particularcourse.

6.5.4 If the theory course, in which the student has failed, is either a professional elective or an open elective, the student may register for the same or any other professional elective or open elective course, respectively in the subsequent semesters. However, the change of elective courses is permitted onlyonce.

6.5.5 In this case (Clause 6.5.4), the student shall attend the classes, satisfy the attendance requirements (vide Clause 7), earn Continuous Assessment marks and appear for the End SemesterExamination.

6.5.6 The student who fails in any Laboratory Course/ Project work / Seminar or any other EEC courses (Specified in Clause 3.1) shall register for the same inthe

Subsequent semesters or when offered next, and **repeat** the course as per Clause 6.5.5.

6.5.7 If a student is prevented from writing the end semester examination of a course or several courses due to lack of attendance, the student has to register for that / those course(s) again, when offered next, attend the classes and fulfill the requirements as per Clause 6.5.5 & 6.5.6. If the course, in which the student has 'lack of attendance', is a Core Elective or an Open Elective, the student may register for the same or any other Core Elective or Open Elective course(s) respectively in the subsequent semesters and appear in the examination as per Clause6.5.5.

7. REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF ACOURSE

A student who has fulfilled the following conditions (vide Clause 7.1 and 7.2) shall be deemed to have satisfied the attendance requirements for appearing for End Semester Examination of a particular course.

7.1 Every student is expected to attend all the periods and earn 100% attendance. However, a student shall secure not less than 80% attendance course wise taking into account the number of periods required for that course as specified in thecurriculum.

7.2 If a student, secures attendance between 70% and 79% in any course(s) in the current semester due to medical reasons (prolonged hospitalization / accident / specific illness) or participation in Institution/ University/ State/ National/ International level extra and co-curricular activities, with prior permission from the Head of the Department, shall be permitted to appear for the current semester examinations subject to the condition that the student shall submit the medical certificate / participation certificate attested by the Head of the Department(along with Condonation form). Such certificates along with the condonation forms shall be forwarded to the Controller of Examinations for verification and permission to attend the examinations. However during the entire programme of study, a student can avail such Condonation in any two semesters only (regardless the number of courses).

7.3 A student shall normally be permitted to appear for End Semester Examination of the course(s) if the student has satisfied the attendance requirements (vide Clause

7.1 – 7.2) and has registered for examination in those courses of that semester by paying the prescribedfee.

7.4 Students who do not satisfy Clause 7.1 and 7.2 and who secure less than 70% attendance in a course will not be permitted to write the End-Semester Examination of that course. The student has to register and repeat this course in the subsequent semesters or when it is offered next (vide Clause6.5).

7.5 In the case of reappearance registration for a course (vide Clause 6.5), the student hasto register for examination in that course by paying the prescribedfee.

7.6 A student who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement ofgrades.

8. FACULTYADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a Faculty member of the Department who shall function as Faculty Advisor for those students. The Faculty Advisor shall advise and guide the students in registering of courses, reappearance of courses, monitor their attendance and progress and counsel them periodically. If necessary, the Faculty Advisor may also discuss with or inform the parents about the progress / performance of the studentsconcerned.

9. COMMITTEES

9.1 Common CourseCommittee

9.1.1 A theory course handled by more than one faculty including the discipline with multiple divisions (greater than or equal to 2) shall have a “Common Course Committee” comprising of all members of faculty teaching that course with one of the members as the Course Coordinator, nominated by the Head of the Institution (Head of the Department in the case of multiple divisions of a discipline) and student representatives (one per specialization or division) registered for that course in the current semester.

First meeting of the Common Course Committee shall be held within fifteen days from the date of commencement of the semester. Two subsequent meetings in a semester may be held at suitable intervals. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to all the students.

9.1.2 In addition, Common Course Committee (without the student representatives) shall meet to ensure uniform evaluation through the common question papers during Continuous Assessment and End SemesterExaminations.

9.2 Class Committee Meeting

For all the courses taught, prescribed in the curriculum, Class Committee meeting shall be convened thrice in a semester (first meeting within 15 days from the commencement of the semester and other two meetings at equal interval after the first meeting) comprising members of the faculty handling all the courses and two student representatives from the class.

One of the members of the faculty (preferably not handling any courses to that class), nominated by the Head of the Department, shall coordinate the activities of the Committee. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all the students to improve the effectiveness of the teaching-learning process. It is the responsibility of the student representatives to convey the proceedings of these meetings to all otherstudents.

10. SYSTEM OFEXAMINATION

10.1 Performance in each course of study shall be evaluated based on (i) Continuous Assessment throughout the semester and (ii) End Semester examination at the end of the semester for the regular courses or as given in the Clause 16. However, the final examination in the case of one credit courses / certificate / value added courses may be conducted, as and when the course is completed, through the office of the Controller of Examinations.

10.2 Each course, both theory and practical including project work, shall be evaluated as per the Scheme of Assessment given in Clause16.

10.3 The End Semester Examinations shall normally be conducted after satisfying the Clause 5.2. Supplementary Examinations may also be conducted, at such times, for the benefit of the students as decided by the Controller ofExaminations.

10.4 For the End Semester examinations, both theory and practical courses including project work, the internal and external examiners (from Academia or Industry) shall be appointed by the Controller of Examinations as per the guidelines given by the Examination and Evaluation Board of the Institute.

11. PASSING REQUIREMENTS ANDPROVISIONS

11.1 A student who secures not less than 50% of total marks prescribed for a course, vide Clause 16, comprising a minimum of 50% of the marks prescribed for the End Semester Examination, shall be declared to have passed the course successfully and earned the prescribed credits for that course, applicable for all registeredcourses.

11.1.1 If a student fails to secure a pass in a particular course, i.e., failing to obtain minimum marks, as stated above, it is mandatory that he/she shall register and reappear for the examination in that course in the subsequent semester(s) whenever the examinations are conducted for that course, till he / she secures a‘Pass’.

11.1.2 Continuous Assessment (CA) marks obtained by the student in the first appearance shall be retained and considered valid for one subsequent attempt, except Clause 6.5.4, 6.5.5, 6.5.6 and 6.5.7. However, from the third attempt onwards, the student shall be declared to have passed the course if he/she secures a minimum of 6 Grade Points (B Grade) in the course prescribed during the End SemesterExaminations.

11.2 The minimum number of total credits to be earned by a student to qualify for the award of Degree in the various branches of study as prescribed by the respective Boards of Studies is given below:

Branch of Study	Minimum Credits	
	Regular Admission	Lateral Entry
B.E. Programmes		
Aeronautical Engineering	178	134
Agricultural Engineering	177	133
Automobile Engineering	179	134
Civil Engineering	176	131
Computer Science and Engineering	176	131
Electrical and Electronics Engineering	176	132
Electronics and Communication Engineering	177	132
Electronics and Instrumentation Engineering	177	133
Mechanical Engineering	179	135
Mechatronics	177	133
B.Tech. Programmes		
Biotechnology	175	131
Fashion Technology	176	132
Information Technology	176	131
Textile Technology	175	131
Food Technology	175	131

11.2.1 Student Migration and Credit Transfer: Normalization of the Credits will be carried out in consultation with the Board of Studies of the programme concerned and approved by the Head of Institution, if a student migrates from other institutions to Bannari Amman Institution of Technology or rejoins from previous regulation to thisregulation.

11.3 A student shall be declared to have qualified for award of B.E/B.Tech. Degree if he/she successfully completes the course requirements (vide Clause 7, 10 and 11) and passed all the prescribed courses of study of the respective programme (listed in Clause 2), within the duration specified in Clause5.1.

12. ASSESSMENT AND AWARD OF LETTER GRADES

12.1 The assessment shall be based on the performance in the End Semester Examinations and / or Continuous Assessment, carrying marks as specified in Clause 16. Letter Grades (based on Credit Point and Grade Point) are awarded to the students based on the performance in the evaluationprocess.

12.2 Credit Point is the product of Grade Point and number credits for a course and Grade Point is a numerical weight allotted to each letter grade on a 10-point scale (as specified in the Clause 12.3), while the Letter Grade is an index of the performance of a student in a saidcourse.

12.3 The performance of a student will be reported using Letter Grades, each carrying certain points as detailedbelow:

Range of Total Marks (as specified in Clause 16) / Specific Reason	Grade Points	Letter Grade
91 to 100	10	O (Outstanding)
81 to 90	9	A + (Excellent)
71 to 80	8	A (Very Good)
61 to 70	7	B + (Good)
50 to 60	6	B (Above average)
0 to 49	0	RA (Reappearance Registration)
Incomplete	0	I
Withdrawal	0	W
Absent	0	AB
Shortage of Attendance	0	SA

'RA' ---Reappearance registration is required for that particular course

'I' --- Continuous evaluation is required for that particular course in the subsequentexaminations.

'SA' --- shortage of attendance (Clause 7) and hence prevented from writing end semesterexamination.

12.4 After completion of the evaluation process, Grade Point Average (GPA), and the Cumulative Grade Point Average (CGPA) is calculated using the formula:

$$GPA/CGPA = \frac{\sum_1^n C_i * g_i}{\sum_1^n C_i}$$

where

c_i : Credit allotted to thecourse.

g_i : Grade Point secured corresponding to the course.

n : number of courses successfully cleared during the particular semester in the case of GPA and all the semesters, under consideration, in the case CGPA.

12.5 A student who does not appear for the End Semester Examinations in a course, after registering for the same, shall be deemed to have appeared for that examination for the purpose of classification (Subject to Clause 14 and15).

12.6 For the non credit courses Grades shall be indicated as given in the Clause 16 and shall not be counted for the computation ofGPA/CGPA.

12.7 **Photocopy / Revaluation:** A student, who seeks the re-valuation of the answer script is directed to apply for the photocopy of his/her semester examination answer paper(s) in the theory course(s), within 2 working days from the declaration of results in the prescribed format to the Controller of Examinations through the Head of the Department. On receiving the photocopy, the student can consult with a competent member of faculty and seek the opinion for revaluation. Based on the recommendations, the student can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations shall arrange for the revaluation and declare the results. Revaluation is not permitted to the courses other than theory courses. In the case of theory courses with laboratory component, a student can seek revaluation for the theory component only, following the procedure statedabove.

13. CLASSIFICATION OF THE DEGREEAWARDED

For the purpose of the 'Award of Degree', the duration of completion of the programme shall be the total duration taken by a student for completing first time registration of all the required courses and satisfying Clause 11, regardless to the period of Break-of-study as per Clause 15 and satisfy any one of the conditions required as givenbelow.

13.1 **First Class with Distinction**: A student who qualifies for the award of the Degree having passed all the courses of study of all the Eight Semesters (six semestersfor lateral entry students) at the first opportunity, after the commencement of his / her study and securing a CGPA not less than 8.50 (vide clause 12.3) shall be declared to have passed with **First Class with Distinction**.

13.2 **First Class**: A student who qualifies for the award of the Degree having passed all the courses of study of all the eight semesters (six semesters for lateral entry students) after the commencement of his / her study and securing a CGPA not less than 6.50 shall be declared to have passed with **First Class** (not exceeded the total duration as specified in the Clause5).

13.3 **Second Class**: All other students who qualify for the award of the Degree shall be declared to have passed in **Second Class.**

13.4 Course Completion Certificate shall be given to a student, provided he / she should have registered all the courses and also registered for the examinations in those courses (subject to Clause 6.0 and7.0).

14. WITHDRAWAL FROM THE EXAMINATION

14.1 A student may, for valid reasons, be granted permission by the Head of the Department to withdraw from appearing in the examination in any course(s) only once during the entire duration of the degree programme.

14.2 Withdrawal application shall be valid only, if the student is eligible to write the examination as per Clause 7 and, if such request for withdrawal is made prior to the submission of the Continuous Assessment marks of the course(s) with the recommendations from the Head of the Department.

14.3 Withdrawal shall not be considered as an appearance in the examination for the eligibility of a student for First Class with Distinction or FirstClass.

15. AUTHORIZED BREAK OF STUDY FROM APROGRAMME

15.1 A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of oneyear.

15.2 A student is normally not permitted to break the period of study temporarily. However, if a student happens to discontinue the programme temporarily during the middle of programme of study, for reasons such as personal accident or hospitalization due to ill health or in need of health care, he/she shall apply to the Head of the Institution in advance, in any case, not later than the last date for registering for the semester examination, through the Head of the Department stating the reasons for the break-of-study (for one academic semester or 6 months, whichever is earlier). However, a student detained for want of minimum attendance requirement as per Clause 7 shall not be considered as permitted 'Break of Study' and Clause 15.3 is not applicable for such case.

15.3 The student is permitted to rejoin the programme after the break shall be governed by the rules and regulations of DoTE and the Curriculum and Regulations in force at the time of rejoining, subject to the Clause11.2.1.

15.4 Authorized break of study will be counted towards the duration specified for passing all the courses (vide Clause 5.1 and 5.2) and for the purpose of classification of Degree (vide Clause13).

15.5 The total period for completion of the programme reckoned from the commencement of the first semester to which the student is admitted shall not exceed the maximum period specified in Clause 5.1, irrespective of the period of break of study in order that he / she may be eligible, for the award of the degree (vide Clause13).

15.6 In case of valid reasons (as stated in Clause 15.2) extended break-of-study may be granted by the Head of the Institution for a period not more than one year (total duration or two semesters whichever is earlier) in addition to the earlier authorized break ofstudy.

15.7 If a student does not report back to the Institute, even after the extended Break of Study, the name of the student shall be deleted permanently from the college enrollment. Such students are not entitled to seek readmission under anycircumstances.

16. SCHEME OFASSESSMENT

Courses offered under B.E. / B.Tech. Programmes are assessed as given below:

I	**THEORY COURSES**	**Marks**
	Continuous Assessment	**50**
	DistributionofmarksforContinuous Assessment:	
	Test I (15)	
	Test II (15)	
	Open book test (10)	
	Library - Seminars / Assignments (Two) (10)	
	End Semester Examination	**50**
	Total Marks	**100**

II	**THEORY COURSES WITH LAB COMPONENT**	**Marks**
	Continuous Assessment	**50**
	DistributionofmarksforContinuous Assessment:	
	Test I (10)	
	TestII (10)	
	Conduct of Experiment	
	Preparation(5)	
	Experiment and Results (5)	
	Record Note#	
	Final Lab Examination (20)	
	End Semester Examination (QP pattern as per (I))	**50**
	Total Marks	**100**
III	**LABORATORY COURSES**	**Marks**
	Continuous Assessment	**50**
	DistributionofmarksforContinuous Assessment:	
	Conduct of Experiment	
	i. Preparation(5)	
	ii. Experiment and Results(10)	
	iii. Record / Observation#(5)	
	Test – Cycle I (15)	
	Test – Cycle II (15)	
	End Semester Examination	
	Experiments & Results (40)	**50**
	Viva Voce – (10)	
	Total Marks	**100**
IV	**TECHNICAL SEMINAR**	**Marks**
	Continuous Assessment	**50**
	DistributionofmarksforContinuous Assessment:	
	PresentationI (25)	
	Presentation II (25)	
	End Semester Examination	
	Report#(20) *Presentation (20)* *Viva voce (10)*	**50**
	Total Marks	**100**

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V	**PROJECT**	**Marks**
	Continuous Assessment	**50**
	DistributionofmarksforContinuous Assessment:	
	<u>*Review I*</u>	
	Literaturesurvey (10)	
	Problem Identification (5)	
	Methodology (10)	
	<u>*Review II*</u>	
	Continuation in Methodology (10)	
	Results / Progress (15)	
	End Semester Examination	
	Report[#](20)	
	Presentation (20)	**50**
	Viva voce (10)	
	Total Marks	**100**
VI	**LANGUAGE ELECTIVE**	**Marks**
	(CONTINUOUS ASSESSMENT ONLY)	
	<u>Test 1</u>	
	Listening (10)	
	Speaking (5)	**25**
	Reading (5)	
	Writing (5)	
	<u>Test 2</u>	
	Listening (10)	
	Speaking (5)	**25**
	Reading (5)	
	Writing (5)	
	Oral Exam	**50**
	Total Marks	**100**
VII	**ONE-CREDIT COURSE**	**Marks**
	Test	**30**
	Quiz	**20**
	Final Examination	50
	Total Marks	**100**

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VIII	**MINI-PROJECT (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Review I	**25**
	Review II	**25**
	Project Evaluation	**50**
	Report (25)#Presentation&Viva Voce (25)	
	Total Marks	**100**
IX	**LIFE SKILLS (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Examination	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory/Not Satisfactory)	
X	**VALUE ADDED / CERTIFICATE COURSES (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Evaluation / Test	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory / NotSatisfactory)	
XI	**ENGINEERING GRAPHICS**	**Marks**
	Continuous Assessment	**50**
	DistributionofmarksforContinuous Assessment:	
	Class work (based on attendance) (5)	
	Assignments (Minimum 8 Assignments) (20)	
	Model Examination (25)	
	End Semester Examination	**50**
	Total Marks	**100**
	Grades (Excellent / Good / Satisfactory / Not Satisfactory)	

Optional Test: *A student becomes eligible to appear for the one optional test conducted after the Periodical Test II, only under the following circumstances: (i) absent for Test I or Test II or both on account of medical reasons (hospitalization / accident / specific illness),*

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or (ii) participation in the College / University / State / National / International level Sports events with prior permission from the Head of the Institution and (iii) on satisfying the conditions (i) or (ii), the student should have registered for the Optional Test, through the concerned member of faculty who handles the course or through the respective Head of the Department, submitted to the Controller of Examinations. Such Optional Tests are not conducted for the courses under the categories III, IV, V, VI, VII, VIII, IX, X and XI listed above.

17. FIELD / INDUSTRIAL VISIT /INTERNSHIP

Heads of Departments, in order to provide the experiential learning to the students, shall take efforts to arrange at least two industrial visits / field visits in a semester. The students may also undergo in-plant training / internship during summer / winter vacation between III and VII semesters.

18. PERSONALITY AND CHARACTER DEVELOPMENT

Every student shall be required to undergo a minimum of 40 hours of Personality Development Programmes viz, NSS / NCC / YRC / YOGA / Sports and Games / Technical and Non-technical Club activities during the first year, failing which he/she shall not be permitted to appear for the End Semester examinations of semester II and there onwards. Such students are permitted to appear for the End Semester examinations of semester II and there onwards only after completing satisfactorily the requirements.

The attendance of the personality and character development courses / events shall be maintained on the regular basis by the concerned First Year Co-ordinators and made available in the Office of the Controller of Examinations before the commencement of Semester examinations of Semester I or Semester II.

19. DISCIPLINE

A student is expected to follow the rules and regulations laid down by the Institute and the affiliating University, as published from time to time. Any violations, if any, shall be treated as per the procedures statedthereof.

If a student indulges in malpractice in any of the End Semester / Continuous Assessments, he / she shall be liable for punitive action as prescribed by the Institution / University from time to time.

20. REVISION OF REGULATIONS, CURRICULUM ANDSYLLABI

The Institution reserves the right to revise/amend/change the Regulations, Curriculum, Syllabi, Scheme of Examinations and date of implementation and to introduce Additional Electives, Open Electives, One Credit Courses and Value Added Courses through the Academic Council.

The Question Paper pattern (Theory Examination) for UG Programme is given below:

PART A

Objective Type Questions: 20 (20 X 1 = 20 Marks) 20

PART B

Short Answer Questions: 10 (10 X 2 =20 Marks) 20

PART C

Long Answer Questions: 5 (5 X 12 =60 Marks) 60

Total 100

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. Become successful Civil Engineer to meet the demand driven needs in the field of Civil Engineering and related profession.

II. Demonstrate core competence to pursue higher study or research in institute of repute.

III. Exhibit good breadth of knowledge in core areas of Civil and related engineering by offering/assisting consultancy and testing services.

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

a. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. **Problem Analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

c. **Design/ Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d. **Conduct Investigations of Complex Problems**: Use research- based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

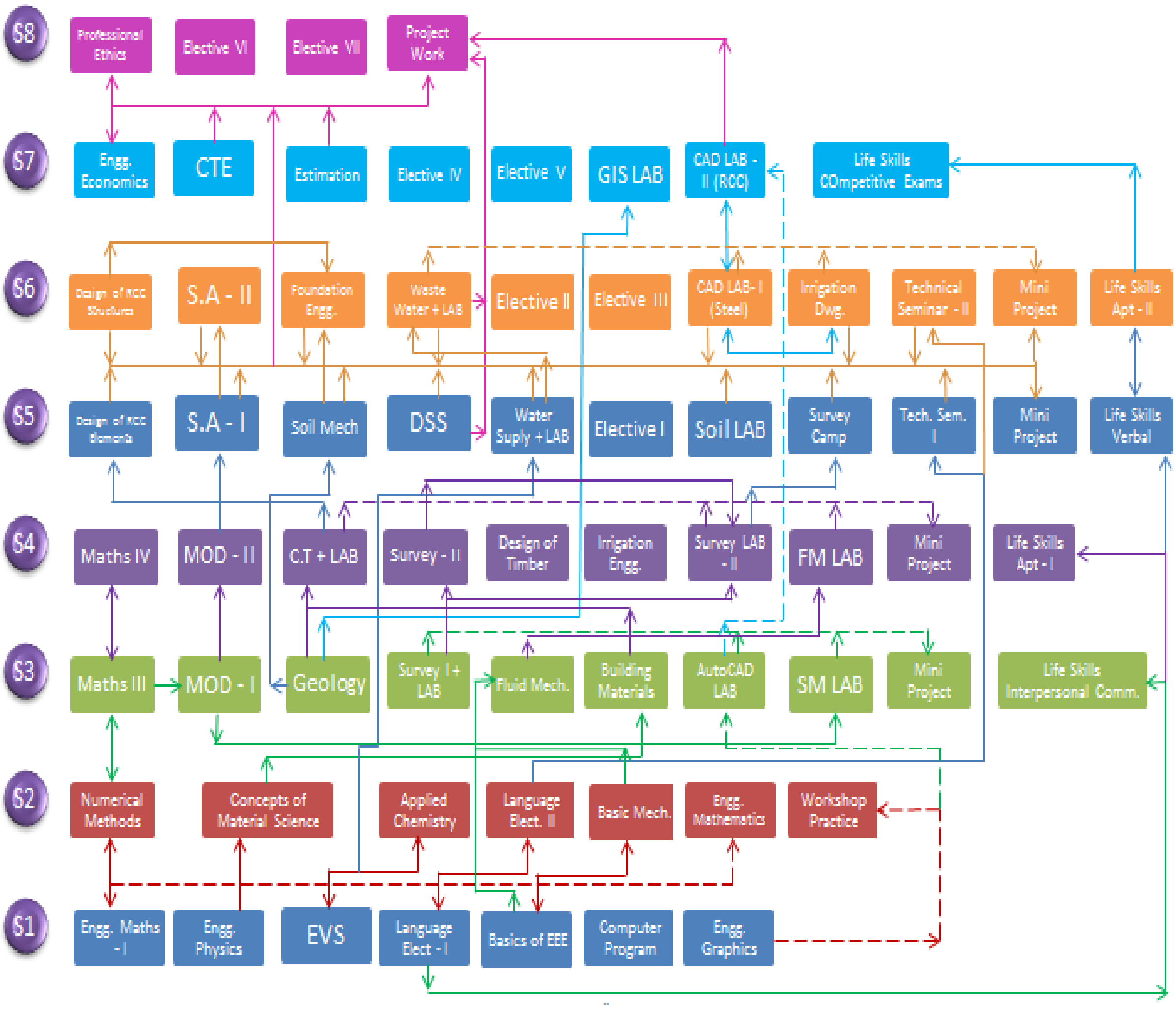
k. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. **Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MAPPING OF PEOs AND POs

POs	a	b	c	d	e	f	g	h	i	j	k	l
PEO1	X	X	X	X	X	X	X	X	X	X	X	X
PEO2	X	X	X	X	X				X	X	X	X
PEO3	X	X	X	X	X	X	X				X	X

Connectivity Chart



B.E. CIVIL ENGINEERING
Minimum Credits to be Earned :176

FIRST SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA101	MATRICES AND CALCULUS*	I	a,b	3	2	0	4	50	50	100	BS
15PH102	ENGINEERING PHYSICS*	I	a	2	0	2	3	50	50	100	BS
15CH103	ENVIRONMENTAL SCIENCE*	II	g	2	0	2	3	50	50	100	HSS
	LANGUAGE ELECTIVE I#	-	-	-	-	-	3	100	-	100	HSS
15GE105	BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING$^{\Delta}$	I	a	2	0	2	3	50	50	100	ES
15GE206	COMPUTER PROGRAMMING$^{\Psi}$	I,II,III	a,b,c	3	0	2	4	50	50	100	ES
15GE207	ENGINEERING GRAPHICS$^{\lambda}$	I	a, b, d, e	0	0	4	2	50	50	100	ES
Total				12	2	12	22	**400**	**300**	**700**	-

SECOND SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Maximum Marks			Category
		PEOs	POs					CA	ES	Total	
15MA201	VECTOR CALCULUS AND COMPLEX ANALYSIS*	I	a,b	3	2	0	4	50	50	100	BS
	PHYSICS ELECTIVE*	-	-	-	-	-	4	50	50	100	BS
	CHEMISTRY ELECTIVE*	-	-	-	-	-	4	50	50	100	BS
	LANGUAGE ELECTIVE II#	-	-	-	-	-	3	100	-	100	HSS
15CE205	BASICS OF MECHANICAL ENGINEERING	I,II,III	a,d,j	3	0	0	3	50	50	100	ES
15CE206	ENGINEERING MECHANICS	I,II,III	a,e	3	2	0	4	50	50	100	ES
15GE107	WORKSHOP PRACTICE$^{\Omega}$	I,III	a,e	0	0	2	1	50	50	100	ES
Total				9	4	2	23	**400**	**300**	**700**	-

*Common to all branches of B.E./B.Tech

#Common to all branches of B.E./B.Tech (Continuous Assessment)

$^{\Delta}$Common to AE,AG,AU,CE,ME,MTRS,BT,TT,FD (I Semester) and to CSE,FT,IT (II Semester)

$^{\Psi}$Common to CE (I Semester) and to AE,AG,AU,ME,MTRS,BT,FT,TT,FD (II Semester)

$^{\lambda}$Common to CE,CSE,ECE,EEE,EIE,IT(I Semester) and to AE, AG,AU,ME,MTRS,BT,FT,TT,FD (IISemester)

$^{\Omega}$CommontoAE,AG,AU,ME,MTRS,BT,FT,TT,FD(ISemester)andtoCE,CSE,ECE,EEE,EIE,IT(IISemester)

THIRD SEMESTER												
Code No.	Course	Objectives & Outcomes		L	T	P	C	Max marks			Category
		PEOs	POs					CA	ES	Total	
15MA301	FOURIER SERIES AND TRANSFORMS[α]	II	a,b	3	2	0	4	50	50	100	BS
15CE302	MECHANICS OF DEFORMABLE BODIES I	I,II,III	a,e	3	0	0	3	50	50	100	PC
15CE303	APPLIED GEOLOGY	I,II,III	a	3	0	0	3	50	50	100	ES
15CE304	SURVEYING - I	I,II,III	b,c,d,f,g,k	3	0	0	3	50	50	100	PC
15CE305	FLUID MECHANICS AND MACHINERIES	I,II,III	a,c,d,e,m	3	0	0	3	50	50	100	PC
15CE306	BUILDING MATERIALS AND CONSTRUCTION	I,II,III	a,b,d	3	0	0	3	50	50	100	PC
15CE307	COMPUTER AIDED DRAWING PRACTICE	I,II,III	d,i,n	0	0	2	1	50	50	100	PC
15CE308	SURVEYING - I LABORATORY	I,II,III	a,c,m	0	0	2	1	50	50	100	PC
15CE309	STRENGTH OF MATERIALS LABORATORY	I,II,III	b,c,d,e,f	0	0	2	1	50	50	100	PC
15CE310	MINI PROJECT I	III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE310	LIFE SKILLS: BUSINESS ENGLISH[Φ]	III	j	0	0	2	-	100	-	100	EEC
Total				18	2	10	23	**600**	**400**	**1000**	-

FOURTH SEMESTER												
Code No.	Course	Objectives & Outcomes		L	T	P	C	Max Marks			Category
		PEOs	POs					CA	ES	Total	
15MA405	NUMERICAL METHODS[β]	I,II,III	a,b	2	2	0	3	50	50	100	BS
15CE402	MECHANICS OF DEFORMABLE BODIES II	I,II,III	a,j	3	2	0	4	50	50	100	PC
15CE403	CONCRETE TECHNOLOGY	I,II,III	a,b,c,d,e,f	3	0	0	3	50	50	100	PC
15CE404	SURVEYING - II	I,II,III	a,b,c,d,e	3	0	0	3	50	50	100	PC
15CE405	CONSTRUCTION TECHNIQUES EQUIPMENT AND PRACTICES	I,II,III	a,b,m,n	3	0	0	3	50	50	100	PC
15CE406	IRRIGATION ENGINEERING	I,II,III	a,b,e,g	3	0	0	3	50	50	100	ES
15CE407	FLUID MECHANICS LABORATORY	I,II,III	a,c,e	0	0	2	1	50	50	100	PC
15CE408	SURVEYING - II LABORATORY	I,II,III	a,b,c,d,e	0	0	2	1	50	50	100	PC
15CE409	CONCRETE TECHNOLOGY LABORATORY	I,II,III	a,b,c,d,e	0	0	2	1	50	50	100	PC
15CE410	MINI PROJECT II	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE410	LIFE SKILLS: VERBAL ABILITY[Φ]	III	j	0	0	2	-	100	-	100	EEC
Total				17	4	10	23	600	400	1000	-

[α]Common to all branches of B.E./B.Tech.except CSE
[Φ]Common to all branches of B.E./B.Tech (Non-Credit Course)
[β]Common to AE,CE

FIFTH SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Max Marks			Category
		PEOs	POs					CA	ES	Total	
15CE501	DESIGN OF STEEL STRUCTURES	I,II,III	b,c,d,e,k	3	0	0	3	50	50	100	PC
15CE502	STRUCTURAL ANALYSIS - I	I,II,III	a,b	3	0	0	3	50	50	100	PC
15CE503	SOIL MECHANICS	I,II,III	e	3	0	0	3	50	50	100	PC
15CE504	DESIGN OF RCC ELEMENTS	I,II,III	b,c,e	3	0	0	3	50	50	100	PC
	ELECTIVE I	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE II	-	-	-	-	-	3	50	50	100	PE
15CE507	IRRIGATION AND PUBLIC HEALTH DRAWING	I,II,III	e,g	0	0	2	1	50	50	100	PC
15CE508	SURVEY CAMP	I,II,III	e	0	0	2	1	50	50	100	PC
15CE509	SOIL MECHANICS LABORATORY	I,II,III	b,c,d,m,n	0	0	2	1	50	50	100	PC
15CE510	TECHNICAL SEMINAR I	II, III	i,j	0	0	2	1	50	50	100	EEC
15CE511	MINI PROJECT III	II, III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE511	LIFE SKILLS: APTITUDE I$^{\Phi}$	III	a,b	0	0	2	-	100	-	100	EEC
Total				12	0	12	23	**650**	**450**	**1100**	

SIXTH SEMESTER

Code No.	Course	Objectives & Outcomes		L	T	P	C	Max Marks			Category
		PEOs	POs					CA	ES	Total	
15GE601	PROFESSIONAL ETHICS^{+}	II	f,g,h	2	0	0	2	50	50	100	HSS
15CE602	STRUCTURAL ANALYSIS - II	I,II,III	a,b,d	3	2	0	4	50	50	100	PC
15CE603	FOUNDATION ENGINEERING	I,II,III	a,b,e,k	3	0	0	3	50	50	100	PC
15CE604	DESIGN OF RCC STRUCTURES	I,II,III	b,c	3	0	0	3	50	50	100	PC
	ELECTIVE III	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE IV	-	-	-	-	-	3	50	50	100	PE
15CE607	COMPUTER AIDED ANALYSIS, DESIGN AND DRAWING LABORATORY - I(Steel)	I,II,III	a,d,i,m,n	0	0	2	1	50	50	100	PC
15CE608	GIS LABORATORY	I,II,III	a,d,m	0	0	2	1	50	50	100	PC
15CE609	TECHNICAL SEMINAR II	II,III	j	0	0	2	1	50	50	100	EEC
15CE610	MINI PROJECT IV	II,III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE611	LIFE SKILLS: APTITUDE II$^{\Phi}$	III	a,b	0	0	2	-	100	-	100	EEC
Total				11	2	10	22	**650**	**450**	**1100**	-

$^{\Phi}$Common to all branches of B.E./B.Tech (Non-Credit Course)

$^{+}$ Common to Common to AE, AU,CE,ME,MTRS,BT,FT,TT, FD (VI Semester) and to CSE,ECE,EEE,EIE,IT (VIISemester)

SEVENTH SEMESTER												
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**	**Max Marks**			**Category**
		PEOs	**POs**					**CA**	**ES**	**Total**	
15GE701	ENGINEERING ECONOMICS[$]	II	a,f,g,k,l	3	0	0	3	50	50	100	HSS
15CE702	ENVIRONMENTAL ENGINEERING	I,II,III	a,b,c,d,e,f,g, h,i,j,k	3	0	0	3	50	50	100	ES
15CE703	ESTIMATION AND COSTING	I,II,III	b,c,d,e,g	3	0	0	3	50	50	100	PC
15CE704	HIGHWAY ENGINEERING	I,II,III	a,b,c,d	3	0	0	3	50	50	100	PC
	ELECTIVE V	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE VI	-	-	-	-	-	3	50	50	100	PE
15CE707	ENVIRONMENTAL ENGINEERING LAB	I,II,III	a,b,c,d,e,f,g ,i,k	0	0	2	1	50	50	100	ES
15CE708	COMPUTER AIDED ANALYSIS, DESIGN AND DRAWING LABORATORY - II(RCC)	I,II,III	a,d,i,n	0	0	2	1	50	50	100	PC
15CE709	HIGHWAY ENGINEERING LABORATORY	I,II,III	b,c,d,k	0	0	2	1	50	50	100	PC
15CE710	MINI PROJECT V	II,III	a,b,c,d,e,i	0	0	2	1	100	-	100	EEC
15GE710	LIFE SKILLS : COMPETITIVE EXAMS[Φ]	III	a,b,l	0	0	2	-	100	-	100	EEC
Total				12	0	10	22	**600**	**400**	**1000**	**-**

EIGHT SEMESTER											
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**	**Max Marks**			**Category**
		PEOs	**POs**					**CA**	**ES**	**Total**	
	ELECTIVE VII	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE VIII	-	-	-	-	-	3	50	50	100	PE
	ELECTIVE IX	-	-	-	-	-	3	50	50	100	PE
15CE804	PROJECT WORK	I,II,III	a-l	-	-	-	9	50	50	100	EEC
Total				**-**	**-**	**-**	**18**	**200**	**200**	**400**	**-**

[$] Common to CSE,ECE,EEE,EIE,IT (VII Semester) and to AE, AG,AU,CE,ME,MTRS,BT,FT,TT,FD (VI Semester)
[Φ]Common to all branches of B.E./B.Tech (Non-Credit Course)

ELECTIVES							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
LANGUAGE ELECTIVES							
15LC203	CHINESE	I,II,III	a,b,i	3	0	0	3
15LE101	BASIC ENGLISH I	I,II,III	a,b,i	3	0	0	3
15LE102	COMMUNICATIVE ENGLISH I	I,II,III	a	3	0	0	3
15LE201	BASIC ENGLISH II	I,II,III	a	3	0	0	3
15LE202	COMMUNICATIVE ENGLISH II	I,II,III	a	3	0	0	3
15LF203	FRENCH	I,II,III	a,b,i	3	0	0	3
15LG203	GERMAN	I,II,III	a,b,i	3	0	0	3
15LH203	HINDI	I,II,III	a	3	0	0	3
15LJ203	JAPANESE	I,II,III	a	3	0	0	3
PHYSICS ELECTIVES							
15PH201	PHYSICS OF MATERIALS	I,II,III	a,b,i	3	0	2	4
15PH202	APPLIED PHYSICS	I,II,III	a,b,i	3	0	2	4
15PH203	MATERIALS SCIENCE	I,II,III	a	3	0	2	4
15PH204	PHYSICS OF ENGINEERING MATERIALS	I,II,III	a	3	0	2	4
15PH205	SOLID STATE PHYSICS	I,II,III	a	3	0	2	4
CHEMISTRY ELECTIVES							
15CH201	ENGINEERING CHEMISTRY	I,II,III	a,b,d	3	0	2	4
15CH202	APPLIED CHEMISTRY	I,II,III	a,b,d	3	0	2	4
15CH203	APPLIED ELECTROCHEMISTRY	I,II,III	a,b	3	0	2	4
15CH204	INDUSTRIAL CHEMISTRY	I,II,III	a,b	3	0	2	4
15CH205	WATER TECHNOLOGY AND GREEN CHEMISTRY	I,II,III	a,b	3	0	2	4
DISCIPLINE ELECTIVES							
15CE001	HYDROLOGY	I,II,III	a,b	3	0	0	3
15CE002	TRANSPORTATION PLANNING AND SYSTEMS	I,II,III	a,b,c	3	0	0	3
15CE003	PREFABRICATED STRUCTURES	I,II,III	b,c,d,e	3	0	0	3
15CE004	MASS TRANSPORTATION SYSTEM	I,II,III	a,c,d,e	3	0	0	3
15CE005	BASICS OF STRUCTURAL DESIGN AND ASEISMIC DESIGN OF STRUCTURES	I,II,III	a,b,c,d	3	0	0	3

15CE006	RAILWAYS, AIRPORTS AND HARBOR ENGINEERING	I,II,III	a,b,c,d,f	3	0	0	3
15CE007	WATER RESOURCES PLANNING AND MANAGEMENT	I,II,III	b,c,d,f,k	3	0	0	3
15CE008	TRAFFIC ENGINEERING AND MANAGEMENT	I,II,III	a,b,c,d,e,f	3	0	0	3
15CE009	MUNICIPAL SOLID WASTE MANAGEMENT	I,II,III	a,b,f,g	3	0	0	3
15CE010	DESIGN OF INDUSTRIAL STRUCTURES	I,II,III	b,c,d	3	0	0	3
15CE011	ENVIRONMENTAL IMPACT ASSESSMENT	I,II,III	a,b,d,f,g,h,i,j	3	0	0	3
15CE012	ADVANCED RC DESIGN	I,II,III	b,c,d	3	0	0	3
15CE013	GROUND IMPROVEMENT TECHNIQUES	I,II,III	a,b,c,d,e,g	3	0	0	3
15CE014	REPAIR AND REHABLITATION OF STRUCTURES	I,II,III	a,b,d,e	3	0	0	3
15CE015	BUILDING SERVICES	I,II,III	a,b,c	3	0	0	3
15CE016	BRIDGE ENGINEERING	I,II,III	a,b,c,d,g	3	0	0	3
15CE017	CONCEPTS OF ENGINEERING DESIGN	I,II,III	a,b,c,f,g	3	0	0	3
15CE018	FINITE ELEMENT ANALYSIS	I,II,III	a,b,c	3	0	0	3
15CE019	ADVANCED STEEL DESIGN	I,II,III	b,c	3	0	0	3
15CE020	REMOTE SENSING AND GIS	I,II,III	a,b,c,e	3	0	0	3
15CE021	INDUSTRIAL WASTE MANAGEMENT	I,II,III	a,b,d,e,g	3	0	0	3
15CE022	DESIGN OF TIMBER, MASONRY AND STEEL ELEMENTS	I,II,III	b,c	3	0	0	3
15CE023	DESIGN OF PRESTRESSED CONCRETE STRUCTURES	I,II,III	a,b,c	3	0	0	3
15CE024	PLANNING AND MANAGEMENT FOR HOUSING	I,II,III	a,b,c	3	0	0	3
15CE025	CONSTRUCTION MANAGEMENT PRINCIPLES FOR CIVIL ENGINEERS	I,II,III	a,d,f,g,h	3	0	0	3
15CE026	TOTAL STATION AND GPS SURVEYING	I,II,III	a,b,c,d	3	0	0	3
15CE028	INDUSTRIAL POLLUTION PREVENTION AND CLEANER PRODUCTION	I,II,III	a,b,c,d	3	0	0	3
15CE030	PAVEMENTS - DESIGN AND CONSTRUCTION	I,II,III	a,b,c	3	0	0	3
15CE031	AIR POLLUTION CONTROL AND	I,II,III	a,b,c	3	0	0	3

	MANAGEMENT						
15CE034	ROCK MECHANICS AND APPLICATIONS	I,II,III	a,b,d	3	0	0	3
15CE035	ARCHITECTURE AND URBAN PLANNING	I,II,III	a,b,c	3	0	0	3
15CE036	GEOENVIRONMENTAL ENGINEERING	I,II,III	a,b,c,f	3	0	0	3
ENTREPRENEURSHIP ELECTIVES							
15GE001	ENTREPRENEURSHIP DEVELOPMENT I	-	-	3	0	0	3
15GE002	ENTREPRENEURSHIP DEVELOPMENT II	-	-	3	0	0	3
OPEN ELECTIVES							
15CE0YA	GREEN BUILDINGS	I,II,III	a,c,f,g	3	0	0	3
15CE0YB	HAZARDOUS WASTE MANAGEMENT AND SITE REMEDIATION	I,II,III	a,b,f	3	0	0	3
15CE0YC	DISASTER MITIGATION AND MANAGEMENT	I,II,III	a,b,c,f,g	3	0	0	3
15CE0YD	ENVIRONMENTAL IMPACT ASSESSMENT	I,II,III	a,b,i,j	3	0	0	3
15CE0YE	BUILDING SERVICES	I,II,III	a,b,c	3	0	0	3
15CE0YF	REMOTE SENSING AND GIS	I,II,III	a,b,c,d,e,f,g,h,k	3	0	0	3
15CE0YG	INDUSTRIAL WASTE MANAGEMENT	I,II,III	a,b,c	3	0	0	3
15CE0YH	WEALTH FROM WASTE	I,II,III	a,b,c,e,f	3	0	0	3
15CE0YI	RISK AND SAFETY MANAGEMENT	I,II,III	a,b,e,f,g,i	3	0	0	3
15CE0YJ	PROJECT FORMULATION AND APPRAISAL	I,II,III	a,b	3	0	0	3
ONE CREDIT COURSES							
15CE0XA	E-WASTE MANAGEMENT	I,II,III	a	1	0	0	1
15CE0XB	INTERIOR DESIGN	I,II,III	a	1	0	0	1
15CE0XC	CONSTRUCTION COMMUNICATION	I,II,III	e,i,j	1	0	0	1
15CE0XD	LESSON FROM FAILURE OF STRUCTURES	I,II,III	a,b,c	1	0	0	1
15CE0XE	TOPOGRAPHIC MAPS	I,II,III	d,e	1	0	0	1
15CE0XF	PRACTICAL PROJECT GUIDANCE AND PERSONALITY DEVELOPMENT	I,III	f	1	0	0	1

15CE0XG	RECENT PRACTICES IN PLANNING, DESIGN, CONSTRUCTION AND MAINTENANCE OF BUILDING	I,II,III	a,c,f	1	0	0	1
15CE0XH	IRRIGATION MANAGEMENT: PRESENT AND FUTURE	I,II,III	a,d,e	1	0	0	1
15CE0XI	LARGE SCALE PLANNING SYSTEMS	I,II,III	a	1	0	0	1
15CE0XJ	ARBITRATION AND DISPUTE RESOLUTION	I,II,III	a	1	0	0	1
15CE0XK	PROJECT DELIVERY SYSTEM IN BUILDING SECTOR	I,II,III	a,e,f	1	0	0	1
15CE0XN	APPLICATION OF SOFTWARE PACKAGES IN CIVIL ENGINEERING	I,II,III	a,e,f	1	0	0	1
15CE0XO	ENVIRONMENTAL CONSERVATION IN RIVER BASINS FOR SUSTAINABLE DEVELOPMENT - I	I,II,III	a,b	1	0	0	1
15CE0XP	ENVIRONMENTAL CONSERVATION IN RIVER BASINS FOR SUSTAINABLE DEVELOPMENT - II	I,II,III	a,b	1	0	0	1
15CE0XQ	FOUNDATION STRUCTURES - A CASE STUDY APPROACH	I,II,III	a	1	0	0	1
15CE0XR	ANALYSIS AND DESIGN OF BRIDGE USING STAAD PRO	I,II,III	a,b	1	0	0	1
15CE0XS	CONSTRUCTION CHEMICALS IN CONSTRUCTION INDUSTRY - THE SIGNIFICANCE	I,II,III	a	1	0	0	1
15CE0XT	INTEGRATED WATERSHED DEVELOPMENT AND MANAGEMENT	I,II,III	a,g	1	0	0	1
15CE0XW	BEHAVIOUR OF SHEAR WALL IN MULTISTOREY BUILDING	I,II,III	a,c,e	1	0	0	1
15CE0XU	HEALTHY CONSTRUCTION PRACTICE AND ETHICS	I,II,III	a,c,e	1	0	0	1

SUMMARY OF CREDIT DISTRIBUTION

S.No	CATEGORY	CREDITS PER SEMESTER								TOTAL CREDIT	CREDITS in %	Range of TotalCredits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	7	12	4	3					26	15	15%	20%
2	ES	9	8	3	3			4		27	15	15%	20%
3	HSS	6	3				2	3		14	8	5%	10%
4	PC			15	16	15	12	8		66	38	30%	40%
5	PE					6	6	6	9	27	15	10%	15%
6	EEC			1	1	2	2	1	9	16	9	10%	15%
Total		22	23	23	23	23	22	22	18	176	100	-	-

BS - Basic Sciences
ES - Engineering Sciences
HSS - Humanities and Social Sciences
PC - Professional Core
PE - Professional Elective
EEC - Employability Enhancement Course
CA - Continuous Assessment
ES - End Semester Examination

15MA101 MATRICES AND CALCULUS 3 2 0 4

Course Objectives

- Interpret the introductory concepts of Matrices and Calculus, which will enable them to model and analyze physical phenomena involving continuous changes of variables.
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of Matrices and Calculus.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Analyze the characteristics of a linear system with eigen values andvectors.
2. Identify and model the real time problem using first order linear differential equations.
3. Recognize and solve the higher order ordinary differentialequations.
4. Characterize the functions and get the solutions of thesame.
5. Evaluate the functions to get the surface area and volume using multipleintegral.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1										
2	1	1										
3	1	2										
4	2	1										
5												

UNIT I **9Hours**

MATRICES

Eigen Values and Eigen Vectors of a real matrix - Properties of Eigen Values-Stretching of elastic membranes.Cayley - Hamilton Theorem - Quadratic form: Reduction of a quadratic form to a canonical form.

UNIT II **8 Hours**

ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER

Leibnitz's Equations - Modelling and solutions using Newtons law of cooling of bodies - solutions to R-L and R-C electric circuits.

UNIT III **11 Hours**

ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER

Linear differential equations of second and higher order with constant coefficients. Linear differential equations of higher order with variable coefficients: Cauchys linear differential equation - Method of variation of parameters for second order differential equations.

UNIT IV **9 Hours**

MULTIVARIABLE CALCULUS

Functions of Two Variables and their solutions- Total Differential - Derivative of implicit functions-Jacobians Unconstrained maxima and minima.

UNIT V **8 Hours**

MULTIPLE INTEGRALS

Double integration with constant and variable limits-Region of integration -Change the order of integration -Area as double integral in cartesian coordinates. Triple integral in Cartesian coordinates.

FOR FURTHER READING

Applications of mass spring system in ordinary differential equations of higher order

Total: 75 Hours

Reference(s)

1. C. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd,2003.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi2015.
3. Peter V. O Neil , Advanced Engineering Mathematics, Seventh Edition , Cengage Learning India Private Limited,2012.
4. B.S. Grewal, Higher Engineering Mathematics, Forty Third Edition, KhannaPublications , New Delhi2014.
5. Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India,2014.
6. T.Veerarajan, Engineering mathematics for First Year,Tata McGraw-Hill Publishing company Limited, New Delhi,2014.

Assessment Pattern

Unit/ RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					6					6			6											20
2	2					2				4					4				6						18
3		2			2						6			6					6						22
4		2					6				8				6										22
5	2						4			6									6						18
Total																									100

Assessment Questions

Remember

1. Define spectral values of a matrix.
2. State Cayley - Hamilton theorem.
3. List out five natures of a quadratic form.
4. Reproduce the solution for the first order linear differential equation $\frac{dy}{dx} + Py = Q$
5. State Newton's Law of cooling in ordinary differential equation.
6. Define Jacobian in three dimensions
7. State Wronskian determinant.
8. List two sufficient conditions for extermum of a function

$z = f(x, y)$ at (a, b) .

9. Define Jacobian of u and v with respect to x and y.
10. Recall any two properties of Jacobians.

Understand

1. Identify whether there exist a square matrix without eigenvalues? Give reason
2. Indicate the matrix which has real eigenvalues and real eigenvectors?
3. Identify in which cases can we expect orthogonal eigenvectors?.
4. Compare second and higher order ordinary differential equation
5. A condenser of capacity C discharged through an inductance L and resistance R in series and the charge q at the time t satisfies the equation L$\frac{d^2q}{dt^2}$+R$\frac{dq}{dt}$+$\frac{q}{c}$=0.given that L=0.25 henries,R=250 ohms,C=2×10^{-6}farads,and that when t=0,charge q is 0.002 coulombs and the current $\frac{dq}{dt}$=0,obtain the value of q in terms of t.
6. Represent the area bounded by the parabolas y^2=4-x and y^2=4-4x as a double integral.
7. Formulate Leibnitz's equation where R=100 ohms L=0.05 henry E=100 Cos300t volts
8. A condenser of capacity C discharged through an inductance L and resistance R in series and the charge q at the time t satisfies the equation L$\frac{d^2q}{dt^2}$+R$\frac{dq}{dt}$+$\frac{q}{c}$=0.the circuit consists of an inductor of 1H,a resistor of 12Ω,capacitor of 0.01 F,and a generator having voltage given by E(t)=24 sin10t.find the charge q and the current I at time t,if q=0 and i=0 at t=0 where i=$\frac{dq}{dt}$.
9. Formulate the area between the curves y^2=4x and x^2=4y .
10. Indicate and change the order of integration for $\int_0^1 \int_{x^2}^{2-x} xydydx$

Apply

1. Carry-out the three engineering applications of eigen value of a matrix.
2. Find the eigen values and eigen vectors of the matrix A = $\begin{pmatrix} 11 & -4 & -7 \\ 7 & -2 & -5 \\ 10 & -4 & -6 \end{pmatrix}$ and hence find the eigen values of A^2, 5A and A^{-1} using properties.(P)
3. Use Cayley Hamilton theorem to find inverse of A =$\begin{pmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{pmatrix}$. (P)
4. Find the points of the function $f(x, y) = x^2y + xy^2 - axy$ where f is a maximum or minimum.
5. A body originally at 80^0C cools down to 60^0C in 20 minutes, the temperature of the air being 40^0C. What will be the temperature of the body after 40 minutes from the original
6. If the temperature of a cake is 300^0F when it leaves the oven and is 200^0F 10 minutes later, when will it be practically equal to the room temperature of 60^0F, say, when will it be 61^0F? Use Newton's law of cooling.
7. In an L-C-R circuit, the change q on a plate of a condenser is given by L$\frac{d^2q}{dt^2}$+R$\frac{dq}{dt}$ $\frac{q}{c}$=Esinpt, where i=$\frac{dq}{dt}$.the circuit is tuned to resonance so that p^2=1/LC. If initially the current I and the charge

q bezero.show that, for small values of R/L, the current in the circuit at time t is given by (Et/2L) sinpt. (P)

8. Construct the solution for the equation $(D^3 - \text{D})\text{y} = xe^x$(P)
9. Use the method of variation of parameters to solve $(D^2 + 4)y = \cot 2x$.(P)
10. Construct the equation $x^2y'' + xy' = x$ into a linear differential equation with constant coefficients.

Analyze

1. Justify whether the matrix B = $\begin{pmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$ is orthogonal or not? .(P)
2. Suppose that in Winter the day time temperature in a certain office building is maintained at 70°F, The heating is shut off at 10 P.M. and turned on again at 6 A.M. On a certain day the temperature inside the building at 2 A.M. was found to be 65°F. The outside temperature was 50°F at 10 P.M. and had dropped to 40°F by 6 A.M. Find the temperature inside the building when the heat was turned on at 6 A.M.? .(P)
3. Experiment show that the radio active substance decomposes at a rate proportional to the amount
present. Starting with 2grms at time t=0 find the amount available at a later time.
4. Transform the equation $x^2y'' + xy' = x$ into a linear differential equation with constant coefficients.
5. If the voltage in the RC circuit is E = E_0cosωt, find the charge and the current at time t.
6. Solve $(x^2D^2-2xD+2)y = (3x^2-6x+6)e^x$, y(1) = 2 +3e, $y'(1)$ =3e
7. In a circuit the resistance is 12Ω and the inductance is 4 H. The battery gives a constant voltage of 60 V and the switch is closed when t = 0, so the current starts with I(0) = 0.
(a) Find I(t) (b) Find what happens to the current after a long time justify the current after 1 s.
8. If $g(x,y)=\psi(u,v)$ where $u = x^2 - y^2$, $v = 2xy$ prove that
$$\frac{\partial^2 g}{\partial x^2} + \frac{\partial^2 g}{\partial y^2} = 4(x^2 + y^2)\left(\frac{\partial^2\psi}{\partial u^2} + \frac{\partial^2\psi}{\partial v^2}\right).$$
9. Solve the triple integral $\int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} xdxdydz$

Evaluate

1. Use Cayley-Hamilton theorem to find the value of $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$ if the matrix A = $\begin{pmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{pmatrix}$
2. Determine the nature, index, rank and signature by reducing the quadratic form $2x^2+2y^2+2z^2+2yz$ to canonical form by an orthogonal transformation.
3. Determine the value of y from the equation $\frac{dy}{dx} = \frac{x^2+y^2+1}{2xy}$
4. Determine the solution of y of the equation $\sqrt{1 - y^2}dx = (sin^{-1}x - x)dy$.
5. Determine the value of y from the equation$\frac{dy}{dx} - \frac{tany}{1+x} = (1 + x)\, e^x secy.$
6. Determine the complete solution for y from the equation $\frac{d^2y}{dx^2} + \frac{1}{x}\frac{dy}{dx} = \frac{12logx}{x^2}$.
7. Determine the complete solution for y of$(x^2D^2 - xD + 4)y = x^2 \sin(\log x)$.

8. Determine the solution of the initial value problem $y'' + y' - 6y = 0$ with the initial conditions y(0)=10 and $y'(0) = 0$.

9. Evaluate $\iiint (x^2 + y^2 + z^2)\, dxdydz$ taken over the region of space defined by $x^2 + y^2 \le 1$ and $0 \le x \le 1$.

10. Evaluate $\int_0^a \int_y^a \frac{x}{x^2 + y^2} dxdy$ by changing into polar coordinates

15PH102 ENGINEERING PHYSICS 2 0 2 3

Course Objectives

- To impart knowledge in properties of matter, crystallography and ultrasonics
- To understand the applications of lasers and fiberoptics
- To implement the principles of quantum physics in the respective engineeringfields

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Analyze the concept of properties of matter and apply the same for practicalapplications
2. Identify the suitable laser source for fiber optic communicationapplications
3. Analyze the properties of ultrasonic waves and apply the same for day todayapplications
4. classify the different types of crystal structures and analyze theirproperties
5. Apply the Schrodinger wave equation to illustrate the motion of quantumparticles

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	1											
3	2											
4	1											
5	1											

UNIT I **8Hours**

PROPERTIES OF MATTER

Elasticity: elastic and plastic materials - Hooke's law - elastic behavior of a material -stress -strain diagram- factors affecting elasticity. Three moduli of elasticity- Poisson's ratio-torsional pendulum-twisting couple on a cylinder. Young's modulus- uniform bending -non- uniform bending. Viscosity: coefficient of viscosity -streamline and turbulent flow -experimental determination of viscosity of a liquid -Poiseuille's method.

UNIT II **6 Hours**

APPLIED OPTICS

Interference: air wedge- theory- uses- testing of flat surfaces- thickness of a thin wire. Laser: introduction-principle of laser- characteristics of laser- types: CO2 laser -semiconductor laser (homo junction). Fiber optics: principle of light transmission through fiber- expression for acceptance angle and numerical aperture- types of optical fibers (refractive index profile and mode)- fiber optic communication system (block diagram only).

UNIT III **5 Hours**

ULTRASONICS

Ultrasonics: introduction- properties of ultrasonic waves-generation of ultrasonic waves-magnetostriction- piezo electric methods- detection of ultrasonic waves. Determination of velocity of ultrasonic waves (acoustic grating). Applications of ultrasonic waves: SONAR- measurement of velocity of blood flow -study of movement of internalorgans.

UNIT IV **5 Hours**

SOLID STATE PHYSICS

Crystal Physics: lattice -unit cell -crystal systems- Bravais lattices- Miller indices- 'd' spacing in cubic lattice- calculation of number of atoms per unit cell, atomic radius, coordination number and packing density for SC, BCC, FCC and HCP structures- X-ray diffraction: Laue's method - powder crystal method.

UNIT V **6 Hours**

QUANTUM MECHANICS

Quantum Physics: development of quantum theory- de Broglie wavelength -Schrodinger's wave equation- time dependent and time independent wave equations- physical significance. Application: particle in a box (1d)- degenerate and non-degenerate states. Photoelectric effect: quantum theory of light work function- problems.

FOR FURTHER READING

Neutrions - expanding universe

2 Hours

INTRODUCTION 1

Exposure to Engineering Physics Laboratory and precautionary measures

4 Hours

EXPERIMENT 2

Determine the moment of inertia of the disc and calculate the rigidity modulus of a given wire using torsion pendulum (symmetrical masses method).

4 Hours

EXPERIMENT 3

Find the elevation of the given wooden beam at the midpoint by loading at the ends and hence calculate the Youngs modulus of the material.

4 Hours

EXPERIMENT 4

Find the depression at the midpoint of the given wooden beam for 50g, 100 g, 150 g, 200 g and 250 g subjected to non-uniform bending and determine the Youngs modulus of the material of the beam.

4 Hours

EXPERIMENT 5

Determine the coefficient of viscosity of the given liquid by Poiseulles method.

EXPERIMENT 6 **4 Hours**

Form the interference fringes from the air wedge setup and calculate the thickness of the given wire.

EXPERIMENT 7 **4 Hours**

By applying the principle of diffraction, determine the wavelength of given laser and the average particle size of lycopodium powder using laser source.

EXPERIMENT 8 **4 Hours**

Determine the
(i) wavelength of ultrasonics in a liquidmedium,
(ii) velocity of ultrasonic waves in the givenliquid
(iii) compressibilityof the given liquid using ultrasonicinterferometer.

Total: 60 Hours

Reference(s)

1. D. S. Mathur, Elements of Properties of Matter, 5th edition, S Chand & Company Ltd., New Delhi,2012.
2. Charles Kittel, Introduction to Solid State Physics, 8th edition, Wiley India Pvt. Ltd., New Delhi, 2012.
3. Arthur Beiser, ShobhitMahajan and S RaiChoudhury, Concepts of Modern Physics, 6th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi,2010.
4. B. K. Pandey and S. Chaturvedi, Engineering Physics, 1st edition, Cengage Learning India Pvt. Ltd., New Delhi,2012.
5. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc,2011.
6. Ian Morison, Introduction to Astronomy and Cosmology, John Wiley and Sons, Ltd.,2013.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	2				4	2				6				4				4						24
2		2				2	6			2	4			4											20
3		4				4	2			4				2				2							18
4	2	2				4					6			2				2							18
5	2	2				4	4			4					4										20
Total																									100

Assessment Questions

Remember

1. Reproduce Hooke'slaw.
2. Name the three types of moduli ofelasticity.
3. List the two applications of airwedge.
4. Recall the two conditions required for achieving total internalreflection.
5. Define magnetostrictioneffect.

6. Recognize the four applications of ultrasonics in medical field.
7. Write the Bragg's condition necessary for obtaining X-ray diffraction incrystals.
8. Retrieve the seven types of crystalsystem.
9. Recall four physical significance of wavefunction.
10. Define photoelectriceffect.

Understand

1. Explain the procedure adopted for determining the Young's modulus of the given material by non-uniform bendingmethod.
2. Illustrate the effect of temperature on elasticity of amaterial.
3. Classify the fiber optics based on refractive indexprofile.
4. Indicate the role of optical resonators in the production oflaser.
5. Compare the merits of magnetostriction and piezo-electricoscillators.
6. Summarize the four applications of ultrasonic waves in day-todaylife.
7. Identify the closely packed cubic crystal structure with anexample.
8. Compare Laue method and powder crystal method used in X-raydiffraction.
9. Infer the significance of photoelectriceffect.
10. Represent the two assumptions involved in solving the Schrödinger time dependent wave equation.

Apply

1. Show that when a cylinder is twisted the torsional couple depends on torsionalrigidity.
2. Using torsional pendulum, explain the rigidity modulus of the wire.
3. Design an experimental setup used for determining the thickness of a thinmaterial.
4. A silica optical fiber has a core refractive index of 1.50 and a cladding refractive index of 1.47. Find the numerical aperture for thefiber.
5. Construct the piezo electric oscillator circuit and explain the generation of ultrasonicwaves
6. Find the depth of submerged submarine if an ultrasonic wave is received after 0.33 s from the time of transmission.(given v=1400m/s).
7. Show that the axial ratio for an ideal HCP structure is1.633.
8. Sketch the planes having Miller indices (100) and(111).
9. Assess the various energy levels of an electron enclosed in a one dimensional potential well of finite width'a'.
10. Compute the relation between de Broglie wavelength and velocity of aparticle.

Analyze

1. Differentiate uniform bending from non-uniformbending.
2. Straight lined fringes are formed only in flat glass plates.Justify.
3. Conclude that the thickness of thin wire is influenced by band width of amaterial
4. Outline the merits and demerits of magnetostriction oscillatormethod.
5. Five fold symmetry is not possible in crystal structures. Justify youranswer.
6. Compare the degenerate state with non-degeneratestate.

Evaluate

1. Determine the viscosity of a given liquid using Poiseuille's method (Given: water, burette, stop clock, capillary tube, stand and travellingmicroscope).
2. When ultrasonic waves are passed through liquids, cavitations are produced. Criticize the statement.

15CH103 ENVIRONMENTAL SCIENCE 2 0 2 3

Course Objectives

- Realize the interdisciplinary and holistic nature of theenvironment
- Understand how natural resources and environment affect the quality of life and stimulate the quest for sustainabledevelopment
- Recognize the socio-economic, political and ethical issues in environmentalscience

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Assess the importance of interdisciplinary nature of environment studies, uses and exploitation of naturalresources.
2. Analyze the different types of ecosystems and biodiversity, its values and also role of professionals in protecting the environment fromdegradation.
3. Identify the existing environmental challenges related to pollutionand its management.
4. Select suitable strategies for sustainable management of components ofenvironmental.
5. Correlate the impacts of population and human activities onenvironment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1												
2		2										
3			3			3	1					
4			2			1	3					
5			2			2	2					

UNIT I **6 Hours**

NATURAL RESOURCES

Forest resources: Use - over exploitation - deforestation - case studies. Water resources: Use - over utilization of surface and ground water - conflicts over water. Mineral resources: Use - exploitation - environmental effects of extracting and using mineral resources - case studies. Food resources: Effects of modern agriculture - fertilizer-pesticide problems (eutrophication, blue baby syndrome, biomagnification)

- waterlogging - salinity - case studies. Energy resources: renewable(solar, wind, tidal, geothermal and hydroelectric power) - non renewableenergysources

UNIT II **6 Hours**

ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem: Structure and function of an ecosystem - producers - consumers - decomposers - food chains - food webs and ecological pyramids - Types of ecosystem: Introduction - characteristic features:forestecosystem-desertecosystem-ecologicalsuccession.Biodiversity-valueofbiodiversity - threats to biodiversity - endangered and endemic species - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity - field study

UNIT III **6 Hours**

ENVIRONMENTAL POLLUTION

Pollution: Definition - causes - effects - control measures of air pollution - water pollution : (Sewage water treatment by activated sludge and trickling filter process) - marine pollution - thermal pollution - noise pollution. Disaster management: causes - effects - control measures of floods - earthquake -cyclone - landslides

UNIT IV **7 Hours**

SOCIAL ISSUES AND ENVIRONMENT

Sustainable development : Definition - Unsustainable to sustainable development - urban problems related to energy. Environmental ethics - issues and possiblesolutions - solid waste management - causes - effects - 3R Principles (landfills, incineration, composting). Water conservation - rain water harvesting - watershed management. Climate change - global warming - acid rain - ozone layer depletion. Environment protection act: Air (Prevention and control of pollution) act - wildlife protection act

UNIT V **5 Hours**

HUMAN POPULATION AND ENVIRONMENT

Human population: Population growth - characteristics - variation among nations - population explosion - women and child welfare programmes - value education - HIV / AIDS. Role of information technology in environment and human health - occupational safety and health administration (OSHA)

FOR FURTHER READING

Human rights:E - waste and biomedical waste -Identification of adulterants in food materials

EXPERIMENT **1**2 Hours

General instructions to students for handling the reagents and safety precautions.

EXPERIMENT 2 4 Hours

Estimation of dissolved oxygen in a water sample/sewage by Winklers method

EXPERIMENT 3 4 Hours

Estimation of chloride content in water by argentometric method

4

EXPERIMENT 4 4 Hours
Estimation of calcium in lime by complexometric method

EXPERIMENT 5 4 Hour
Estimation of chromium in leather tannery effluents

EXPERIMENT 6 4 Hours
Determination of percentage purity of washing soda

EXPERIMENT 7 4 Hours
Estimation of heavy metals in the given solution by EDTA method

EXPERIMENT 8
Determination of Prussian blue dye concentration by spectrophotometer **4 Hours**

Total: 60 Hours

Reference(s)

1. AnubhaKaushik, C.P. Kaushik, Environmental Science and Engineering , 4th Multi ColourEdtion, New Age International Publishers, New Delhi,2014
2. A. Ravikrishnan, Environmental Science and Engineering, 5th revised Edition, Sri Krishna Hitech Publishing company (P) Ltd, Chennai,2010
3. T. G. Jr. Miller, S. Spoolman, New Environmental Science, 14th Edition, Wadsworth Publishing Co, New Delhi,2014
4. E. Bharucha, Textbook of Environmental studies, second Edition, Universities Press Pvt. Ltd., New Delhi,2013
5. A. K. De, Environmental Chemistry, 7th Edition , New age international publishers, New Delhi, 2014

Assessment Pattern

Unit/RBT	**Remember**				**Understand**				**Apply**				**Analyse**				**Evaluate**				**Create**				**Total**
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	3	3			4	5				1			1	3											20
2	4	1			5	7							1	2											20
3	3				4	6	2		1	1			1	1				1							20
4	1	2			3	8	1			4			2	4											25
5	1	2			2	5				1			1	2				1							15
																								Total	100

Assessment Questions

Remember

1. Define the termbio-magnification.
2. Name any four major gases responsible for airpollution.
3. Recall four gases responsible for greenhouseeffect.
4. State environmentalethics.
5. List any two impacts of waterpollution.
6. Mention the two objectives of valueeducation.
7. List the any four consequences of air pollution on humanhealth.
8. Recognize any two endangered and endemic species ofIndia.
9. List any two disadvantages of nuclear energyproduction.

Understand

1. Summarize the structural and functional attributes of anecosystem.
2. With the help of neat flow chart explain waste water treatment process using activated sludge process.
3. Explain the modern method of rain water harvesting technique diagrammatically and discuss the various strategies adopted for waterconservation.
4. Summarize the abstracts of Wildlife (protection) Act,1972.
5. Indicate the three consequences of noisepollution.
6. Classify the ecosystems on the basis of energysources
7. Infer two types of photochemical reactions involved in formation and destruction of ozone in the stratosphere.
8. Explain how the impacts of natural disasters can be minimized on human communities with on representative eexample.
9. Summarize four major effects caused on forests and tribal people due to big damconstruction.
10. Infer the any two conflicts over water, confining to ournation.
11. Identify three major threats to Indian biodiversity
12. Relate the concept of food chain and food web with tropic level and mention their three significances.

Apply

1. Identify any seven impacts caused if ground water is usedenormously.
2. Select the proper disaster management techiques that can be implemented to manage. a) Earthquake b)Floods
3. Summarize the concept age-structure pyramids as a tool to achieve stabilized population in our nation.
4. Predict the significances of child welfare programmesinIndia.
5. Implement the 3R approach to manage solidwaste.
6. Assess the four adverse effects of solidwaste.
7. Assess how climate change affects humanhealth.

Analyse

1. Differentiate between confined and unconfinedaquifers.
2. Distinguish between critical and strategic minerals with two examples foreach.
3. Outline variations in population growth among nations with necessarydiagram.
4. “Day by day our atmosphere gets prone to serious effects” and “deterioration of environment affects human health”. Justify these twostatements.
5. Compare the major two advantages and limitations of major greenhouse pollutantCO_2.

Evaluate

1. Choose any one suitable method to minimize the impact of acid rain on environment.

15GE105 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

2 0 2 3

Course Objectives

- To understand the basic concepts of electric circuits and magneticcircuits.
- To illustrate the construction and operation of various electrical machines and semiconductor devices.
- To Learn the fundamentals of communicationsystems.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Apply the fundamental laws to electric circuits and compute the different alternatingquantities.
2. Apply the laws of magnetism for the operation of DCmotor.
3. Examine the construction and working principle of different ACmachines
4. Analyze the different speed control methods of DC motors and specialmachines.
5. Analyze the performance characteristics and applications of semiconductordevices.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3											
2	1											
3	1											
4	1											
5	1											

UNIT I **7 Hours**

ELECTRIC CIRCUITS

Definition of Voltage, Current, Electromotive force, Resistance, Power & Energy, Ohms law and Kirchoffs Law & its applications - Series and Parallel circuits - Voltage division and Current division techniques - Generation of alternating emf - RMS value, average value, peak factor and form factor- Definition of real, reactive and apparent power.

UNIT II **5 Hours**

DC MACHINES

Introduction of magnetic circuits - Law of Electromagnetic induction, Flemings Right & Left hand rule- Types of induced emf - Definition of Self and Mutual Inductance - DC Motor- Contruction - Working Principle- Applications.

UNIT III **6 Hours**

AC MACHINES

Single Phase Transformer - Alternator - Three phase induction motor - Single phase induction motor - Contruction - Working Principle - Applications.

UNIT IV **5 Hours**

ELECTRICAL DRIVES

Speed control of dc shunt motor and series motor - Armature voltage control - Flux control - Construction and operation of DC servo motor - Construction and operation of DC servo motor stepper motor.

UNIT V **7 Hours**

ELECTRON DEVICES AND COMMUNICATION

Characteristics of PN Junction diode and Zener diode - Half wave and Full wave Rectifiers - Bipolar Junction Transistor - Operation of NPN and PNP transistors - Logic gates - Introduction to communicationsystems.

FOR FURTHER READING

Voltage Regulator - Stepper motor - Energy meter - SMPS, Satellite and Optical communication.

EXPERIMENT 1 4 Hours

Analyze the VI characteristics of a fixed resistor and a lamp by varying its temperature.

EXPERIMENT 2 4 Hours

Apply the voltage division and current division techniques for series and parallel connections of lamp loads.

EXPERIMENT 3 4 Hours

Understand the concept of electromagnetic induction using copper coil.

EXPERIMENT 4 4 Hours

Understand the construction and working principle of DC machines.

EXPERIMENT 5 4 Hours

Determine the VI Characteristics of PN Junction diode and plot the input and output wave shapes of a half wave rectifier.

EXPERIMENT 6 4 Hours

Realize the working of transistor as an electronic switch through experiments.

EXPERIMENT 7 4 Hours

Lighting applications using logic gates principle.

Total: 60 Hours

Reference(s)

1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. SmarjithGhosh, Fundamentals of Electrical and Electronics Engineering, Prentice Hall (India) Pvt. Ltd.,2010
3. A. Sudhakar, Shyammohan S Palli, Circuits and Networks Analysis and Synthesis, Tata McGraw Hill,2010
4. R. S. Sedha, A Textbook of Applied Electronics, S.Chand& Company Ltd,2013
5. Muthusubramanian&Salivahanan, Basic Electrical and Electronics Engineering and Communication Engineering, Seventh Edition, Tata MCGraw Hill Education Private Limited, 2011

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					2	2			2			2				2			2		2		4	20
2		3									2	2		2					2	2			2	5	20
3			3				2				2			6				2		2		3			20
4				2				2		2		2			4		3		2				3		20
5			2				2			2				3				3	3		2			3	20
																								Total	100

Assessment Questions

Remember

1. State Kirchhoff’s currentlaw.
2. State Ohm’slaw.
3. State Kirchhoff’s voltagelaw.
4. State Faraday’s law of electromagnetic induction.
5. Give the properties of fluxlines.
6. Definereluctance.
7. Define magneticflux.
8. State the operating principle of atransformer.
9. State the operating principle of DCgenerator.
10. What is backemf?
11. State the operating principle of DCMotor.
12. State Fleming’s Left handrule.
13. State Fleming’s Right handrule.
14. Sketch the V-I characteristics of zenerdiode.
15. What is junctionbarrier?
16. What isBJT?
17. List the applications of optical fibre communication.
18. Define aspectratio.

Understand

1. Define averagevalue.
2. Compare series and parallelcircuits.
3. Why domestic appliances connected inparallel?

4. Classify the magneticcircuits.
5. Describe the concepts of self and mutually induced emf.
6. What is leakagecoefficient?
7. Interpret the laws of electromagneticinduction.
8. Elucidate the working principle of atransformer.
9. What is DCgenerator?
10. List the applications of DCmotors.
11. Illustrate the construction and working principle of three phase inductionmotor.
12. Outline the applications of DCgenerators.
13. Demonstrate the action of diode in forward and reversebiasing.
14. Explain the operation of NPNtransistor.
15. Draw symbol of diode and zenerdiode.
16. Illustrate the input and output characteristics of CEconfiguration.
17. Exemplify the need formodulation.
18. Summarize the advantages of FM overAM.
19. State the need formodulation.
20. Discuss the principle of frequencymodulation.

Apply

1. Three resistors are connected in series across a 12V battery. The first resistance has a value of 2 Ω, second has a voltage drop of 4V and third has power dissipation of 12 W. Calculate the value of the current in thecircuit.
2. A 25 Ω resistor is connected in parallel with a 50 Ω resistor. The current in 50 Ω resistor is 8A. What is the value of third resistance to be added in parallel to make the total line current as 15A?
3. The self - inductance of a coil of 500turns is 0.25H.If 60% of the flux is linked with a second coil of 10500 turns. Calculate a) the mutual inductance between the two coils and b) emfinduced in the second coil when current in the first coil changes at the rate of100A/sec.
4. An air cored toroidal coil has 480 turns, a mean length of 30cm and a cross-sectional area of 5 cm^2.Calculate a)the inductance of the coil and b) the average induced emf, if a current of 4 A is reversed in 60 milliseconds
5. A toroidal air cored coil with 2000 turns has a mean radius of 25cm, diameter of each turn being 6cm. If the current in the coil is 10A, find mmf, flux, reluctance, flux density and magnetizing force.
6. Construct the circuit of voltageregulator.
7. Outline the applications of DCmotors.
8. Develop the block diagram of the television and explain eachblock.
9. Build the circuit of full wave bridgerectifier.
10. Develop the block diagram of the optical fibre communication and explain eachblock.
11. Construct the circuit of half waverectifier.

Analyse

1. Analyze the voltage, current and power in a resistor supplied with analternating voltage.
2. Obtain the equations for the equivalent star network resistances for a given deltanetwork.
3. Derive the expression for RMS, average value, peak and form factor of sinusoidalvoltage.
4. Analyze the voltage, current and power relationship in three phase star connectedsystem.
5. Derive the expressions for self -inductance and mutualinductance.
6. Analyze the series and parallel magnetic circuit and derive the total mmfrequired.
7. Compare electric and magneticcircuits.

8. Derive the emfequation of DCGenerator.
9. Obtain the expression for current amplificationfactor.
10. Derive the expression of ripple factor, efficiency of full wave bridgerectifier.

Evaluate

1. Estimate the value of mesh currents in the followingnetwork.
2. For the circuit in Fig. determine i_X and compute the power dissipated by the 15-kΩresistor.
3. Estimate the value of node voltage in the followingnetwork.
4. An iron rod of 1cm radius is bent to a ring of mean diameter 30cm and wound with 250 turns of wire. Assume the relative permeability of iron as 800. An air gap of 0.1cm is cut across the bent ring. Calculate the current required to produce a useful flux of 20,000 lines if leakage isneglected.
5. Theeffectiveresistanceoftworesistorsconnectedinseriesis100 . When connected in parallel, then effective value in 24 ohm’s. Determine the value of tworesistors.
6. Determine the equivalent resistance of the followingcircuit
7. Calculate the total resistance R_T, and total current I in the following circuits using star delta transformationtechnique

Create

1. Create the circuit diagram of 5V regulated powersupply.
2. Plan the combinational circuit diagram of EX-NOR gate using NORgate.

15GE206 COMPUTER PROGRAMMING 3 0 2 4

Course Objectives

- To learn the basics of computerorganisation.
- To study the basics of C primitives, operators andexpressions.
- To understand the different primitive and user defined datatypes.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Develop solutions using problem solving techniques and number systemconversions
2. Develop programs using operators, type conversion and input-outputfunctions
3. Apply decision making and looping statements in writing Cprograms
4. Apply the concepts of arrays and strings in developing Cprograms
5. Design applications using structures and functions inC

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3											
2	3											
3	2											
4	1											
5	1											

UNIT I **8 Hours**

INTRODUCTION TO COMPUTERS

Introduction to computers - Characteristics of Computers - Evolution of Computers - Computer Generations - Basic Computer Organization - Number System - Problem Solving Techniques - Features of a Good ProgrammingLanguage.

UNIT II **9 Hours**

INTRODUCTION TO C PROGRAMMING

Overview of C-Structure of C program-Keywords-Constants- Variables-Data types-Type conversion Operators and Expressions: Arithmetic-Relational-Logical-Assignment- Increment and Decrement-Conditional-Bitwise -Precedence of operators-Managing I/O operations-Formatted I/O-Unformatted I/O.

UNIT III **10 Hours**

CONTROL STATEMENTS

Decision Making and Branching: simple if statement-if else statement-nesting of if else Statement-Switch Statement.Decision Making and Looping: while statement-do while statement-for statement-Nested for statement Jump Statements: goto-break-continue-return statement

UNIT IV **9 Hours**

ARRAYS AND STRINGS

Arrays: Introduction, one dimensional array, declaration - Initialization of one dimensional array, two-dimensional arrays, initializing two dimensional arrays, multi dimensional arrays. Strings: Declaring and initializing string variables- Reading strings from terminal - writing string to screen - String handlingfunctions.

UNIT V **9 Hours**

STRUCTURES AND FUNCTIONS

Structures and Unions: Introduction-defining a structure- declaring structure variables-accessing structure members- structure initialization-Unions-Enumerated data type
User Defined Functions: Elements of user defined functions -Definition of functions-return values and their types- function calls-function declaration-categories of function -call by value and call by reference-recursion-Preprocessor directives andmacros.

FOR FURTHER READING

Creating and manipulating document using word - Mail merge - Creating spread sheet with charts and formula using excel - developing power point presentation with Animations - C graphics using built in functions

EXPERIMENT 1 **3 Hours**

Write a C program to perform arithmetic operations on integers and floating point numbers.

EXPERIMENT 2 **3 Hours**

Write a C program to implement ternary operator and relational operators.

EXPERIMENT 3 **3 Hours**

Write a C program to find the greatest of three numbers using if-else statement.

EXPERIMENT 4 **3 Hours**

Write a C program to display the roots of a quadratic equation with their types using switch case.

EXPERIMENT 5 **3 Hours**

Write a C program to generate pyramid of numbers using for loop.

EXPERIMENT 6 4 Hours

Write a C program to perform Matrix Multiplication

EXPERIMENT 7 3 Hours

Write a C program to check whether the given string is Palindrome or not.

EXPERIMENT 8 4 Hours

Write a C program to find the factorial of given number.

EXPERIMENT 9 4 Hours

Design a structure to hold the following details of a student. Read the details of a student and display them in the following format Student

Total: 75 Hours

Reference(s)

1. Pradeep K. Sinha, PritiSinha, Computer Fundamentals, BPB publications,2008
2. Ashok. N. Kamthane, Computer Programming, Second Edition, Pearson Education,2012
3. E.Balagurusamy, Programming in ANSI C, Tata McGraw-Hill,2012
4. Herbert Schildt, C -The complete Reference, Tata McGraw-Hill,2013
5. Byron Gottfried, Programming with C, Schaum's Outlines, Tata Mcgraw-Hill,2013

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	6	4				4					6														20
2	6					2					12														20
3	2				2		4				6		6												20
4	6				2		4		4		4														20
5	4				2		2				2						6				4				20
																								Total	100

Assessment Questions

Remember

1. List the characteristics of acomputer.
2. List the features of a good programminglanguage.
3. Define aconstant.
4. Defineassociativity.
5. List the three looping statments inC.
6. State the use of switch casestatement.
7. Recallarrays.
8. Recallstrings.
9. Define astructure.
10. Define aunion.

Understand

1. Explain the generationsofcomputers.

2. Exemplify the problem solvingtechniques.
3. Illustrate the structure of a C program with anexample.
4. Summarise the operators inC.
5. Exemplify the decision making statements inC.
6. Classify the looping statements inC.
7. Classify the types of arrays inC.
8. Summarize the string handling functions inC.
9. Exemplify the process of defining astructure.
10. Explain the components of afunction.

Apply

1. Predict the reason for calling C as a structured programminglanguage.
2. Demonstrate the concept of numberconversions.
3. Execute a C program to find the roots of a quadratic equation.
4. Implement a C program to use the bitwiseoperators.
5. Implement a C program to generate fibonacciseries.
6. Implement a C program to check whether a number i prime ornot.
7. Implement a C program to perform matrixmultiplication.
8. Implement a C program to check whether a string is a palindrome ornot.
9. Implement a C program to find the size of aunion.
10. Implement a C program to swap two numbers using call by value and call byreference.

Analyse

1. Differentiate while and do whilestatements.
2. Compare structure and union inC.
3. Organize the basic computerorganization.
4. Differentiate == and =operators.
5. Differentiate rack and continuestatements.

Evaluate

1. Check the value of th expression c=(x*y+(z/x)) withx=10,y=20,z=30.
2. Determine the sum of n numbers usingfunctions.
3. Determine the vowels using switch casestatement.
4. Differentiate the use of strcpy() and strncpy()functions.

Create

1. Generate a structure to store the following details: Rollno, Name, Mark1, Mark2, Mark3, Total, Average, Result and Class. Write a program to read Rollno, name and 3 subject marks. Find out the total, result and class asfollows:
   a) Total is the addition of 3 subjectmarks.
   b) Result is "Pass" if all subject marks are greater than or equal to 50 else"Fail".
   c) Class will be awarded for students who have cleared 3subjects
   i. Class "Distinction" if average>=75
   ii. Class "First" if average lies between 60 to 74 (bothinclusive)
   iii. Class "Second" if average lies between 50 & 59 (bothinclusive)
   d) Repeat the above program to manipulate 10 students' details and sort the structures as per rank obtained bythem.
2. Derive a C program that determines whether a given integer is odd or even and displays the number and description on the sameline.

15GE207 ENGINEERING GRAPHICS 0 0 4 2

Course Objectives

- To learn conventions and use of drawing tools in making engineeringdrawings.
- To draw orthographic projections of points, line andsolids.
- To draw the section of solids and development of surfaces of the givenobjects.
- To draw the isometric projections and perspective projections of the givensolids.
- To introduce CAD software to draw simple two dimensionaldrawings.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Recognize the conventions and apply dimensioning concepts while drafting simpleobjects.
2. Draw the orthographic projection of points, line, and solids.
3. Draw the section of solid drawings and development of surfaces of the givenobjects.
4. Draw the isometric and perspective projection of the givenobjects.
5. Draw the simple two dimensional drawings using computer aided drawingtool.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2		1										
3			1									
4			2									
5	1	1		1	1							

1 **12 Hours**

CONVENTIONS AND BASIC DRAWINGS

Importance - conventions - ISO and BIS - drawing tools and drawing sheets - lettering, numbering, dimensioning, lines and Symbols-Conic sections - types constructions -ellipse, parabola and hyperbola - eccentricity and parallelogram method.

14 Hours

ORTHOGRAPHIC PROJECTIONS

Principles - first and third angle projections - Points - first angle projection of points, straight lines - parallel, perpendicular and inclined to one reference plane, solid - cylinders, pyramids, prisms and cones.

12 Hours

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACE

Section of solids - simple illustrations.Development of surfaces - cylinders, pyramids, prisms, cones and simple truncated objects.

12 Hours

ISOMETRIC AND PERSPECTIVE PROJECTIONS

Importance - orthographic to isometricprojection - simple and truncated solids- perspective projections of simple solids.

10 Hours

INTRODUCTION TO COMPUTER AIDED DRAWING (NOT FOR END SEMESTER EXAMINATION)

Basics commands of AutoCAD - two dimensional drawing, editing, layering and dimensioning - coordinate Systems -Drawing practice - orthographic views of simple solids using AutoCAD.

Total: 60 Hours

Reference(s)

1. K Venugpoal, Engineering Drawing and Graphics, Third edition, New Age International,2005.
2. BasantAgrawal, Mechanical drawing, Tata McGraw-Hill Education,2008.
3. Engineering Drawing Practice for Schools & Colleges, BUREAU OF INDIAN STANDARDS- SP46,2008.
4. N. D. Bhatt and V. M. Panchal, Engineering Drawing, Charotar Publishing House Pvt. Limited, 2008.
5. K.V.Natarajan, A Text Book of Engineering Graphics, Dhanalakshmi Publishers,2013.
6. George Omura, Brian C. Benton, Mastering AutoCAD 2015 and AutoCAD LT 2015: Autodesk Official Press, Wiley Publisher,2015.

15MA201 VECTOR CALCULUS AND COMPLEX ANALYSIS

3 2 0 4

Course Objectives

- Implement the Complex Analysis, an elegant method in the study of heat flow, fluid dynamics and electrostatics.
- Summarize and apply the methodologies involved in solving problems related to fundamental principles of Calculus viz: Differentiation, Integration and Vectors.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Determine & apply the important quantities associated with vector fields such as the divergence, curl and scalar potential.
2. Apply the theoretical aspects of vector integral calculus in their core areas.
3. Recognize the differentiation properties of vectors.
4. Identify the complex functions and their mapping in certain complex planes.
5. Use the concepts of integration to complex functions in certain regions.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1										
2	2	3										
3	2											
4	1	3										
5	3											

UNIT I **10 Hours**

VECTOR CALCULUS

Gradient -Divergence -Curl - Directional derivative- Solenoidal -Irrotational vector fields -Line Integral - Surface integrals.

UNIT II **9 Hours**

INTEGRAL THEOREMS OF VECTOR CALCULUS

Green's theorem in a plane- Stoke's Theorem- Gauss divergence theorem- Applications involving cubes and parallelepiped.

UNIT III **8 Hours**

ANALYTIC FUNCTIONS

Analytic Functions- Necessary and Sufficient conditions of Analytic Function- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method - Applications to the problems of Potential Flow.

UNIT IV **8 Hours**

MAPPING OF COMPLEX FUNCTIONS

Physical interpretation of mapping- Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).

UNIT V **10 Hours**

INTEGRATION OF COMPLEX FUNCTIONS

Cauchy's Fundamental Theorem - Cauchy's Integral Formula - Taylor's and Laurent's series- Classification of Singularities - Cauchy's ResidueTheorem.

FOR FURTHER READING

Applications to Electrostatic and Fluid Flow.

Total: 75 Hours

Reference(s)

1. C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-HillPublishing Company Ltd,2003
2. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited,New Delhi2015
3. J. A. Brown and R. V. Churchill, Complex Variables and Applications , Sixth Edition, McGraw Hill,New Delhi,1996
4. B. S. Grewal, Higher Engineering Mathematics, Forty third Edition, Khanna Publications , New Delhi2014
5. Peter V. O. Neil, Advanced Engineering Mathematics, Seventh Edition ,Cengage Learning India Private Limited,2012
6. Glyn James, Advanced Engineering Mathematics, Third Edition,WileyIndia,2007

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					6					8			4			2								22
2	2					4				4					4				6						20
3		2									10								6						18
4	2						4				6				6										18
5	2						4			6				4					6						22
																								Total	100

Assessment Questions
Remember

1. Define gradient of a vector.
2. Define irrotational of a vector.
3. State Green's theorem.
4. State Gauss divergence theorem.
5. Check whether the function is f(z)=z3 analytic?
6. List the necessary condition for a function f(z) to be analytic.
7. Define Bilinear transformation.
8. State the condition for the transformation w = f(z) to be conformal at a point.
9. State the formula for finding the residue of a double pole?
10. State Cauchy's integral formula.

Understand

1. If $\vec{F} = x^2\vec{i} + xy^2\vec{j}$ evaluate the line integral $\int \vec{F}.\vec{dr}$ from (0,0) to (1,1) along the path y=x.
2. Identify the unit normal vector to the surface $x^2 + xy + z^2 = 4$ at the point (1,-1,2).
3. Identify the value of $\nabla x \nabla \Phi$.(F), using Stoke's theorem.
4. Formulate the area of a circle of radius a using Green's theorem . (C)
5. Illustrate the two properties of analytic function.
6. Represent the analyticity of the function w = sin z.
7. Identify fixed points of the transformation w = z^2.
8. Identify the image of the triangular region in the z plane bounded by the lines x= 0, y = 0, and x + y = 1 under the transformation w = 2z.
9. Infer $\int_c \frac{dz}{(z-3)^2}$ where c is the circle $|z| = 1$.
10. Identify the residues of the function $f(z) = \frac{4}{z^3(z-2)}$ at its simple pole.

Apply

1. Find $\int_c \overline{F}.dr$ where $\overline{F} = (2y+3)i + xzj + (yz-x)k$ along the line joining the points (0,0,0) to (2,1,1).
2. If $\vec{F} = 3xy\vec{i} - y^2\vec{j}$, find $\int_C \vec{F} \cdot d\vec{r}$ where C is the curve in the xy-plane y=2x2 from (0,0) to (1, 0).
3. Apply Green's theorem in the plane to Compute $\int_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is the boundary of the region defined by x=0, y=0 and x+y=1.
4. Using Gauss divergence theorem,Compute $\iint_s \vec{F} \cdot \hat{n} ds \; where \; \vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ and S is the surface of the cube bounded by x=0,y=0,z=0,x=1,y=1,z=1.

5. If ω=φ+iψ represent the complex potential for an electric field and $\psi = x^2 - y^2 + \dfrac{x}{x^2+y^2}$, find the function φ.

6. If $u = \log(x^2 + y^2)$, find v and f (z) such that f (z) =u+iv is analytic.

7. Find bilinear transformation which maps the points I,-1,I of the z plane into the Points 0,1,∞ of the w plane respectively.

8. Find the image of the circle $|z-1| = 1$ in the complex plane under the transformation w = $\dfrac{1}{z}$.

9. Find Taylor's series f(z) = cos z about z = $\dfrac{\pi}{3}$.

10. 10. Find the nature of singularity $z\, e^{\left(\frac{1}{z}\right)^2}$.

Analyze

1. Conclude $div\, grad(r^n) = \nabla^2(r^n) = n(n+1)\, r^{n-2}$.
2. Demonstrate the irrotational vector and solenoidalvector with an example.
3. Justify stokes's theorem for $\overline{F} = -yi + 2yzj + y^2k,$ where S is the upper half of the sphere $x^2+y^2+z^2=1$.
4. Justify Gauss divergence theorem for $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ where S is the surface of the cuboid formed by the planes x= 0, x= a, y = 0, y = b, z = 0 and z = c.
5. The complex potential f(z)=z2 describes a flow with constant equipotential lines and streamlines ,Determine the velocity vector.
6. Show that the function $u = x^3 + x^2 - 3xy^2 + 2xy - y^2$ is harmonic and find the corresponding analytic function.
7. Find the image of the rectangle whose vertices are (0,0), (1,0), (1,2), (0,2) by means of linear transformation w = (1+i)z+2-i. Also compare the images.
8. Generate $f(z) = \dfrac{z}{(z-1)(z-3)}$ as Laurent's series valid in the regions: $1 < |z| < 3$ and $0 < |z-1| < 2$
9. Use Cauchy's integral formula Compute $\int_C \dfrac{e^z\, dz}{(z+2)\,(z+1)^2}$ where C is the circle $|\, z\, | = 3$.
10. .Find $\int_C \dfrac{z+4}{z^2+2z+5}dz$ where C is $|z+1+i| = 2$. (C)

Evaluate

1. Determine $\iint_s (xdydz + 2ydzdx + 3zdxdy)$,where s is the closed surface of the sphere $x^2 + y^2 + z^2 = a^2$.
2. Prove that $curl(curl\vec{F}) = grad(div\vec{F}) - \nabla^2\vec{F}$.

3. Check Stokes theorem for $\vec{F} = (x^2 + y^2)\vec{i} - 2xy\vec{j}$ taken around the rectangle bounded by x=±a,y=0 y=b.

4. Check Green's theorem in the plane to determine $\int_c (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where c is the boundary of the region defined by $(i)\, x = 0, y = 0, x + y = 1 (ii)\, y = \sqrt{x}\ and\ y = x^2$.

5. Determine the analytic function f(z) = P + iQ, if Q = $\dfrac{\sin x \sinh y}{\cos 2x + \cosh 2y}$, if f(0) = 1.(C)

6. Determinef(z) and the conjugate harmonic v such that w = u + iv is an analytic function of z given that u = $e^{x^2 - y^2} \cos 2xy$.

7. Determine the image of the infinite strip $\frac{1}{4} \le y \le \frac{1}{2}$ under the transformation w = $\frac{1}{z}$

8. Determine the Laurent's series expansion $f(z) = \dfrac{z - 1}{(z + 2)(z + 3)} \quad for\ 2 < |z| < 3$.

9. Determine $\int_C \dfrac{z + 4}{z^2 + 2z + 5} dz$ where C is $|z + 1 + i| = 2$

10. Using Cauchy's integral formula determine $\int_C \dfrac{e^z dz}{(z + 2)(z + 1)^2}$ where C is $|z| = 1$

15CE205 BASICS OF MECHANICAL ENGINEERING 3 0 0 3

Course Objectives

- To provide basic knowledge in engineering materials and manufacturing process aspects of mechanical engineering.
- To provide basic knowledge in boilers, power plants, IC engines and refrigeration.
- To provide foundation and understanding in Construction equipment and maintenance.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Course Outcomes (COs)

1. Recognize the various engineering materials and manufacturing process.
2. Analyse and design of Boilers, power plants, IC engines and refrigeration.
3. Acquire knowledge in Construction equipment and maintenance.
4. Differentiate the working principle of 4 stroke and 2 stroke and diesel engine
5. Classify the construction equipments based on operation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1			2					1	1		
2	2			2					2	2		
3	1			1					1	1		
4	1			1					1	2		
5	1			1					1	1		

UNIT I **9 Hours**

ENGINEERING MATERIALS

Mechanical properties of engineering materials- classification-ferrous-nonferrous, composition - cast iron, mild steel, high carbon steel, high speed steel, aluminum, copper, brass and applications in civil engineering-introduction to composite and smart materials.

UNIT II **9 Hours**

MANUFACTURING PROCESSES

Introduction - casting process - pattern, mould, types of sand, melting furnaces - Electrical furnaces-Metal cutting - saw cutting, gas cutting, shear cutting-Metal Joining-welding - Arc and Gas Welding, Soldering and Brazing. Introduction to Metal Forming process- Hot working and cold working processes- Forming types-Rolling, Extrusion, Bending-Lathe, Drilling and Milling machine- specifications and operation.

UNIT III **9 Hours**

BOILERS AND POWER PLANTS

Boilers -types - simple vertical boiler and Lamont boilers- Power Plants - Classification - Steam, Nuclear, Diesel, Hydel and Gas Turbine power plants - Energy- Solar Energy, Wind Mills, Tidal Power, Geothermal Power, Ocean Thermal Energy Conversion (OTEC), Biomass energy.

UNIT IV **9 Hours**

IC ENGINES AND REFRIGERATION

IC engines - classification - main components of IC engines, working of a 4 stroke and 2 stroke petrol and diesel engine, differences between 4 stroke and 2 stroke petrol and diesel engines-Refrigeration: working principle of vapour compression and vapour absorption systems -air conditioning.

UNIT V **9 Hours**

CONSTRUCTION EQUIPMENT AND MAINTENANCE

Introduction, Role of construction equipment. Earthmoving, excavating and lifting equipments- selection, Tracks and tires, buckets and blades , accessories and attachment, Bulldozers, scrapers, trucks, Excavators, cranes and forklifts. Construction equipment maintenance-types, preventive maintenance - availability and reliability, Field maintenance, Different types of hand tools and specialized maintenance tools.

FOR FURTHER READING

TMT bar, low boiling point liquids, Turbo Charger, Friction stir welding and resistant welding

Total: 45 Hours

Reference(s)

1. G. Shanmugam& S Ravindran, Basic Mechanical Engineering, Tata McGraw-Hill Publishing Company limited, New Delhi, 2010
2. . K. Sarkar, Thermal Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2008
3. P. N. Rao, Manufacturing Technology: Foundry, Forming and Welding, Tata McGraw-Hill Publishing Company Limited, New Delhi,2013.
4. S.R.J.Shantha Kumar, Basic Mechanical Engineering, Hi-tech Publications, Mayiladuthurai,2015
5. Douglas D. Gransberg ,Calin M Popescu& Richard C Ryan ,Construction equipment management for engineers, estimators, and owners, CRC Press, BocaRaton-2006.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5	5				10																			20
2		5				5				10															20
3		10				10																			20
4	10	10																							20
5		10				5				5															20
																								Total	100

Assessment Questions
Remember

1. What are the classifications ofBoilers?
2. What isturbine?
3. What do you mean by water tubeboiler?
4. What do you mean by fire tubeboiler?
5. Name the main parts of aturbine?
6. Classify powerplants?
7. DefineEnergy.
8. What are the classifications of ICEngines?
9. Name the main components of ICEngines.
10. DefineRefrigeration.
11. What do you mean by vapor compression system.
12. Define ferrousmetals.
13. What are the uses of high carbon steel.
14. Definewelding.
15. Definesoldering.
16. How you definedrilling?
17. List the types of steamTurbines?
18. Name four non-renewable sources ofenergy.
19. Name two nuclearfuels.
20. What are the advantages of windenergy?

Understand

1. How Solar Energy isgenerated?
2. How Energy is Generated using steamTurbines?
3. Compare and contrast reaction and impulseturbines.
4. How energy is generated from Diesel PowerPlants?
5. Mention the applications of solarenergy.
6. What is the function of a hydraulic turbine?
7. What is the function of a surgetank?
8. Name of the important components of diesel powerplant.
9. Name the important parts of gasturbine.
10. State the function of condenser in steam powerplant.
11. What are the requirements of a goodboiler?
12. What are the aims of pre-heating of air in a boiler?
13. State the function ofeconomizer.
14. How does a fusible plug function as a safetydevice?
15. What is the function of a steamnozzle?
16. What is the function of a sparkplug?

17. Why is cooling necessary in an ICengine?
18. How energy is generated from Nuclear PowerPlants?
19. Differentiate between vapor compression system and vapor absorptionsystem.
20. Compare and contrast 4 stroke and 2 strokeengine.
21. Differentiate between petrol & dieselengines.
22. How Taper Turning is carried out in Lathes?

Apply

1. Apply the concept of power generation and saving from other energysources
2. Apply the concept of Refrigeration in Heat removal and Heataddition
3. Draw the pressure-velocity diagram for a single stage impulse turbine.

15CE206 ENGINEERING MECHANICS 3 2 0 4

Course Objectives

- To introduce coplanar and space forces and the conditions for the equilibrium of particles and rigid bodies.
- To enhance the practical knowledge on Newton's second law of motion to the dynamics of particles

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Compute the resultant force for various force systems using laws ofmechanics.
2. Apply the equations of statics to determine the unknown reactions in plane andspace.
3. Compute the unknown frictional forces using free body diagram of particles and rigidbodies.
4. Evaluate the sectional properties of surfaces andsolids.
5. Apply the equations of dynamics to determine the unknown quantities in kinetics and kinematics.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2											
2	1	2										
3	1	3										
4	1		3									
5	3	1										

UNIT I **9 Hours**

BASICS AND STATICS OF PARTICLES

Introduction - Units and dimensions - Laws of mechanics - Parallelogram law of forces - Vectors - Vectorial representation of forces -Coplanar forces - Resolution and composition of forces - Equilibrium of a particle under coplanar forces - Forces in space - Equilibrium of a particle in space.

UNIT II **9 Hours**

EQUILIBRIUM OF RIGID BODIES

Free body diagram - Types of supports and their reactions - Moments and couples- Vectorial representation of moments and couples - Scalar components of a moment - Varignon's theorem - Resolution of a given force into a force acting at a given point and a couple - Reduction of a system ofcoplanar forces acting on a rigid body into a single force and a single couple - Equilibrium of rigid bodies in two dimensions - Equilibrium of rigid bodies in three dimensions

UNIT III **9 Hours**

FRICTION

Frictional force - Laws of Coulomb friction - Angle of friction - Cone of friction - Simple contact friction - Ladder friction - Belt friction -Transmission of power through belts - Wedge friction - Problems involving the equilibrium of rigid bodies with frictional forces

UNIT IV **9 Hours**

PROPERTIES OF SURFACES AND SOLIDS

Determination of areas and volumes - First moment of area and the determination of centroid of any cross section - Moment of inertia of plane areas - Parallel axis theorem - Polar moment of inertia-Product of inertia-Principal moments of inertia of plane areas

UNIT V **9 Hours**

DYNAMICS OF PARTICLES

Kinematics of particles in rectilinear motion - Relationships between displacement - velocity and acceleration - Uniform rectilinear motion and uniformly accelerated rectilinear motion - Curvilinear motion-projectile motion.Newtons second law of motion - Work done by a force-kinetic energy and potential energy - Principle of work and energy

FOR FURTHER READING

Principles of relativistic Mechanics- Equilibrium of Multiply Connected Rigid Bodies - Friction Offered by Thrust Bearing - Screw jack - Self locking - Rolling resistance - Mass centre of a body - Moment of inertia of mass of a body - Principal Mass Moment of Inertia - Principle of impulse and momentum - Impact of elastic bodies

Total: 75 Hours

Reference(s)

1. M. S. Palanisamy and S. Nagan, Engineering Mechanics - Statics & Dynamics, TMH Publishing Company,2005
2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers - Statics and Dynamics,Tata McGraw Hill Publishing Company, New Delhi,2005
3. R.C. Hibbeller, Engineering Mechanics- Statics (vol. I), Dynamics (vol. II), Pearson Education Asia Pvt. Ltd.,2000
4. Andrew Pytel and JaanKiusalaas, Engineering Mechanics - Statics (vol.I), Dynamics (vol. II), Brooks / Cole Publishing Company, 1999
5. Irving H. Shames, Engineering Mechanics - Statics and Dynamics, Pearson Education Asia Pvt.

Ltd.,2004

6. Kottiswaran.N, Engineering Mechanics - Statics and Dynamics, Sri Balaji Publications,2005

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					2					6				4				6						20
2	4					4				2				6					4						20
3	2				6	4				4					4										20
4	4					6				4					6										20
5	4					4				12															20
																								Total	100

Assessment Questions

Remember

1. State Lame's theorem
2. Write the equilibrium equations of solid body
3. Distinguish between scalar and vector
4. List out the different types of supports.
5. Define friction
6. What is meant by cone of friction?
7. State perpendicular axis theorem.
8. Differentiate between center of gravity and centroid
9. State Newton's second law of motion.
10. State Transmissibility of Force.

Understand

1. Write the difference between units and dimensions
2. State the theorem to solve the unknowns for the concurrent force system.
3. What is meant by composition of forces?
4. Determine the support reaction for a simply supported beam with UDL over the entire span.
5. Draw the free body diagram of a body rest on ground and is tied with vertical wall.
6. Discuss the transmission of power through belts
7. A bullet of weight 50 gm is fired into a body of weight 5 kg, which is suspended by a string 1 m long. Due to this impact, the 5 kg body swings through an angle of 30º from the vertical. Calculate the velocity of the bullet.

Apply

1. Derive the expression between tensions on two sides of a belt and pulley system in terms of angle of wrap and coefficient of friction.
2. What are perpendicular and parallel axis theorems? Discuss their application
3. Calculate the moment of inertia about the base of a rectangle 350 x 250 mm
4. Determine the centroid of hollow circular section of thickness 25mm and external diameter 300mm
5. A stone is dropped in to a well at a velocity of 100m/s. Calculate the height of the well if the height of water in the well is 5m.
6. Calculate the friction between the ladder and the floor, the angle between the floor and the ladder is 60 degree. The length of the ladder is 3m and a man is standing at a height of 2m from bottom of the ladder. Assume the vertical surface is smooth.
7. What are the necessary and sufficient conditions for equilibrium for a concurrent force system?

15GE107 WORKSHOP PRACTICE 0 0 2 1

Course Objectives

- To provide hands on training for fabrication of components using carpentry, sheet metal and welding equipment /tools.
- To gain the skills for making fitting joints and household pipe line connections using suitable tools.
- To develop the skills for preparing the green sand mould and to make simple household electrical connection
- To provide hands on training for dismantling and assembling of petrol engines, gear box and pumps.
- To develop the skills for making wood/sheet metal models using suitabletools

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Fabricate simple components using carpentry, sheet metal and weldingequipment/tools
2. Make fitting joints and household pipe line connections using suitabletools.
3. Prepare green sand mould and make simple household electrical connections using suitabletools
4. Dismantle and assemble petrol engines, gear box andpumps.
5. Make simple models using wood and sheetmetal.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2											
2	1											
3	1											
4	2											
5	1											

EXPERIMENT 1 **2 Hours**

Forming of simple object in sheet metal using suitable tools (Example: Dust Pan / Soap Box)

EXPERIMENT 2 **4 Hours**

Fabrication of a simple component using thin and thick plates. (Example: Book rack)

EXPERIMENT 3 **2 Hours**

Making a simple component using carpentry power tools. (Example: Pen stand/Tool box/ Letter box].

EXPERIMENT 4 **2 Hours**
Prepare a "V" (or) Half round (or) Square joint from the given mild Steel flat.

EXPERIMENT 5 **4 Hours**
Construct a household pipe line connections using pipes, Tee joint, Four way joint, elbow, union, bend, Gate way and Taps (or) Construct a pipe connections of house application centrifugal pump using pipes, bend, gate valve, flanges and foot valve.

EXPERIMENT 6 **4 Hours**
Prepare a green sand mould using solid pattern/split pattern.

EXPERIMENT 7 **4 Hours**
Construct a domestic electrical wire connections using indicator, one way switch with calling bell, two way switch with lamp, one way switch with fan regulator and one way switch with socket.

EXPERIMENT 8 **4 Hours**
Dismantling and assembly of Centrifugal Monoblock / Gear Pump / Gear box.

EXPERIMENT 9 **2 Hours**
Dismantling and assembly of two stroke and four stroke petrol engine.

EXPERIMENT 10 **2 Hours**
Mini Project (Fabrication of Small Components).

Total: 30 Hours

15MA301 FOURIER SERIES AND TRANSFORMS 3 2 0 4

Course Objectives

- Understand the concepts of Fourier series, Transforms and Boundary Conditions, which will enable them to model and analyze the physical phenomena
- Implement the Fourier analysis, an elegant method in the study of heat flow, fluid mechanics and electro magnetic fields.
- Summarize and apply the mathematical aspects that contribute to the solution of one dimensional wave equation
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Recognize the periodicity of a function and formulate the same as a combination of sine and cosine using Fourier series.
2. Formulate a function in frequency domain whenever the function is defined in time domain.
3. Apply the Fourier transform, which converts the time function into a sum of sine waves of different frequencies, each of which represents a frequency component.
4. Classify a partial differential equation and able to solve them.
5. Use the Z-transform to convert a discrete-time signal, which is a sequence of real or complex numbers, into a complex frequency domain representation.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1										
2	2	1										
3	2	1										
4	1	2										
5	2	1										

UNIT I **9 Hours**

FOURIER SERIES

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range cosine and sine series - Root mean square value

UNIT II **13 Hours**

LAPLACE TRANSFORM

Laplace Transform- Existence Condition -Transforms of Standard Functions - Unit step function, Unit impulse function- Properties- Transforms of Derivatives and Integrals - Initial and Final Value Theorems
- Laplace transform of Periodic Functions - Inverse Laplace transforms.

UNIT III **8 Hours**

FOURIER TRANSFORM

Fourier Integral Theorem- Fourier Transform and Inverse Fourier Transform- Sine and Cosine Transforms - Properties - Transforms of Simple Functions - Convolution Theorem - Parseval's Identity

UNIT IV **8 Hours**

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of Second Order Quasi Linear Partial Differential Equations - Fourier Series Solutions of One Dimensional Wave Equation - One Dimensional Heat Equation - Steady State Solution of Two- Dimensional Heat Equation - Fourier Series Solutions in Cartesian Coordinates.

UNIT V **7 Hours**

Z -TRANSFORM

Z-Transform - Elementary Properties - Inverse Z-Transform - Convolution Method- Partial fraction method - Solution of Difference Equations using Z-Transform.

FOR FURTHER READING

Solutions of one dimensional wave equation and heat equations using Laplace transforms method.

Total: 75 Hours

Reference(s)

1. Larry.C.Andrews and Bhimsen.K.Shivamoggi, Integral Transforms for Engineers, First Edition, PHI Learning, New Delhi,2007
2. Ian.N.Sneddan, The Use of Integral Transforms, Second Edition, McGraw Hill companies, 1972.
3. E. Kreyszig, Advanced Engineering Mathematics, Eighth Edition, John Wiley and Sons, Inc, Singapore,2008.
4. Peter V. O. Neil,Advanced Engineering Mathematics, Seventh Edition, Cenage Learning India Private Ltd,2012.
5. B.S.Grewal,Higher Engineering Mathematics, Fourth Edition,KhannaPublications,New Delhi,2007
6. Ray Wylie and C.LouisBarrett , Advanced Engineering Mathematics, Tata McGraw- Hill Publishing CompanyLtd,2003.

Assessment pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					2					6				6				6						22
2	2					6				6					6				6						26
3		2					2				6							6							16
4		2					6				6				6										20
5	2						2			6									6						16
Total																									100

Assessment Questions

Remember

1. State the Dirichlet's Conditions.
2. Define even and odd function graphically.
3. List out the complex Fourier transform pair.
4. State convolution theorem in Fourier transforms.
5. Label the condition for the existence of Laplace Transform.
6. Reproduce L (t sin at).
7. State the final value theorem for Laplace Transform.
8. Label the inverse Laplace Transform of 1/(s2+w2)2 .
9. Recognize $z\{f(n+1)\}\ in\,terms\,of\ \overline{f}(z)$.
10. Recall the Z – Transform of $\cos\left(\frac{n\pi}{2}\right)$.

Understand

1. Infer the half-range cosine series for the function $f(x)=x, 0<x<\pi$.
2. Interpret the Fourier series of period 2 for the function $f(x)=\begin{cases}\pi x & 0\le x\le 1\\ \pi(2-x) & 1\le x\le 2\end{cases}$.
3. Identify the Fourier transform of $f(x)=\begin{cases}1-|x| & \text{for } |x|\le 1\\ 0 & \text{for } |x|>1\end{cases}$. Hence evaluate $\int_0^\infty\left(\frac{\sin x}{x}\right)^2 dx$ and $\int_0^\infty\left(\frac{\sin x}{x}\right)^4 dx$.
4. Illustrate the Fourier Sine and Cosine transform of e^{-ax} and evaluate $\int_0^\infty \frac{dx}{(a^2+x^2)}$.
5. Exemplify $\int_0^t \sin u\cos(t-u)\,du$ using Laplace Transform .
6. Indicate the inverse Laplace transform of $\frac{z}{(z-1)(z-2)(z-3)}$ by the method of partial fraction.
7. Use convolution theorem to find the inverse Laplace transform of $\frac{8z^2}{(2z-1)(4z+1)}$.
8. Classify the possible solutions of one dimensional wave equation.

9. Formulate $z\{nf(t)\} = -z\dfrac{dF}{dz}(z)$

10. Summarize Z-transform.

Apply

1. Execute the function $f(x) = |\cos x| \;\; in \;\; (-\pi, \pi)$ to represent as a Fourier series of periodicity 2π.

2. A taut string of length L is fastened at both ends. The midpoint of the string is taken to a height of b and then released from rest in this position. Find the displacement of the string at any time t.

3. Find the Fourier transform of $f(x) = \begin{cases} a-|x| & for \; |x| \le a \\ 0 & for \; |x| > a \end{cases}$. Hence evaluate $\int_0^\infty \left(\frac{\sin x}{x}\right)^2 dx$ and $\int_0^\infty \left(\frac{\sin x}{x}\right)^4 dx$.

4. Find the Fourier transform of $f(x) = \begin{cases} 1, \; for \; |x| < a \\ 0, \; for \; |x| > a \end{cases}$ hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$ and $\int_0^\infty \left(\frac{\sin^2 x}{x^2}\right) dx$

5. Verify the initial and final value theorem for the function $1 + e^{-2t}$.

6. Find $L\left(\dfrac{\cos 2t - \cos 3t}{t}\right)$

7. Using Convolution theorem find the inverse Laplace transform of $\dfrac{1}{s^2(s^2+25)}$.

8. Find $L^{-1}\left(\dfrac{p^2 - p + 2}{p(p+2)(p-3)}\right)$ using Partial fraction method.

9. Using Convolution theorem evaluate $z^{-1}\left(\dfrac{z^2}{(z-1)(z-3)}\right)$.

10. Solve the differential equation
$y(n+3) - 3y(n+1) + 2y(n) = 0 \;\; given \;\; that \;\; y(0) = 4, \; y(1) = 0 \;\; and \;\; y(2) = 8$.

Analyze

1. Organize the sine series for $f(x) = \begin{cases} x \;\; in \;\; 0 < x < l/2 \\ l - x \;\; in \;\; l/2 < x < l \end{cases}$ in the interval $(0, l)$.

2. A tightly stretched string of length 'ℓ' fastened at both ends. The mid-point of the string taken to a height 'b' and show that the displacement at any time 't' is given by

$$y(x,t) = -\frac{8b}{\pi^2}\left[\frac{1}{1^2}\sin\left(\frac{\pi x}{\ell}\right)\cos\left(\frac{\pi at}{\ell}\right) - \frac{1}{3^3}\sin\left(\frac{3\pi x}{\ell}\right)\cos\left(\frac{3\pi at}{\ell}\right) + \dots\dots\right].$$

3. Organize the Fourier transform of f(x) given by $f(x) = \begin{cases} a^2 - x^2 & for \;\; |x| \le a \\ 0 & for \;\; |x| \ge a \end{cases}$. Hence evaluate

$$\int_0^\infty \left[\frac{\sin t - t\cos t}{t^3}\right] dt = \frac{\pi}{4} \; .$$

4. Integrate $\displaystyle\int_0^\infty \frac{dx}{(x^2+a^2)(x^2+b^2)}$ using transform method.

5. Organize the Fourier sine and cosine transform of $f(x)=\begin{cases} x, & 0<x<1 \\ 2-x, & 1<x<2 \\ 0, & x>2 \end{cases}$.

6. Prove that the Laplace Transform of the triangular wave of period 2π defined by

f (t) = $\begin{cases} t & , 0 \le t \le \pi \\ 2\pi - t & , \pi < t < 2\pi \end{cases}$ is $\frac{1}{s^2}\tan h\left(\frac{\pi s}{2}\right)$.

7. Organize the inverse Laplace transform of $\dfrac{s+2}{s^2-4s+13}$ using partial fraction.

8. Solve using Laplace Transforms $\dfrac{d^2y}{dt^2}+4\dfrac{dy}{dt}+4y=te^{-t}$; $y(0)=0;\ y'(0)=-1$.

9. Find $z^{-1}\left(\dfrac{z^2}{(z+2)(z^2+4)}\right)$ by the method of partial fraction.

10. Using Z – Transform solve

$y(n)+3y(n-1)-4y(n-2)=0,\ n\ge 2\ \textit{given that}\ y(0)=3\ \textit{and}\ y(1)=-2$.

Evaluate

1. Determine the Fourier series of the function f(x) of Period 2π given by

$$f(x)=\begin{cases} 1+\dfrac{2x}{\pi} & in \quad -\pi \le x \le 0 \\ 1-\dfrac{2x}{\pi} & in \quad 0 \le x \le \pi \end{cases}$$

2. A string is stretched between two fixed points at a distance 2ℓ apart and the points of the string are given initial velocities ‘u’ where $u = \begin{cases} \dfrac{cx}{\ell}, & in\ 0<x<\ell \\ \dfrac{c}{\ell}(2\ell - x) & in\ \ell<x<2\ell \end{cases}$ x being the distance from one end point. Find the displacement of the string at any subsequent time.

3. Use transforms method to evaluate $\displaystyle\int_0^\infty \frac{dx}{(x^2+1)(x^2+4)}$

4. Determine the Fourier cosine transform of $e^{-a^2x^2}$. Hence prove $e^{-\frac{x^2}{2}}$ is a self-reciprocal.

5. Choose the Laplace transform of the function f(t) with period $\frac{2\pi}{\omega}$, where f(t) =

$\begin{Bmatrix} \sin \omega t & , for\ 0<t<\pi/\omega \\ 0 & , for\ \pi/\omega < t < 2\pi/\omega \end{Bmatrix}$.

6. Using Laplace Transform evaluate $\displaystyle\int_0^\infty te^{-3t}\sin 2t\ dt$

7. Using Convolution theorem find the inverse Laplace transform of $\dfrac{1}{s^2(s^2+25)}$.

8. Solve using Laplace Transforms $\dfrac{d^2y}{dt^2}+4\dfrac{dy}{dt}+4y=te^{-t}$; $y(0)=0;\ y'(0)=-1$.

15CE302 MECHANICS OF DEFORMABLE BODIES I 3 0 0 3

Course Objectives

- Develop the understanding on the state of stresses and strains in engineering components as a result of different loadingconditions
- Provide the principles and equations, and necessary tools to analyze structural members under axial loads, bending, shear, andtorsion.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Compute the simple stress and strain for one and two dimensionalelements
2. Evaluate Principal stress,strain and analyze thincylinders
3. Determine and plot shear force and bending moment diagram for statically determinatebeams
4. Analyze and design flexuralmember
5. Calculate the stress and strain in shafts andsprings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2										
2	1	2										
3	1	2										
4	2	3	1									
5	2	3										

UNIT I **10 Hours**

STRESSES AND STRAINS

Stress at a point - Types of stress - Strain at a point - Types of strain - Elastic limit - Hooke's law - Modulus of elasticity - Stress-Strain diagram - Stresses in composite bars - Thermal stresses - Poisson's ratio Rigidity modulus - Bulk modulus - Relation between elastic constants - Strain energy due to axial force - Stresses and strain energy due to suddenly applied load and impactload.

UNIT II **8 Hours**

TWO DIMENSIONAL STATE OF STRESS

Two dimensional state of stress at a point -Normal and shear stresses on any plane -Principal planes and principal stresses -Maximum shear stress -Analytical methods and Mohr's circle method – Twodimensional state of strains at a point-Principal strains and their directions. Thin Cylinder: Stresses and deformations in thin walled cylinders and spherical shells due to internal pressure

UNIT III **9 Hours**

BEAMS AND BENDING

Types of beams -Types of supports -Shear force and bending moment in beams -Sketching of shear force and bending moment diagrams for cantilever, simply supported and over hanging beams for any type of loading - Relationship between rate of loading, shear force and bending moment

UNIT IV **10 Hours**

STRESSES IN BEAMS

Theory of simple bending –Assumptions, Analysis for bending stresses -Load carrying capacity of beams -Proportioning sections -Flitchedbeams - Leaf springs -Strain energy due to bending moment -Shear stress distribution - Strain energy due to pure shear

UNIT V **8 Hours**

TORSION OF CIRCULAR SHAFTS AND SPRINGS

Derivation of torsion equation -Assumptions -Theory of torsion -Stresses in solid and hollow circular shafts -Power transmitted by the shaft -Stepped shafts - Composite shafts- Strain energy due to torsion-Deformations and stresses in closed and open coiled helical springs - Stress due to combined bending and torsion

FOR FURTHER READING

Determination of principal stresses at any point in a beam - Strain rosettes

Reference(s) **Total: 45 Hours**

1. S. Rajput, Strength of Materials, S. Chand & Co.,2014
2. R. K. Bansal, A Textbook ofStrengthof Materials, Laxmi Publications,6th Edition2015
3. S. M. A. Kazimi, Solid Mechanics, Tata McGraw â€“Hill Book Co Ltd.,2001
4. P. Boresi, Richard J. Schmidt, Advanced Mechanics of Materials, 6th Edition,2002.
5. B. S. Basavarajaiah and P. Mahadevappa, Strength of Materials, CBS Publishers & Distributors Pvt. Ltd.,2014

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3				3	2			3		3		4					2							20
2		3	3			3				3			3	2					3						20
3	4									4			3		3			3			3				20
4	3			3		2	2			4				4				2							20
5			3					4			4				4				5						20
Total																									100

Assessment Questions

Remember

1. Draw stress strain diagram for a mild steel specimen
2. An axially loaded member is subjected to a force of 10 kN. The length of the member is 2.5 m. The area of cross section is 10 cm^2. IfÂ E = 2.1 x 105 N / mm^2. Find the strain energy stored.
3. The Young's modulus and Shear modulus of a material are 120GPa and 45GPa respectively. What is its Bulk modulus?
4. A rod 200cm long and of diameter 3cm is subjected to an axial pull of 30kN. If the Young's modulus of the material of the rod is 2 x 105 N / mm2, determine: (i) stress (ii) strain.
5. What are the sign conventions for shear force and bending moment in general?
6. Draw the S.F and B.M diagrams for a simply supported beam carrying a uniformly distributed load of *w* per unit length over the entire span. Also calculate the maximum bending moment
7. Draw the S.F and B.M diagrams for a cantilever of length L carrying a uniformly distributed load *w* per m length over its entire length.
8. Draw the S.F and B.M diagrams for a simply supported beams carrying a uniformly varying load from zero at each end to *w* per unit length at the centre.
9. Draw the S.F and B.M diagrams for a simply supported beam of length L carrying a point load W at its middle point.
10. State any two assumptions made in the theory of simple bending.
11. Determine the radius to which a bar of 20 mm diameter will be required to be bent so that maximum stress induced reaches 100 N / mm 2.
12. A simple beam 4 m span carries audl of 2 kN / m over entire span. If bending stress is not to exceed 165 N / mm 2, find the value of Z for the beam and the diameter if the beam is circular.
13. Write down the expression for strain energy stored in a body due to torsion.
14. Define helical springs. Name the two important types of helical springs.
15. Draw the stress strain curve of a ductile material.

Understand

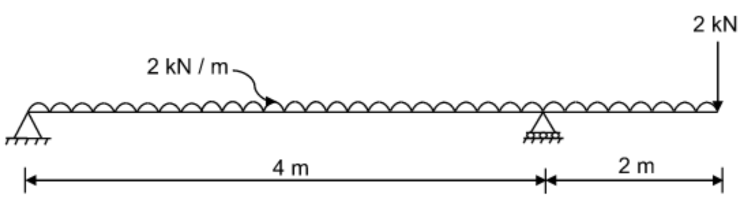
1. Why hollow circular shafts are preferred when compared to solid circular shafts?
2. Three sections of a bar are having different lengths and different diameters. The bar is subjected to an axial load P. Determine the total change in length of the bar. Take Young's modulus is same.
3. Show that in a direct stress system, the maximum shear stress in a body is half the magnitude of the applied stress.
4. Indicate the shapes of shear force diagram in case of uniformly distributed load and for triangular loads.
5. Drive the relation between shear force and bending moment in a beam.
6. Indicate the shapes of bending moment diagram for point load and triangular load.
7. Write a note on 'Resisting moment' and ' Moment of resistance'.
8. The principal stresses at a point in an elastic material are 22N/mm2 (tensile),11022N/mm2(tensile) and 5522N/mm2(compressive). If the elastic limit in simple tension is 22N/mm2 and Poisson's ratio is 0.3, then determine whether the failure will occur or not according to Maximum strain energy theory.
9. A simply supported beam of length 8m carries a point load of 4kN at its centre. Draw SFD and BMD.
10. Write down the Poisson's value for various material

Apply

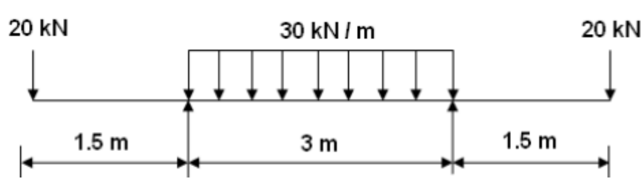
1. A rod of 150 cm long and diameter 2.0 cm is subjected to an axial pull of 20 kN. If the modulus of elasticity of the material of the rod is 2 x 105 N/mm2. Determine i) Stress ii) Strain iii) the elongation of the rod
2. Calculate the modulus of rigidity and bulk modulus of the cylindrical bar of diameter 25 mm and of length 1.5 m, if the longitudinal strain in the bar during a tensile test is 4 times the lateral strain. Take young‘s modulus equal to 1.5 x 105 MPa
3. A beam 2.5 m long has rectangular section of 80 mm width and 120 mm depth. If the beam is carrying a uniformly distributed load of 15 kN/m, find the maximum bending stress developed in the beam
4. A T-section beam with 100 mm x 15 mm flange and 150 mm x 10 mm web is subjected to a shear force of 15 kN at a section. Draw the shear stress variation across the depth of the beam and obtain the value of maximum shear stress at the section
5. In what way is the solution of the equations of transformation of stresses resemble the equation of a circle from which the Mohr‘s circle results?

Analyze

1. A simply supported beam 6 m span carries udl of 20 kN/m for left half of span and two point loads of 25 kN and 35 kN at 4 m and 5 m from left support. Find maximum SF and BM and their location. Construct the shear force and bending moment diagram
2. Draw the shear force and bending moment diagram for a cantilever beam of 2 m length subjected to 2 kN/m over a length 1 m from free end. It also carries a point load of 4 kN at a distance of 0.5 m from the free end.
3. A simply supported beam 6 m span carries udl of 20 kN/m for left half of span and two point loads of 25 kN and 35 kN at 4 m and 5 m from left support. Find maximum SF and BM and their location. Construct the shear force and bending moment diagram
4. Draw the shear force and bending moment diagram for a cantilever beam of 2 m length subjected to 2 kN/m over a length 1 m from free end. It also carries a point load of 4 kN at a distance of 0.5 m from the free end



5. Draw the shear force diagram and the bending moment diagram for the beam shown in figure.



Evaluate

1. Evaluate the diameter of a solid shaft which will transmit 300 kN at 250 rpm. The maximum shear stress should not exceed 30 N/mm2 and twist should not be more than 10 in a shaft length 2 m. Take modulus of rigidity equal to 1x 105 N/mm2
2. It is required to design a closed coiled helical spring which shall deflect 1 mm under an axial load of 100 N at a shear stress of 90 MPa. The spring is to be made of round wire having shear

modulus of 0.8 x 10 5 MPa. The mean diameter of the coil is 10 times that of the coil wire. Evaluate the diameter and length of the wire.

3. The principal stresses at a point in a bar are 160 N/mm2 tensile and 80 N/mm2 compressive. Calculate the resultant stress in magnitude and direction on a plane inclined at 60° the axis of major principal stress and also calculate the maximum shear stress

Create

1. In what way is the solution of the equations of transformation of stresses resemble the equation of a circle from which the Mohr's circle results

15CE303 APPLIED GEOLOGY 3 0 0 3

Course Objectives

- To provide basic knowledge on earth sciences and their applications in civilengineering.
- To provide essential knowledge on classification of rocks and their uses in civil engineering constructions.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Describe the interior and exterior structure ofearth.
2. Discuss the crystal structure, mineral types andproperties
3. Understand the formation of rocks and itsproperties.
4. Demonstrate geophysical methods and explain importance civil engineeringapplications.
5. Explain the geological considerations of dam and tunnelconstructions.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1	1									
2	2	2	2									
3	1		2	3								
4	1			2	3							
5	1	1	1									

UNIT I **9 Hours**

GENERAL GEOLOGY

Introduction to geological time scale and stratigraphy, Laws of stratigraphy. Geology in civil engineeringBranchesof geology - Earth Structures and composition- Elementary knowledge on continental driftandplate technologies. Weathering - Work of rivers - Wind and their engineering importance - Earthquake belts in India -Groundwater: Mode of occurrence- Prospecting - Importance in civil engineering.

UNIT II **8 Hours**

MINERALOGY

Elementary knowledge on symmetry elements of important crystallographic systems -Physical properties of minerals - Study of the rock forming minerals - Quartz family - Feldpar family, Augite, Hornblende, Biotite, Muscovite, Calcite, Garnet - properties, behaviour and engineering significance of clay minerals - Fundamentals of process of formation of ore.

UNIT III **10 Hours**

PETROLOGY AND ROCK MECHANICS

Rocks - Introduction - Rock cycle - Physical description of rock types - Igneous rocks - Granite - Syenite and Basalt - Sedimentary rocks - Conglomerate - Sandstone - Shale and Limestone - Metamorphic rocks - Schist , Gneiss - Quartzite and marble -Rock mechanics - Introduction - Study of rock properties - Porosity - Permeability - Moisture content-Swelling - Durability.

UNIT IV **9 Hours**

STRUCTURAL GEOLOGY AND GEOPHYSICAL INVESTIGATIONS

Introduction to primary and secondary geological structures. - Introduction to geological maps -Folds - Faults and joints -Their bearing on engineering construction - Seismic and electrical methods for civil engineering investigations.

UNIT V **9 Hours**

GEOLOGICAL INVESTIGATIONS IN CIVIL ENGINEERING

Remote sensing techniques - Study of aerial photos and satellite images - Interpretation for Civil Engineering projects - Geological conditions necessary for construction of Dams, Tunnels, Buildings, Road cuttings, Landslides - Causes and preventions - Sea erosion and coastal protection

FOR FURTHER READING

Stress and strain in rocks.Evaluation for suitability of site.Geoengineeringclassification.Duncan's classification.

Total: 45 Hours

Text Book(s)

1. Parbin Singh, Engineering and General Geology, Katson Publication House,2014
2. PrakashJadhav and RavirajSorate,Engineering geology, Nirali Prakahan,2015
3. A.Parthasarathy, V.Panchapakesan and R. Nagarajan, Engineering geology, Willey India Pvt. Ltd, 2013.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	3	4			5	4			1				3												20
2	5	3	3		5	3			1																20
3	4	3			5	3			2				2				1								20
4	3	3			3	2	1		3	2			2				1								20
5	4	2			3				5				4				2								20
																								Total	100

AssessmentQuestions
Remember

1. Write the mechanism behind the movement of tectonic plates and itscauses
2. Write brief note on the age of theearth
3. Write a short account of the origin of theearth
4. DefineMetamorphism
5. What are the metamorphicagents?
6. What is granitictexture?
7. Explain in detail the seismic method and electrical method in geophysicalsurvey.
8. Explain in detail the axial relation, symmetry elements and forms present in the normal class of Isometricsystem.
9. Explain in detail the various physical properties of theminerals.
10. Explain the various geological investigations for tunneling and the methods of tunnel excavation inrocks.
11. What are photo-interpretation elements? List them and explain their role in location suitable sites for civil engineeringinvestigation.

Understand

1. What are the comets andasteroids?
2. Differentiate between cubic system and tetragonalsystem
3. Differentiate between Meander and Ox-bowlake.
4. Write the symmetry elements of normal class of Isometricsystem
5. Write the symmetry elements and forms present in any four of crystalsystem.
6. Explain in detail the electrical method useful in civil engineeringinvestigation.
7. Explain the various physical properties of theminerals.
8. Discuss the rock classification. Give an account on geological and engineering properties of any four Igneousrocks.
9. What are fault structures? Give its classification and explain the importance of fault structure in Dam and Tunnelconstructions.
10. Discuss about the types of landslides and the causative factors. Add a note on the measures to preventlandslides.

Apply

1. Explain briefly the main features of the earth as a planet bringing out clearly its similarities and dissimilarities with the other members of the solarsystem.
2. Write an essay on the geological work ofriver.
3. Give a detailed account on types of aquifers, factors, formation and occurrence

ofgroundwater.

4. Write the physical properties of Hornblende, Biotite mica, Augite and Hypersthene. Discuss its role in rock strengthanalysis.
5. Write an essay on remote sensing techniques, its advantages anddisadvantages.
6. Write the description, occurrence, engineering properties and distribution of diorite, conglomerate, phylliteandschist.
7. Write the description, occurrence, engineering properties and distribution of syenite, shale, gneiss andquartzite.
8. Describe the procedure of interpretation of geological maps for faults, folds, unconformities, attitudes and order ofsuperposition.
9. Write in detail the axial relation, symmetry elements and forms present in the normal class of orthorhombicsystem.
10. Write an essay on the geological work ofwind.
11. What are photo-interpretation elements? List them and explain their role in location suitable sites for civil engineeringinvestigation.

Analyse

1. Write the mechanism behind the movement of tectonic plates and itscauses.
2. What type of minerals could be used in civil engineering works?Why?
3. Why sedimentary terrain is not selected by the civil engineering in all his constructionworks?
4. How rock structures limit the design ofstructures?
5. Analyze the required geological conditions for construction ofdams.
6. Analyze how properties of rocks limit the work of civil engineer in all his construction works?

Evaluate

1. What are the preliminary geological investigations to be carried out for construction of dam structures?
2. Discuss how weathering and tectonic forces impose slides in an area?Discuss how weathering and tectonic forces impose slides in anarea?
3. Write the importance and uses of Minerals – Rocks in civil engineeringworks.
4. Synthesis how the physical properties of rocks controls the mechanical properties of rocks and in turn how it limits the design and execution works of civilengineer?
5. Explain how rock structures and geological conditions limit the design and execution works of civilengineer?
6. What are the criteria‘s followed by the civil engineer for the site selection and how they overcome the problems encountered if any in thefield?

15CE304 SURVEYING - I 3 0 0 3

Course Objectives

- To impart knowledge on the basic principles of field surveyingprocedures
- To impart a clear understanding on the working principles and use oftheodolite

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinaryenvironments.

Course Outcomes (COs)

1. Demonstrate the various functional aspects of surveyinginstruments
2. Prepare topographic map including contours of anysite
3. Perform a highway road alignmentproject.
4. Calculate the area and volume of earthwork
5. Describe tacheometry survey and itsclassification

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	3									
2	2		2	3						2		
3	1		2	3						2		
4	1					2	3				1	
5	1											

UNIT I **9 Hours**

INTRODUCTION AND CHAINSURVEYING

Definition - Principles - Classification - Scales - Survey instruments, their care and adjustment - Ranging and chaining - Reciprocal ranging - Setting perpendiculars - well conditioned triangles - Traversing - Plotting - Enlarging and reducingfigures.

UNIT II **9 Hours**

COMPASS SURVEYING AND PLANE TABLE SURVEYING

Prismatic compass - Bearing - Systems and conversions - Local attraction - True and magnetic meridians - Magnetic declination - Dip - Traversing - Plotting - Adjustment of errors by graphical and analytical methods - Plane table instruments and accessories - Methods: Radiation, Intersection, Resection and Traversing - Three and two pointproblems.

UNIT III **9 Hours**

LEVELLING

Level line - Horizontal line - Spirit level - Temporary and permanent adjustments - Fly and check levelling -
Booking - Reduction - Effect of curvature and refraction - Reciprocal levelling - Longitudinal and cross sections -Plotting - Calculation of areas and volumes - Contouring - Methods - Characteristics ofcontours - Plotting - Earthwork volume - Capacity of reservoirs – Blockcontouring

UNIT IV **9 Hours**

THEODOLITE SURVEYING

Theodolite - Vernier and microptic - Temporary and permanent adjustments of vernier transit - Horizontal angles and their measurement - Vertical angles and their measurement - Heights and distances - Traversing - Closing error and distribution - GaleÃ¢??s tables.

UNIT V **9 Hours**

TACHEOMETRIC SURVEYING

Tacheometric systems - Tangential, stadia and subtense methods - Stadia systems - Fixed hair method - Horizontaland inclined sights - Determination of Stadia constants of the tacheometer - Anallactic lens - Tangential system -Subtense measurements - Subtense bar - Direct reading tachometry.

FOR FURTHER READING

Field and office work - Conventional signs Surveyor's compass - Merits and demerits of plane table surveying Levels and Staves - Sensitiveness - Bench marks - Uses of contours - Microptic Description and uses of theodolite - Omitted measurements - Radial contouring Principles, instruments required - Vertical and normal staffing - Fixed and movablehairs

Total: 45 Hours

Reference(s)

1. K. R. Arora, Surveying, Vol. I, Standard Book House, 15th Edition2015
2. N.N. Basak, Surveying, Tata McGraw Hill,2007
3. T. P. Kanetkar, Surveying and Levelling, Vol. I & II, United Book Corporation,2002
4. B. C. Punmia, Er. Ashok Kr. Jain, Dr.Arun Kumar Jain Surveying, Vol. I & II, Laxmi Publications, New Delhi, Seventeenth Edition,2016

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1		4					4					4			4										16
2		5				5			5				5				5								25
3			4		3					5			4			4									20
4		4				4			3			3			3	4									21
5		5					5				5		3												18
																								Total	100

Assessment Questions

Remember

1. DefineSurveying
2. State the principles ofSurveying
3. What are the steps involved in a surveywork?
4. List the types ofScales.
5. DefineRanging.
6. Define indirect or ReciprocalRanging
7. State the Instruments used for settingperpendiculars.
8. State the methods of Traversing.
9. Define well conditionedtriangle..
10. Retrieve geodeticsurveying.

Understand

1. Compare a check line and a tieline.
2. Classify surveying on the basis oftopography.
3. Explain about Error in chain survey measurements and how it can berectified.
4. Formulate the Tape corrections that can be applied for the measuredlengths.
5. Explain the two basic principles ofsurveying
6. Explain how a compass traverse is carriedout.
7. compare true and magneticmeridian
8. Summarise the functions of prismatic and surveyor'scompass
9. Explain the methods employed in manipulation ofbearings.
10. Explain the precautions to be taken during compass surveying for maximum accuracy of the observations

Apply

1. The area of plane of an old survey platen to a scale of 10m = 1cm, now measured as 19.5cm^2 as found by plan meter. The plan is found to have shrunk that a line originally 10cm long now measures 9.5cm only. A note on the plane also states that the 20m. Chain used was 9cm short. Find true area of thesurvey?
2. A field was measured using 30 m chain which was 15m too short. The area was calculated as 320m² after applying correction. Later it was found that the chain is 15 cm too long. Calculate the truearea.
3. A line was measured with a steel tape which was exactly 30m at a temperature of 20°c and pull of 10 Kg. The measured length 1650 m at temperature of 30°c and applied pull was 15 Kg. tin the true length of live C.S.A. of tape was 0.025 cm² & = 40°c is 3.5 x 106 and E is of take 2.1 x 10^{6}Kg/Cm².

4. The distance P & Q measured along a slope is 250m find horizontal distance between P, if (1) angle of slope is 10° (2) slope is 14.5 (3) the differential
5. elevation
6. The fore bearing of a traverse at a site are as follows:
   AB = 85° 10' CD = 265°51'
   BC = 155° 30' DE = 355° 30'
   Find their Back Bearings?
7. Compute the includedangles.

LINE	F.B	B.B
AB	75° 05'	254° 20'
BC	115° 20'	296° 35'
CD	165° 35'	345° 35'
DE	224° 50'	44° 05'
EA	304° 50'	125° 05'

Analyse

1. Compare correction to length and sagcorrection.
2. Differentiate a level line and a mean sealevel
3. Justify why pull correction is greater than that of a sagcorrection.
4. Conclude the reason for using a EDM than the transit theodolite in higher surveyingtechniques.
5. Resolve the effect of atmospheric conditions in an electronic distance measurementdevice.

Evaluate

1. A line AB between the stations A and B was measured as 348.28m using a 20 m tape, too short by 0.05 m. Determine the correct length of AB, the reduced horizontal length of AB if AB lay on a slope of 1 in 25, and the reading required to produce a horizontal distance of 22.86 m between two pegs, one being 0.56 m above theother.
2. It is proposed to widen a highway by increasing the gradient of the side slope to 1 in 1.5. The difference in level between the bottom and top of the embankment at a critical section was measured as 15.0 m. The length of the embankment along the side slope was measured as 29.872 m using a steel tape under a pull of 151 N at a temperature of 27°C. Determine the additional road width which will be available with the new slope. The tape was standardized on the flat at 18°C under a pull of 47 N. The cross-sectional area of the tape is 6.5 mm^2, E = 20.8 × 10^4 MN/m^2 and $\alpha = 1.1 \times 10^{-5}$per°C.
3. A tape of 30 m length suspended in catenary measured the length of a base line. After applying all corrections the deduced length of the base line was 1462.36 m. Later on it was found that the actual pull applied was 155 N and not the 165 N as recorded in the field book. Correct the deduced length for the incorrect pull. d h = 15 m L′ B x 1 in 1.5 1 in n Proposed slope Existing slope. The tape was standardized on the flat under a pull of 85 N having a mass of 0.024 kg/m and cross-sectional area of 4.12 mm^2. The Young's modulus of the tape material is 152000 MN/ m^2 and the acceleration due to gravity is 9.806m/s^2.
4. The depth of a mine shaft was measured as 834.66 m using a 1000 m steel tape having a cross-section of 10 $mm^2$and a mass of 0.08 kg/m. Determine the correct depth of the mine shaft if the tape was standardized at a tension of 182 N. The Young's modulus of elasticity of the tape material is 21 × 10^4 N/mm^2 and g = 9.806 m/s^2.

15CE305 FLUID MECHANICS AND MACHINERIES 3 0 0 3

Course Objectives

- To enhance the students' knowledge on fluid statics, kinematics anddynamics
- To impart knowledge on the analysis and design of water turbines andpumps

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Explain the fundamental properties of fluids and measures of pressure in fluidstatics
2. Infer fundamentals of fluid kinematics and dynamics and their applications in hydraulic experiments
3. Identify factors affecting flow through pipes to estimate headloss
4. Execute characteristic design of turbines based on the application of momentumprinciple
5. Assess the performance of centrifugal pumps and reciprocating pumps based on characteristic curves

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2										
2	3	2										
3	3	2	1									
4	2	3										
5	2	3										

UNIT I **9 Hours**

FLUID PROPERTIES AND FLUID STATICS

Dimensions and units -Fluid properties - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension Fluid statics- Hydrostatic law- Pascal's law - Atmospheric, absolute, gauge and vacuum pressures - Measurement of pressure by various types of manometers - Buoyancy andmeta-centre.

UNIT II **9 Hours**

FLUID KINEMATICS AND DYNAMICS

Fluid kinematics :Classification of fluid flow - Stream line, streak line and path line - Convective and local acceleration - Continuity equation for one, two and three dimensional flows - Stream function and velocity potential function .

Fluid dynamics : Pressure, kinetic and datum energy - Euler's equations of motion -Bernoulli's theorem and proof - Application of Bernoulli's equation - Pitot tube - Orifice meter, Venturimeter.

UNIT III **9 Hours**

FLOW THROUGH PIPES

Development of laminar and turbulent flows in circular pipes-Laminar flow through circular tubes (Hagen Poiseuille's Equation) - Darcy-Weisbach equation for flow through circular pipe - Major and minor losses- Pipes in series - Equivalent pipe- Pipes inparallel

UNIT IV **9 Hours**

TURBINES

Application of momentum principle - Impact of jets on plane and curved plates - Turbines - Radial flow turbines - Axial flow turbines - Impulse and reaction turbines - Specific speed and characteristic curves.

UNIT V **9 Hours**

PUMPS

Centrifugal pumps - Multistage pumps - Minimum speed to start the pump - Specific speed and characteristic curves - Reciprocating pumps - Negative slip - Indicator diagram - Functions of air vessels

FOR FURTHER READING

Methods of dimensional analysis - Rayleigh's method - Buckingham's - theorem - Hydraulic similitude - Model analysis - Types of models.

Total: 45 Hours

Reference(s)

1. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, LaxmiPublications, New Delhi,2005
2. R. K. Rajput, A Text Book of Fluid Mechanics, S. Chand & Co., New Delhi,2006
3. P. N. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House, Delhi,2010
4. V. L. Streeter and B. E. Wylie, Fluid Mechanics, McGraw Hill International Book Co.,2006
5. YunusA. Cengal and John M. Cimbala, Fluid Mechanics - Fundamentals and Applications (In SI Units), McGraw Hill International Book Co.,2004

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5					5				10															20
2	5					5				10															20
3		5				5				10															20
4		5				5				10															20
5		5				5				10															20
																								Total	100

Assessment Questions
Remember

1. Define fluid and fluidmechanics.
2. Define capillarity andcompressibility.
3. Define pressure and what are thetypes?
4. How are fluidsclassified?
5. Define stream function and state properties of streamfunction.
6. State Pascal's law and give example where this law isapplied.
7. State Bernoulli'sequation.
8. State advantages and limitations ofmanometers.
9. What is Pitottube?
10. What is a manometer? How are theyclassified?
11. Classify Pelton turbine accordingto
    (a) The direction of flow through the turbinerunner
    (b) The action of water on turbine blades.
12. Define specific speed of aturbine.
13. What is the use of drafttube?
14. Define the specific speed of aturbine.
15. Define over all efficiency of aturbine.
16. Define Priming andfoaming.
17. Draw an ideal indicator diagram for a reciprocatingpump.
18. Write down the use of centrifugalpump
19. What is coefficient ofdischarge?

Understand

1. Differentiate between specific volume and specificweight.
2. Distinguish between real and idealfluids.
3. Define dynamic and kinematic viscosity offluids.
4. Define specific gravity and massdensity.
5. What is surface tension and bulkmodulus?
6. For what range of contact angle of a fluid the following will occur(i) capillary rise and (ii) capillaryfall?
7. Define centre of pressure and centreofbuoyancy.
8. State hydrostaticlaw.
9. State a few engineering applications of the momentum equation.
10. How does turbulence affect the flowproperties?
11. Differentiate stream line and pathline.
12. State the assumptions used in deriving Bernoulli'sequation.
13. Explain potential energy, kinetic energy and pressureenergy.
14. Differentiate between simple manometers and differentialmanometers.
15. What are mechanical gauges? Name four important mechanicalgauges?
16. Write down the advantages and disadvantages of using orifice meter over aVenturimeter.
17. What are the characteristics of manometersliquids?
18. Derive an expression for the force exerted and centreof pressure for a completely submerged inclined planesurface.
19. State the practical application of Bernoulli' theorem. Explain its application in a pitottube.
20. Distinguish between impulse and reactionturbines
21. What is cavitation? How do you preventcavitation?
22. How would you classify turbines based on the direction of flow in therunner?
23. Draw typical velocity triangles for inlet and outlet of Peltonwheel.

24. What are the classifications of hydraulic turbine according to the type of energy atinlet?
25. Prove that the maximum efficiency is only 50%. When a liquid jet strikes a series of flat vanes mounted on the periphery of awheel.
26. What is the significance of airvessel?
27. Define negative slip. How does itoccur?
28. Define specific speed of apump.
29. What is the function of foot valve in a pump?
30. What is the condition for finding the minimum starting speed of centrifugalpump?
31. Draw the velocity diagrams for outlet of centrifugal pump for backward facingblades.
32. What are the main parts of a centrifugalpump?
33. What is Net Positive SuctionHead

Apply

1. Calculate the capillary rise in a glass tube of 1.8mm diameter when immersed vertically in water. Take surface tension of water as 0.073 N/m.
2. A cylindrical shaft of 90mm rotates about a vertical axis inside a cylindrical tube of length 50cm and 95mm internal diameter. If the space between them is filled with oil of viscosity 2 poise, find power lost in friction for a shaft speed of200rpm.
3. Determine the minimum size of glass tubing that can be used to measure water level, if the capillary rise in the tube is not to exceed 0.25mm. Take surface tension of water in contact with air as 0.735N/m
4. Determine the bulk modulus of elasticity of a liquid, if as the pressure of the liquid is increased from 7 MN/m^2 to 13 MN/m^2 the volume of liquid decreased by0.15%.
5. Determine the viscosity of oil having kinematic viscosity 6 stokes and specific gravity0.8
6. The left limb of a U tube manometer is connected to a pipe in which a fluid of specific gravity 0.8 is flowing. The right limb is open to atmosphere and manometric fluid is mercury. The difference in mercury level between the two limbs is 20cm and the center of the pipe is 12cm below the mercury level in the right limb. Find the fluid pressure in thepipe.
7. A 2m long conical tube is fixed vertically with its smaller end upwards. It carries liquid in downward direction. The flow velocities at the smaller and larger end are 5m/s and 2m/s respectively. The pressure head at the smaller end is 2.5m of liquid. If the loss of head in the tube is $0.35\ (V1 - V2)^2/2g$ where V1 and V2 being the velocities at the smaller and larger end respectively, determine the pressure head at the largerend.
8. Water flows through a 10cm diameter, 30m long pipe at a rate of 1400 lpm. What percent of head would be gained by replacing the central one third length of pipe by another pipe of 20 cm diameter. Assume that the changes in section are abrupt and f = 0.008 for all pipes. Neglect entrance and exit losses but consider all otherlosses.
9. A Kaplan turbine is to be designed to develop 9000 kW. The net available head is 5.6m. The speed ratio is 2.09 and the flow ratio is 0.68. The overall efficiency is 86% and the diameter of the boss is one third the diameter of the runner. Determine the diameter of the runner, speed and specific speed of theturbine.
10. A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6m, if the speed ratio =2.09, flow ratio =0.68, overall efficiency 86% and the diameter of the boss is 1/3 the diameter of runner.find the diameter of the runner, its speed and specific speed of theturbine.
11. A pelton wheel has to work under a head of 60m while running at 200 rpm. The turbine is to develop a power of 95.6475 kW. The velocity of buckets is 0.45 times of the velocity of jet. The overall efficiency is 0.80 and coefficient of velocity is 0.98. Design the peltonwheel.
12. The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300mm .The pump runs at 50 rpm and lifts water through a height of 25 m .The delivery pipe is

22 m long and 100 mm in diameter .Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 lit/sec, find the percentage of slip. Also determine the acceleration head at the beginning and middle of the deliverystroke

Analyse

1. i) A soap bubble 50mm diameter has an inside pressure of 20 N/m2 above atmosphere. Calculate the tension in the soap film. ii) The water level in a steel tank is measured with a piezometerof diameter 5mm. if the reading of water surface in the tube is 90cm. what is the true depth of water in the tank? Take surface tension of water as 0.0725 N/m.
2. A jet of water of diameter 7.5cm strikes a curved plate at its centre with a velocity of 20m/s.the curved plate is moving with a velocity of 8m/s in the direction of jet.the jet is deflected through an angle of 1650.assuming the plate smoothfind:
   (i) force exerted on the plate in the direction of jet,(ii) power of the jet and(iii)efficiency of the jet.
3. A nozzle of 50mm diameter delivers a stream of water at 20m/s perpendicular to a plate that moves away from the jet at 5m/s. Find:(i)the force on the plate,(ii)the work done,and(iii)the efficiency of thejet.
4. A reaction turbine works at 450 rpm under a head of 120m. The diameter at inlet is 120 cm and the flow area is 0.4m2. The angles made by absolute and relative velocities at inlet are 20 and 60 respectively with the tangential velocity. Find i) discharge ii) power developed and iii) hydraulic efficiency. Assume velocity of whirl at outlet iszero.
5. The velocity of whirl at inlet to the runner of an inward flow reaction turbine is 3.15 √H m/sec and the velocity of flow at inlet is 1.05 √H m/s. the velocity of whirl at exit is 0.22 √H m/s in the same direction as at inlet and the velocity of flow at exit is 0.83 √H m/s, where H is head ofwater = 30m. The inner diameter ofÂ the runner is 0.6 times the outer diameter. Assuming hydraulic efficiency of 80%, compute angle of the runner vanes at inlet and exit.
6. An impulse wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 1.0m3/s under a head of 50m. The buckets deflect the jet through an angle of 165 degree. Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as0.99.
7. The external and internal diameters of an inward flow reaction turbine are 1.2m and 0.6 respectively. The head on the turbine is 22m and velocity of flow through the runner is constant and is equal to 2.5m/s. the guide blade angle is 10 degree and the runner vanes are radial at inlet. Thedischargeisradialatoutlet.Determinei)thespeedoftheturbineii)thevaneangleatoutlet
   iii) hydraulic efficiency.
8. A Kaplan turbine while working under a head of 35m develops power of 20,000kW. Assume flow ratio of 0.6, speed ratio of 2, the diameter of boss is 0.35times the diameter of the runner and overall efficiency is 85%. Find the diameter, speed and specific speed of theturbine.
9. Determine the speed of a pelton wheel, its diameter, number of jet required and the size of each jetif it develops 13,800 kW under a head 0f 430m. Its specific speed is 42r.p.m. Assume necessary suitablevalues.
10. The centrifugal pump has the following characteristics. Outer diameter of impeller is 800mm: width of the impeller vane at outlet = 100mm: angle of the impeller vanes at outlet is 40 degree. The impeller runs at 550 rpm and delivers 0.98m^3/sec under an effective head of 35m. A 500kW motor is used to drive the pump. Determine the manometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radially atinlet.
11. The diameters of an impeller of a centrifugal pump at inlet and outlet are 300mm and 600mm respectively. Determine the minimum starting speed of the pump if it works against head of28m
12. A single acting reciprocating pump running at 50rpm delivers 0.01m^3/sec of water. The diameter of the plunger is 200 mm and the stroke length is 400mm. the delivery and suction head are 10m and 5m respectively. Determine the theoretical discharge, slip, percentage slip, coefficient of

discharge and the power required to derive thepump.

15CE306 BUILDING MATERIALS AND CONSTRUCTION

3 0 0 3

Course Objectives

- Gain knowledge about the properties and uses of various materials forconstructions
- Recognize the necessity for composite materials like concrete,RCC
- Understand the need for Construction equipmentsinsite

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Understand the composition and manufacturing of building materials
2. Illustrate the operation and uses of various construction equipments
3. Identify different types of bonding inmasonry
4. Differentiate various types ofmetals
5. Classify the construction equipments based onoperation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1										
2	2			2								
3				1								
4	1	2										
5	1	2		1								

UNIT I **10 Hours**

BRICKS, STONES AND WOOD

Structural Clay Products: Bricks - Classification of Bricks - Characteristics of Good Bricks - Ingredients of Good Earth Bricks - Clay Tiles Fire Clay Bricks Or Refractory Bricks - Terracotta. Rocks and Stones: Classification of Rocks - Dressing of Stones - Uses of Stones - Characteristics of Good Building Stones. Wood and Wood Products: Classification Of timbers - Structures of Timber - Characteristics of Good Timber - Seasoning Of timber -Defects in Timber - Suitability of timber for specific uses - Wood Products

UNIT II **10 Hours**

CEMENT, FINE AND COARSE AGGREGATES, LIME

Materials for making Concrete: Cement: Portland cement - Chemical Composition of raw materials - Composition of Cement clinker - Hydration- Rate of Hydration - Water requirement for Hydration - Types - Storage- Admixtures. Aggregates: Classification- Characteristics - Alkali Aggregate reaction. Water: Quality of mixing Water - Water for washing Aggregates - Curing Water. Lime: Introduction- Impurities in Lime stones -Classification - Lime Vs Cement. Pozzolans: Introduction -Classification - The activity of Pozzolans -Fly ash - Calcined Clay Puzzolan, Effect of Temperature on Mechanical Properties, Effects of NaturalPozzolans.

UNIT III **9 Hours**

ALLOY, RUBBER AND PLASTICS

Ferrous Metals: Introduction - Manufacturing Process - Iron - Pig iron - Cast Iron - Wrought Iron - Alloy Steel. Non Ferrous Metals: Introduction- Manufacturing Process - Aluminum- Copper - Zinc - Lead - Tin - Nickel. Properties of Tar steel, Stainless steel, Structural steel. Ceramic Materials: Introduction - Classification of Ceramics - Refractories - Glass - Glass Wool - Mechanical Properties - Thermal Properties- Electrical Properties. Polymeric Materials: Introduction - Rubbers - Plastics - Constituents of Plastics - Application of Plastics - Properties ofPlastics.

UNIT IV **8 Hours**

PAINTS AND ENAMELS

Paints, Enamels and Varnishes: Introduction - Composition of Oil paints - Characteristics of an Ideal Paint - Preparation of Paints - Covering power of paints - Pigment Volume Concentration - Enamels - Distempers - Water Wash and Colour Wash - Varnish - French Polish - Wax Polish - Miscellaneous Paints.

UNIT V **8 Hours**

MASONRY AND REINFORCED CONCRETE CONSTRUCTION

Definitions of terms used in masonry, Materials used, Stone masonry, Brick masonry, Different bonds used for brick masonry, Composite masonry. Introduction-Mechanized methods of earthwork: Tractors and attachments, Dozers, Tippers, Scrapers, Shovels and Trenching machines, Dumpers, Rollers and Compactors, Drilling, Blasting methods, Labour protection in drilling and blasting, Fabrication of reinforcement and transportation of erected reinforcement,Concreting.

FOR FURTHER READING

Ferro cement, super plasticizers, FAL - G brick, plastics, and geotextiles. Fibre reinforced plastic in sandwich panels, modelling.

Total: 45 Hours

Reference(s)

1. S. K. Duggal, Building Materials, New Age International (P) Ltd.,2003
2. P. C. Varghese, Building Materials, PHI Learning Private Limited, New Delhi,2010
3. S. P. Arora and S. P. Bindra, Textbook of Building Construction, DhanpatRai Publications (P) Ltd.,2003
4. Punmia B. C., Jain A. J. and Jain A. J. Building construction, Laxmi Publications,2005.
5. Shetty .M.S., " Concrete Technology, Theory and Practice", Revised Edition, S. Chand & company Ltd., NewDelhi,2006
6. Neville. A.M. , " Properties of Concrete", 4th EditionLongman,1995

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	6	4	2		4	2			1	1															20
2	4	4	4			4			1	2	1														20
3	6	4			6				2	2															20
4	4	4			6	4				2															20
5	4		4		4	2			6																20
																								Total	100

Assessment Questions

Remember

1. List the objective of seasoning of timber.
2. Write the properties of an anti-corrosivepaint.
3. Define: Alloysteel.
4. What are the various uses of stones as a buildingmaterial?
5. Define pigment volumeconcentration.
6. List the various processes involved in the fabrication of plasticarticles.
7. Write the Characteristics of an IdealPaint.
8. Classify the pig iron with itsproperties.
9. Classify glasses based on theirconstituents.
10. DefinePuzolanas.
11. Name the different allotropic structures ofiron.
12. List any five admixtures used inconcrete
13. What do you mean by dressing ofStones?
14. What are the tests to be carried out to determine the properties of bricks and briefly? Explain any five ofthem.
15. What do you mean by compounding ofrubber?
16. Discuss the characteristics of goodaggregate
17. Illustrate seasoning oftimber
18. Briefly describe the soundness test ofcement
19. Differentiate between overburnt and under burntbricks
20. Briefly describe the durability and crushing tests ofstones
21. Give the classification of ceramicmaterials
22. Give the uses of gypsum incement

Understand

1. What do you mean bycreep?
2. Recall the process of manufacturing of cement by wet process with neat flowdiagram
3. Why is vulcanization process essential forrubbers?
4. What is the use of base in an oilpaint?
5. How will you fabricate commercial articles fromplastics?
6. Differentiate lime andcement.
7. Will concrete harden underwater?
8. Why is there nograde forPPC?
9. Why are admixtures used inconcrete?
10. Is concrete environmentallyfriendly?

Apply

1. Plot a graph showing the stress-strain relationship for various types ofplastics.
2. Evaluate the chief characteristics of clay as material for the manufacture ofbricks
3. Sketch and state the uses of hollowbricks
4. Illustrate the polymorphism in ceramicmaterials

15CE307 COMPUTER AIDED DRAWING PRACTICE 0 0 2 1

Course Objectives

- To make the students learn the various elements of Residential / Institutional / Workshop buildings
- To impart fundamental knowledge on AutoCAD and to make the students draw truss structures, the plan, elevation and sectional view of abuilding.

Programme Outcomes (POs)

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Know the various components of different types ofbuilding.
2. Acquire knowledge of minimum size of the various components of a building as per National Building Code of India.
3. Draw a building plan for a given area and prepare an elevation and sectional views of the given building code of India.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1				1								
2				2					2			
3									2			

1 **5Hours**

EXPERIMENT 1

Simple drawing using basic draw commands and coordinate system

2 **5 Hours**

EXPERIMENT 2

Develop a model of a Brick wall using basic draw and modify commands

3 **5Hours**

EXPERIMENT 3

Plan of a single storeyed residential building

4 **5 Hours**

EXPERIMENT 4

Elevation and cross section of a single storeyed residential building

5 **5 Hours**

EXPERIMENT 5

Plan, elevation and cross section of an industrial building

6 **5 Hours**

EXPERIMENT 6

Steel truss and its connection details

Total:30 Hours

Reference(s)

1. Donnie Gladfelter, Autocadd 2013 and Autocadd LT 2013, autodesk official training guides, 2013
2. Ellen Finkelstein, Autocadd 2012 and Autocadd LT 2012 Bible,2012

15CE308 SURVEYING - I LABORATORY 0 0 2 1

Course Objectives

- To impart knowledge on the basic principles of field surveyingprocedures
- To impart a clear understanding on the working principles and use oftheodolite

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Demonstrate the various functional aspects of surveyinginstruments
2. Prepare topographic map including contours of anysite
3. Perform a highway road alignment project and Calculate the area and volume ofearthwork

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1		2	3								
2	1	2	3									
3	1		2		3							

1 **2 Hours**

EXPERIMENT 1
Chain surveying : Aligning, Ranging and Chaining

2 **4 Hours**

EXPERIMENT 2
Plane table surveying: Radiation, Intersection, Traversing

3 **4 Hours**

EXPERIMENT 3
Plane table surveying: Resection “ Two and Three point problems

4 **2 Hours**

EXPERIMENT 4
Fly levelling using Dumpy and Tilting level

5 **2 Hours**

EXPERIMENT 5
Check levelling using dumpy level

6 **4 Hours**

EXPERIMENT 6
Longitudinal and and cross section levelling

7 **4 Hours**

EXPERIMENT 7
Repetition and Reiteration

8 **4 Hours**

EXPERIMENT 8
Heights and distances - Single plane method.

9 **2 Hours**

EXPERIMENT 9
Tacheometric Constants

10 **1 Hours**

EXPERIMENT 10
Subtense bar system to calculate distance

Total: 30 Hours

Reference(s)

1. K. R. Arora, Surveying, Vol. I, Standard Book House,2008
2. N.N. Basak, Surveying, Tata McGraw Hill, 2007
3. T. P. Kanetkar, Surveying and Levelling, Vol. I & II, United Book Corporation,2002
4. B. C. Punmia, Surveying, Vol. I & II, Laxmi Publications, New Delhi,2005

15CE309 STRENGTH OF MATERIALS LABORATORY 0 0 2 1

Course Objectives

- To make the students understand the behaviourof materials under various loading conditions, viz., tension, compression, torsion andbending
- To know the impact strength and the hardness number of the givenmaterial

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Evaluate Young Modulus, torsional strength, impact strength, hardness numbers and tensile strength of givenspecimens
2. Find the compressive strength of wood andbrick
3. Find stiffness of open coiled and close coiledsprings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1			1		2							
2		1			2	1						
3			1	2								

EXPERIMENT 1 **3 Hours**

Tension test on mild steel rod

EXPERIMENT 2 **3 Hours**

Torsion test on mild steel rod

EXPERIMENT 3 **3 Hours**

Compression test on brick and wood

EXPERIMENT 4 **3 Hours**

Tests on open coiled helical springs

EXPERIMENT 5 **3 Hours**

Tests on clos coiled helical springs

EXPERIMENT 6 **3 Hours**

Izod and Charpy impact tests

EXPERIMENT 7 **3 Hours**

Determination of Rockwell and BrinellHardness Number

EXPERIMENT 8 **3hours**

Shear test on mild steel rod

EXPERIMENT 9 **3 Hours**

Static bending test on metal beam

EXPERIMENT 10 **3 Hours**

Demonstration on the variation of shear force in a beam

Total: 30 Hours

15CE310 MINI PROJECT I 0 0 2 1

Course Objectives

- To develop knowledge to formulate a real world problem and project's goals
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Express the technical ideas, strategies and methodologies.
3. Express the technical ideas, strategies and methodologies.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness
5. Prepare report and present the oral demonstrations

15MA401 NUMERICAL METHODS 2 2 0 3

Course Objectives

- Ability to find solution of initial and boundary value problems using multi stepapproximations.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Classify the equations into Algebraic, Transcendental or simultaneous and apply the techniques to solve thenumerically
2. Demonstrate and implement an appropriate numerical method forinterpolation.
3. Apply numerical computational techniques to obtain the differentiation and Integration of functions.
4. Obtain the solutions of first order ordinary differential equations,numerically.
5. Classify the partial differential equations and able to get the solutions of those equations using numerical methods

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	1	2										
3	3											
4	2	3										
5	2											

UNIT I **6 Hours**

SOLUTION OF ALGEBRAIC, SYSTEM OF LINEAR EQUATIONS AND EIGEN VALUE PROBLEMS

Solution of algebraic and transcendental equations: Newton - Raphson method - Solution of system of linear equations: Gauss elimination method - Matrix inversion: Gauss- Jordan method - Eigen value of a matrix by power method.

UNIT II **5 Hours**

INTERPOLATION

Interpolation: Newton's forward and backward interpolation formulae, Lagrange's and Newton's divided difference interpolation formula

UNIT III **6 Hours**

NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical differentiation: Newton's forward and backward interpolation formulae - Numerical integration: Trapezoidal and Simpson's 1/3 rules - Two point Gaussian quadrature formula- Double integrals: Simpson's rules.

UNIT IV **6 Hours**

NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS

Initial value Problems: Single step methods: Taylor's series method, Euler's method and Fourth order Runge - Kutta method for solving first order differential equations- Multi step method: Adam-Bashforth predictor and corrector method for solving first order differential equations.

UNIT V **7 Hours**

NUMERICAL TECHNIQUES FOR THE SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

Finite difference solution of parabolic equations by Crank-Nicholson method - Solution of elliptic equations by iterative methods - Solution of hyperbolic equations by explicit finite difference method.

FOR FURTHER READING

Modelling of an electric circuit with differential equations and its solutions numerically - Formation of equations of simple harmonic motions and its solutions numerically.

Total: 60 Hours

Reference(s)

1. SankaraRao. K, Numerical Methods for Scientists and Engineers, Third Edition, Eastern Economy Edition, 2009.
2. Grewal B. S, Numerical Methods in Engineering and Science with Programmsin C & C++, Ninth Edition, Khanna Publications,2010.
3. Gerald C.F and Wheatley P.O,Applied Numerical Analysis, Seventh Edition, Pearson Education, New Delhi,2006.
4. Jain M.K, Iyangar S.R.K and Jain R.K Numerical Methods For Scientific and Engineering Computation New Age International (P) Ltd , New Delhi ,2005.
5. S.S.Sastry, Introductory Methods of Numerical Analysis, Fifth Edition, PHI Learning Pvt. Ltd, 2012.
6. Burden R. L and Douglas FairesJ, Numerical Analysis Theory and Applications, Cengage Learning, Ninth Edition,2005.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					6					8			4			2								22
2		2									12								4						18
3	2					2				4					4				6						18
4	2						2			6				4					6						20
5		2					2				12				6										22
																								Total	100

Assessment Questions
Remember

1. Define Algebraic and Transcendental equations.
2. Recall the order of convergence of Newton-Raphson method.
3. State Newton's Forward and Backward Interpolation formula.
4. Recognize the normal equations for a straight line.
5. Recall the formula for the first order derivative of a function.
6. Write down the Euler's formula.
7. List the formula of Fourth order Runge – Kutta method.
8. State the formula of Milne's for solving ODEs.
9. State the finite difference scheme of $u_{xx} + u_{yy} = 0$.
10. Write down the finite difference scheme to solve $\nabla^2 u = f(x, y)$.

Understand

Illustrate the condition of convergence of Regula False position method.
1. Indicate the condition of convergence of Newton- Raphson method.
2. Infer the working rule in Gaussian elimination method.
3. Form a Newton's divided difference table for 1/x.
4. Fit a straight line to

X:	1	2	3	4	5
Y:	10	25	36	47	58

5. Exemplify y' (2) from the following:

X :	0	1	2	3	4
Y:	6.9897	7.4036	7.7815	8.1281	8.4510

6. Select the value of $\int_1^5 \log x\, dx$.

7. Using Taylor's method find the solution of the initial value problem
$\frac{dy}{dt} = t + y,\ y(0) = 0.$

8. Identify dy/dx=y^2 -x^2 / y^2+x^2 with y(0)=1 at x=0.2 find y by Taylor's series method.

9. Using Newton's backward formula, construct an interpolating polynomial of degree 3 for the data(-0.75) = -0.0718125, f(-0.5) = -0.02475, f(-0.25) = 0.3349375, f(0)= 1.101. Hence find f(-1/3).

10. Write down the general and the simplest forms of the difference equation corresponding to the hyperbolic equations $u_{tt} = c^2 u_{xx}$.

Apply

1. Find the inverse of the following matrix using Gauss Jordan method

$$\begin{pmatrix} 1 & 0 & -2 \\ 3 & 4 & 8 \\ -1 & 0 & 5 \end{pmatrix}$$

2. Solve $x^3 - 5x^2 + 2x + 10 = 0$ using Graffe's root squaring method.

3. The table given below reveals the velocity V of a body during the time 't' specified. Find its acceleration at t = 1.1:

t:	1.0	1.1	1.2	1.3	1.4
v:	43.1	47.7	52.1	56.4	60.8

4. $Evaluate \int_0^1\int_0^1 \frac{dx\,dy}{1+x+y} by\, simpson's\, rule.\ (C)$

5. Find the value of f (34) from the following:

X:	20	25	30	35	40
f(x):	11.4699	12.7834	13.7648	14.4982	15.0463.

6. Fit a parabola from the following:

X:	1	2	3	4	5
Y:	90	220	390	625	915 .

7. Compute dy/dx=y^2 -x^2 / y^2+x^2 with y(0)=1 at x=0.2 find y by Taylor's series method.

8. Use Runge-kutta method, find y(0.01) from dy/dx= -x, y(0)=1.

9. Evaluate the pivotal values of the following equations taking h =1 and upto one half of the period of the oscillation

$$16u_{xx} = u_{tt},\ given\ u(0,t) = u(5,t) = 0,\ u(x,0) = x^2(5-x)\ and\ u_t(x,0) = 0.$$

10. $Solve\ y_{tt} = y_{xx}\ upto\ t = 0.5\ with\ a\ spacing\ of\ 0.1\ subject\ to\ y(0,t) = 0,\ y(1,t) = 0,\ y_t(x,0) = 0$ $and\ y(x,0) = 10 + x(1-x).\ (C)$

Analyze / Evaluate

1. Solve by Gaussian elimination method: 6x + 3y +12z = 36; 8x -3y +2z = 20; 4x +11y –z =33.
2. Solve using Neton-Raphson method, cos x – x e^x = 0.

3. Use Newton's forward interpolation formula to find x when y = 20

X :	1	2	3	4
Y:	1	8	27	64.

4. Find y(10) from the following:

X:	5	6	9	11
Y:	12	13	14	16

5. From the following data, find y' at x = 43:

X:	40	50	60	70	80	90
Y:	184	204	226	250	276	304

6. Evaluate $\int_0^{\pi/2}\int_0^{\pi/2} \sin(x+y)\ dx\ dy$ using Simpson's rule.

7. Using Euler's formula, to find the value of y when x = 0.4, given $\frac{dy}{dx} = \frac{x\,y}{2}$
Y (0) = 1, y (0.1) = 1.01, y (0.2) = 1.022 and y (0.3) = 1.023.

8. Compute the first three steps of the initial value problem $\frac{dy}{dx} = \frac{x-y}{2}$ y(0)=1 by Taylor series method and next step by Runge- kutta method.

9. Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units; satisfying the following boundary conditions;

$(i)\quad u(0,y)=0 \ \ for\ \ o\le y\le 4$

$(ii)\ \ u(4,y)=12+y\ \ for\, o\le y\le 4$

$(iii)\ u(x,0)=3x\ \ for\ \ o\le x\le 4$

$(iv)\ \ u(x,4)=x^2\ \ for\, o\le x\le 4$

10. Solve $u_t = 2u_{xx}$ by finite difference method subject to the conditions u(0,t)=0, u(1,t)=0, u(x,0)= sinπx.

15CE402 MECHANICS OF DEFORMABLE BODIES II 3 2 0 4

Course Objectives

- To impart knowledge on deflection of statically determinate beams and ideal and realcolumns
- To determine the stresses due to unsymmetrical bending and understand various theories of failures
- To analyze the deflection in statically determinate beams and calculate buckling load in columns and determine the stresses in curved beams and thick walledcylinders

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Evaluate the slope and deflection of statically determinate beams using differentmethods.
2. Identify the buckling and stability of columns subjected to axial load, and compute the uniaxial and biaxial bendingmoments
3. Analyze the stress distribution in thick walled cylinders and curvedbeams
4. Estimate the stresses due to unsymmetrical bending and locate the shearcentre
5. Interpret the behavior of structural members based on various theories offailures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	3										
2	1	3										
3	1	3										
4	1	3										
5	1	2										

UNIT I **9 Hours**

DEFLECTION OF STATICALLY DETERMINATE BEAMS

Governing differential equation - Macaulay's method - Moment area method - Conjugate beam method - Strain energy method.

UNIT II **9 Hours**

COLUMNS AND STRUTS

Columns - Slenderness ratio - Calculation of stresses in short columns due to axial load and uni-axial and biaxial bending moments - Core of the section - Buckling load of long columns - Euler's theory - Different end conditions - Rankine's formula - Straight lineformula

UNIT III **9 Hours**

THICK WALLED CYLINDERS AND CURVED BEAMS

Thick walled cylinders - Lame's equations - Hoop stress and radial stress distribution - Compound cylinders - shrink fit. Curved beams - Stresses due to bending by Winkler Bach theory - Rectangular, trapezoidal, circular solid sections - Crane Hook Problems

UNIT IV **9 Hours**

SHEAR CENTRE AND UNSYMMETRICAL BENDING

Shear flow in thin walled beam cross section - Shear centre of mono/symmetric open sections - Hollow thin walled torsion members - Single and multi connected sections - Symmetrical and unsymmetrical bending - Bending stresses in beams subjected to unsymmetrical bending

UNIT V **9 Hours**

THEORIES OF ELASTIC FAILURE

Types of Failure: Brittle and ductile - Maximum principal stress theory - Maximum Principal strain theory - Maximum strain energy theory - Maximum shear stress theory - Mohr's theory - simpleproblems

FOR FURTHER READING

Stresses in Chain Links and Proving Ring, Octahedral Shear Stress Theory, Change in direction of neutral axis and simple problems in unsymmetrical bending- Newmark's method of analysis of statically indeterminate beams

Total: 75 Hours

Reference(s)

1. S. Rajput, Strength of Materials, S. Chand & Co., 2006
2. R. K. Bansal, A Textbook of Strength of Materials, Laxmi Publications,2010
3. P. Boresi, F. B. Seeli and J. P. Smith, Advanced Mechanics of Materials, John Wiley & Sons, 2003
4. D. S. Bedi, Strength of Materials, S. Chand & Co. Ltd.,2012
5. C. Punmia, Strength of Materials, Laxmi Publications,2002

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					6					12														20
2	2					6					12														20
3		4				6				10															20
4	4						4				12														20
5		4				6					10														20
																								Total	100

Assessment Questions

Remember

1. Define the term Poisson'sratio.
2. Mention the effect of change of temperature in a compositebar.
3. State four assumptions made in the analysis of stresses in curvedbars.
4. List five important theories offailure.

5. What are the reasons for unsymmetrical bending?
6. Mention four methods of calculating the critical load of a longcolumn.
7. Define ShearCentre.
8. List two methods of determining slope and deflection ofbeams.
9. Retrieve the term flexuralrigidity.

Understand

1. Formulate a relation for strain energy due toshear.
2. Formilate the equation giving maximum deflection in case of a simply supported beam subjected to udl over the entirespan.
3. Explain Â the effect of crippling load (Pc) obtained by Eulers formula for shortcolumns.
4. Illustate the equivalent length of a column for any two endconditions.
5. Interpret the expression for finding deflection of closely coiled helical spring.
6. Summarise the crippling load in a column of length l hinged at bothends.
7. Compare energy of distortion and Energy ofdilatation?
8. compare maximum principal stress theory and maximum principal straintheory
9. Identify Euler's crippling load for the following cases : one end is fixed and other endfree.
10. Infer the Winkler – Bach theory used to determine the stresses in a curvedbeam.

Apply

1. A simply supported beam of span (*l*) carries an uniformly distributed load of W per unit length over the entire span. Apply Castigliano'stheoremdetermine
   (i) The mid-span deflection of thebeam
   (ii) The slope at the leftsupport
2. Applying the Castigliano's theorem, determine the deflection of the free end of the cantilever beam. A is fixed and B is free end. Take EI = 4.9MNm^2.
3. A bar of cross section 600 mm2 is acted upon by axial compressive forces of 100 kNat each end of the bar. Using Mohr's circle, find the normal and shearing stresses on a plane inclined at 30^o to the direction of loading. Neglect the possibility of buckling of thebar.
4. Consider a rectangular steel bar 40 mm x 50 mm in cross section, pinned at each end and subject to axial compression. The bar is 2 m long and E = 200 GPa. Determine the buckling load using Euler'sformula.
5. A 2m long pin ended column of square cross section. Assuming E = 12.5 GPa, σ allow = 12 MPa for compression parallel to the grain, and using a factor of safety of 2.5 in computing Euler's critical load for buckling, determining the size of the cross section if the column is to safely support P = 200kN.
6. A thick cylinder has diameter 1.2 m and thickness 100 mm is subjected to an internal fluid pressure 15 N/mm2. Sketch the hoop stressdistribution.
7. A boiler of 800 mm diameter is made up of 10 mm thick plates. If the boiler is subjected to an internal pressure of 2.5 MPa, determine circumferential and longitudinalstress.
8. Determine the principal moments of inertia for an angle section 80 mm x 80 mm x 10 mm.
9. The external diameter of a hollow shaft is twice the internal diameter. It is subjected to pure torque and it attains a maximum shear stress (τ). Show that the strain energy stored per unit volume of the shaft is 5 τ^2 / 16C. Such a shaft is required to transmit 5400 kW at 110 r.p.m. with uniform torque, the maximum stress not exceeding 84 MN/m^2.Determine,
   i) The shaftdiameter
   ii) The strain energy stored per m3. Take C = 90GN/m^2.
10. A simply supported beam of span 8 m carries two concentrated loads of 20 kNand 30 kNat 3 m and6mfromleftsupport.Calculatethedeflectionatthecentrebystrainenergyprinciple.

Analyse

1. Differentiate between thin and thickcylinders.
2. A thick cylinder has diameter 1.2 m and thickness 100 mm is subjected to an internal fluid pressure 15 N/mm^2. Sketch the hoop stressdistribution.
3. Critisize,
   (i) Maximum principal stresstheory
   (ii) Maximum principal straintheory
4. What is the influence of the assumptions of Euler on the load carrying capacity of a realcolumn?
5. Outline the relationship exists between slope, deflection, bending moment and theload.
6. What are the failure modes ofcolumns?
7. What do you mean by buckling and bucklingload?

Evaluate

1. A column with one end hinged and other end fixed has a length of 5 m and a hollow circular cross-section of outer dia100 mm and wall thickness 10 mm. If E = 1.60 x $10^5 N/mm^2$ and crushing stress σc = 350 N/ mm^2, find the load that the column may carry with a factor of safety of 2.5 according to Euler theory and Rankine – Gordontheory.
2. A boiler of 800 mm diameter is made up of 10 mm thick plates. If the boiler is subjected to an internal pressure of 2.5 MPa, determine circumferential and longitudinalstress.
3. Choose the minimum diameter of a solid steel shaft that will not twist through more than 3° in a 6-m length when subjected to a torque of 12 kN·m What maximum shearing stress is developed? Use G = 83GPa.
4. A steel marine propeller shaft 14 in. in diameter and 18 ftlong is used to transmit 5000 hpat 189 rpm. If G = 12 × 10^6 psi, determine the maximum shearingstress.
5. A flexible shaft consists of a 0.20-in-diameter steel wire encased in a stationary tube that fits closely enough to impose a frictional torque of 0.50 lb·in/in. Determine the maximum length of the shaft if the shearing stress is not to exceed 20 ksi. Determine the angular deformation of one end relative to the other end G = 12 × 10^6psi.

Create

1. What happens when shear centre in a body does not coincide with the loadapplied?
2. Is torsion uniform throughout the section when it is applied on one end of a rectangularbar.

15CE403 CONCRETE TECHNOLOGY 3 0 0 3

Course Objectives

- To impart a sound Technical knowledge on the ingredients of special and conventional concrete andadmixtures
- To impart basic knowledge on the properties of fresh and hardened concrete and to provide a basic understanding on the usage of admixtures used inconcrete

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Analyze the properties of concrete ingredients as per IS code
2. Apply mix proportion principles to design a concrete mix by IS and ACIcode
3. Characterize the workability requirements of freshconcrete
4. Evaluate the hardened concrete properties based on IScodes
5. Identify the suitable special concrete based on the fieldrequirement.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1										
2	1	2	3									
3	1	1										
4	1	3			2							
5	1	3										

UNIT I **9 Hours**

INGREDIENTS OF CONCRETE

Cement: Composition and properties of cement- different types of cementsâ€“Hydration of cement-Structure of hydrated cement-Tests on physical properties of cement Consistency-Setting time-Soundness-Strength as perIScode.Aggregates: Classification Fine aggregate Coarse Aggregate-Testsonaggregates-IS specificationsâ€“Bulking of sand-Sieve analysis-Fineness modulus-interpretation of grading charts-Quality of water for mixing andcuring.

UNIT II **9 Hours**

ADMIXTURES AND MIX DESIGN

Chemical admixtures: Accelerators -Retarders- Workability agents-Water reducing agents -Air entraining agents. Mineral admixtures: Flyash- Silica fume-Ground granulated blast furnace slag- Metakaoline- Dosage, Usage, structural properties and their effects on concrete properties. Mix Design: Objective- Factors influencing mix proportion , Mix design by ACI method and IS code method-Mix designexamples

UNIT III **9 Hours**

FRESH CONCRETE

Properties of fresh concrete: Workability -Factors affecting workability “Tests for workability of concrete “Slump test and compacting factor test- Segregation and bleeding- Batching and mixing ingredients of concrete- Methods of compactionâ€“Types of curing concrete.

UNIT IV **9 Hours**

HARDENED CONCRETE

Properties of hardened concrete -Determination of compressive, tensile and flexural strength of concrete - Shrinkage and creep- Factors affecting shrinkage and creep Stress- strain curve for concrete- Determination of modulus of elasticity-In situ strength determination-Rebound hammertest.

UNIT V **9 Hours**

SPECIAL CONCRETE

Light weight concrete- Fibre reinforced concrete-High performance concrete-High strength concrete -Self compacting concrete- Polymer concrete Mass concrete Ready mix concrete “properties and applications

FOR FURTHER READING

Mineral additives: reactive and inert- Setting time of concrete-significance and measurements- Durability of concrete: importance of permeability study- Cellular concrete, shotcrete (sprayed concrete), ferrocement,bendable concrete, light transmitting concrete- Soundness of aggregate, Grading of fine & coarse Aggregates,recycled material asaggregates

Total: 45 Hours

Reference(s)

1. A.R.Santhakumar, Concrete Technology, Oxford University Press, New Delhi,2007
2. M.L.Gambhir, Concrete Technology, Tata McGraw Hill Publishing Co., Ltd., New Delhi,2007
3. M.S.Shetty, Concrete Technology, S.Chand and Co., Ltd., NewDelhi,2003
4. A.M.Neville, Properties of Concrete, Tata McGrawHill publishers,2003
5. P.KumarMehta and Paulo J.M. Monteiro, Concrete - Micro structure, Properties and Materials, Indian Concrete Institute,Chennai,1997
6. P.D.Kulkarni, Text book of Concrete Technology, New Age International (P) Ltd.,2007

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5	2			5												8								20
2	5					10			5																20
3	10				10																				20
4	10	10																							20
5		10				5			5																20
																								Total	100

Assessment Questions
Remember
1. What do you mean by hydration ofcement?
2. List out the tests oncement.
3. Mention the functions of mineral and chemicaladmixtures.
4. Name some of the mineral admixtures used in theindustry.
5. Give the objectives of concrete mixdesign.
6. List out the various methods of proportioning concretemix.
7. List out the various factors affecting the workability ofconcrete.
8. Give the relation between compressive and tensile strength ofconcrete.
9. Define shrinkage andcreep.
10. List out the factors that affect the dryingshrinkage.
11. What is meant by plastic shrinkage ofconcrete?
12. Outline the properties of fresh and hardenedconcrete.
13. Defineshotcrete.
14. List out any four advantages of ready mixconcrete.
15. What are the basic characteristics of self compacting concrete in plasticstate?
16. What is meant by ultra highstrengthconcrete?
17. List out the methods ofcompaction.
18. List out the importance factors which influences concrete mixdesign.
19. What is meant by grading ofaggregate?
20. List out the factors that affect the strength ofconcrete.

Understand
1. Explain about the hydration process ofcement.
2. Explain about transitionzone.
3. Describe the importance of sieve analysis in determining particle sizedistribution.
4. Why chloride-based accelerators not used in pre-stressed concretestructures?
5. Distinguish between segregation and bleeding ofconcrete.
6. How the maximum size of aggregate will affect the strength ofconcrete?
7. What is the importance of temperature in massconcreting?
8. Distinguish between plasticizer and super plasticizers.
9. Explain about the factors which control the action of high performanceconcrete.
10. Differentiate high performance and high strengthconcrete.

Apply
1. Design a concrete mix for construction of multistoried framed structure. The specified design strength of concrete is 40 MPa. The specific gravity of fine aggregate and coarse aggregate are 2.6 and2.7respectively.Thedryroddedbulkdensityofcoarseaggregateis1700kg/m^{3}andfineness

modulus of the aggregate is 2.80. Ordinary Portland cement (type I) will be used.A slump of 50mm is necessary. Coarse aggregate is found to be absorptive to the extent of2%.
2. Design the concrete mix for the construction of water tank using IS method of mix design. The design strength of concrete is 20 MPa. The water absorption of coarse and fine aggregate is 0.5% and 1.0% respectively. The surface moisture content of fine aggregate is 2.0%.

Evaluate
1. Discuss the relative merits of self compacting concrete and pumpedconcrete
2. Relate the properties of high strength concrete and high performanceconcrete.
3. Examine the properties of self compacting concrete in the construction ofcolumn.
4. Identify the application of bendable concrete and Fiber reinforcedconcrete.
5. Why the shrinkage and creep treated together? What are the factors that affect shrinkage and creep ofconcrete?
6. Explain in detail about different curing methods of concrete.

15CE404 SURVEYING - II 3 0 0 3

Course Objectives
- Acquire knowledge in designing the curves and set out horizontal and verticalcurves
- Understand the concepts of triangulation, trigonometric leveling, astronomical surveying, hydrographic surveying and the advanced methods of surveying and apply them practically.

Programme Outcomes(POs)
a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
Course Outcomes (COs)
1. Characterize the types of curves based on offset and deflectionangle.
2. Analyze the triangulation survey and trigonometric levelling for error rectification.
3. Identify the errors and sources of errors in the survey data and perform the error corrections by standard methods
4. Calculate the azimuth of a line using astronomical observations
5. Explain the methods of hydrographic surveying and working principle of advanced surveying instruments.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2		2								
2	3	2										
3	3	2	1									
4	2	3										
5					3							

UNIT I **8 Hours**

CURVES

HorizontalCurves: Elements of simple circular curve - Setting out by offset and by Rankine's method of deflection angles - Obstacles to the location of curves - Compound and Reverse curves (Parallel tangent only) - Transition curves - Setting out by offsets and angles

VerticalCurves: Summits and sags - Sight distance - Setting out vertical curves by tangent corrections method

UNIT II **9 Hours**

CONTROL SURVEYING

Triangulation:Signals - Base line measurement - Instruments and accessories - Corrections - Satellite station - Reduction toCentre TrilaterationTrigonometriLevelling:Curvature and refraction - Difference of elevation of two stations by single and reciprocal observations

UNIT III **8 Hours**

SURVEY ADJUSTMENTS

Errors - Sources, precautions and corrections - Classification of errors - True and most probable values - Weighted observations - Method of equal shifts - Principle of least squares - Normal equation - Correlates - Level nets - Adjustment of simple triangulationnetworks

UNIT IV **10 Hours**

ASTRONOMICAL SURVEYING

Celestial sphere - Astronomical terms and definitions - Motion of sun and stars - Apparent altitude and corrections - Celestial co - ordinate systems - Different time systems - use of Nautical almanac - Star constellations - calculations for azimuth of a line

UNIT V **10 Hours**

HYDROGRAPHIC AND ADVANCED SURVEYING

Hydrographic Surveying:Tides - MSL - Sounding methods - Location of soundings and methods - Three point problem - Strength of fix - Sextants and station pointer - River surveys - Measurement of current and discharge

Advanced Surveying:Photogrammetry -Introduction - Basic concepts of terrestrial and aerial photographs - Stereoscopy - Definition of Parallax - Electromagnetic distance measurement - Basic principles - Electronic totalstation

- Basic concepts of Cartography and Cadastral surveying - Basic concepts of Remote Sensing - GIS and GPS

FOR FURTHER READING

Equipment for construction surveys - Setting out pipe line - Setting out buildings and structures - Setting out a highway

Total: 45 Hours

Reference(s)

1. B.C. Punmia, Surveying, Vols. II & III, Laxmi Publications, New Delhi,2005
2. T. P. Kanetkar, and Kulkarni, Surveying and Levelling, Vol. I and II, United Book Corporation, Pune,1994
3. R. Subramanian, Surveying and Levelling, Oxford university Press,2013
4. Bannister A, Raymond S and Baker R, Surveying, Pearson Education Ltd., India,2012
5. Arora, K. R., Surveying Vol. I and II, Standard Book House,2010
6. Duggal, S. K., Surveying Vol. II, Tata McGraw Hill Publishing Company Ltd., New Delhi,2008

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	4					4					4				4				4						20
2			3				4			5				5			5								22
3		4			4				4		4		4		4										24
4		4				4				3			4				3								18
5		5					5						4					2							16
																								Total	100

Assessment Questions

Remember

1. Define a simplecurve.
2. List the three classifications ofcurves.
3. Define a referencegrid.
4. List the five types of referencegrids.
5. Define the degree of acurve.
6. Define a transitioncurve.
7. Reproduce a reversecurve.
8. What is meant by stopping sightdistance?
9. List three instrumental methods commonly used for setting out a circularcurve.
10. Define superelevation.
11. Define superelevation.

Understand

1. What are the corrections to the observed altitude ofsun?
2. What is most probablevalue?
3. What is meant by HourCircle?
4. How to determine the position of a celestialbody?
5. Does the total station usage increase the workingspeed?
6. When to apply Curvature and RefractionCorrections?
7. Illustrate SphericalExcess.
8. Explain levelNet.
9. Exemplify the application ofGPS.
10. Compare GPS andGIS.

Apply

1. Design a horizontal curve for a highway with theradius.
2. Design a topographic map by classifying the types of soil and available naturalresources.

3. Compute the azimuth of sun between 4.00 pm and 5.00pm. the R.L is1000.000m
4. Demonstrate the procedure for setting out a reversecurve.
5. Demonstrate the procedure for setting out a simple curve by two theodolitemethod..
6. Find the length of a simple curve of radius 100m and deflection angle 30degrees.
7. Find the length of the chord for a compound curve of radius 300m and 500m with deflection angles 40 degrees and 50degrees.
8. A base line AB was measured accurately using a subtense bar 1 m long. From a point C near the centre of the base, the lengths AC and CB were measured as 9.375 m and 9.493 m, respectively. If the standard error in the angular measurement was ± 1″, determine the error in the length of the line.
9. The sides of a rectangular tract were measured as 82.397 m and 66.132 m with a 30 m metallic tape too short by 25 mm. Find the error in the area of thetract.
10. Two sides and the included angle of a triangle were measured as under: a = 757.64 ± 0.045 m, b= 946.70 ± 0.055 m, C = 54°18' ± 25" Compute the area of the triangle and its standard error.

Analyse

1. Differentiate the method of setting out a simple curve by two theodolite method and Rankine's method.
2. Integrate compound curve with a transition curve by their method of settingout.
3. Contrast between a declination circle and anhourcircle.
4. Compare a terrestial coordinate system with a celestial co ordinatesystem.
5. Compare cadastral surveying and cartographicsurveying.

Evaluate

1. The coordinates with standard deviations of two stations A and B were determined as given below. Station Easting Northing A 456.961 m ± 20 mm 573.237 m ± 30 mm B 724.616 m ± 40 mm 702.443 m ± 50 mm The length of AB was independently measured as 297.426 m ± 70 mm and its separate determination by EDM is as 297.155 m ± 15 mm. Determine the most probable length of the line and its standarddeviation.
2. If the standard deviation σ of a single measurement in Example 1.1 is ± 3", Determine (i) the magnitude of the deviation likely to occur once in every two measurements, ±= 2.10″. (ii) the probability that a single measurement may deviate from the true value by ± 6", and (iii) the probability that the mean of nine measurmentsmay deviate from the true value by ±1.5".
3. Latitude of a line is 50º48', the altitude of the sun was 46º20'W.The declination angle at the time was 26º42'25". Determine the azimuth of thesun.
4. The azimuth of a heavenly body was observed to be N 111º25'W.Its altitude was 46º 23' and declination was 23º 45' 20". Determine its apparenttime.
5. Determine the latitude if the Sun's meridian is 30º from zenith and declination is 45ºN.

Create

1. Relate a celestial body with terrestial co ordinate system
2. Produce a plan of the movement of the sun above the celestial horizon in west.

15CE405 CONSTRUCTION TECHNIQUES EQUIPMENTS AND PRACTICES

3 0 0 3

CourseObjectives

- To impart knowledge on concrete mix design and the importance of chemical/mineraladmixtures
- Make the student familiar with various construction techniques and practices and their equipment needed for different types of constructionactivities

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Generalize the aspects involved in concretetechnology
2. Identify the suitable site and techniques involved in good constructionpractices
3. Apply appropriate techniques used for sub structureconstruction
4. Identify and apply different techniques for super structureconstruction
5. Identify the different construction equipmentsfor variousapplications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3											
2	1	2										
3		2										
4	1	3										
5	1	2										

UNIT I **9 Hours**

CONCRETE TECHNOLOGY

Cements - Grade of cements - concrete chemicals and Applications - Grade of concrete - manufacturingofconcrete -Batching- mixing - transporting - placing -compaction of concrete - curing and finishing - Testing of fresh and hardened concrete - quality of concrete - Extreme Weather Concreting - Ready mix Concrete - Non-destructivetesting.

UNIT II **9 Hours**

CONSTRUCTION PRACTICES

Site Clearance - Marking -Earthwork - Building foundation-Basements-Temporary shed-Shuttering sheet piles-Slip and moving forms-scaffolding-Deshuttering forms-types of floors and roofs - Ventilators-Building component and their function: Brick masonry- Bond- Jointing-Stone masonry-Design of brick masonry wall as per is code- Rcc beam.

UNIT III **9 Hours**

SUB STRUCTURE CONSTRUCTION

Techniques of box jacking- pipe jacking- under water construction of diaphragm walls and basement Tunnellingtechniques- piling techniques -well and caisson -sinking cofferdam -cable anchoring and grouting, sheet pile-Shoring for deep cutting-well point- Dewatering and stand by plant equipment for underground open excavation

UNIT IV **9 Hours**

SUPER STRUCTURE CONSTRUCTION

Launching girders, bridge decks, off shore platforms - special forms for shells - techniques for heavy decks - in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks.

UNIT V **9 Hours**

CONSTRUCTION EQUIPMENT

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching,tunneling.

FOR FURTHER READING

Colouring agents - workability agents. Shoring - shoring methodology. Mixer - vibration - batching plant- Grouting - weather and water proof -construction practice according to NBC 2005 code mix design as per IS code,1062 Sieve analysis as per IS code.

Total: 45 Hours

Reference(s)

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers,1999.
2. Sharma S.C. â€œConstruction Equipment and Managementâ€• , KhannaPublishers New Delhi, 2002
3. Deodhar, S.V. â€œConstruction Equipment and Job Planningâ€• , KhannaPublishers, New Delhi,2012
4. Dr. Mahesh Varma, â€œConstruction Equipment and its Planning and Applicationâ€• , Metropolitan Book Company, NewDelhi,1983
5. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	4				2				12															20
2	2	2				2	2				12														20
3	2	2				2	2				12														20
4	2	2			2	2				12															20
5	2	2				2	2				12														20
																								Total	100

Assessment Questions

Remember

1. List out any four mineral chemical admixtures used in concrete
2. Name the different types of grades of cement
3. Recall the types of bonds in masonry structures
4. Identify the functional planning of buildings
5. Recall the factors affecting the selection of construction equipments
6. Repeat the special types of construction equipments.
7. Reproduce the advantages of steel sheet pile walls
8. Select any two repair techniques for the cracks in RCBeam.
9. Write the damage assessment procedure in repair and rehabilitation of structures
10. Develop a high strength concrete mix design procedure incorporating different admixtures

Understand

1. Explain any two chemical admixtures used in concrete mix proportions
2. Describe the properties of High strength concrete
3. Summarize the Shoring methodology in building construction
4. Indicate the Functional planning of building
5. Express the operations of Earthwork equipment.
6. Describe the lengthening joint and widening joint
7. Describe the causes of deterioration of concrete structures.
8. Differentiate between chemical and mineral admixtures used in concrete mix.
9. Identify the distresses in concrete structures
10. Point out the safety measures in construction Describe the lengthening joint and widening joint

Apply

1. Apply the prevention measures for the Deterioration of structures
2. Recall the tunnel or box jacking
3. Relate the decay and damage of the structures
4. Indicate the water proofing of below ground structure
5. Examine the chemical reaction of High strength concrete with mineral admixture
6. Differentiate between chemical and mineral admixtures used in concrete mix.

15CE406 IRRIGATION ENGINEERING 3 0 0 3

Course Objectives

- To impart basic knowledge on the types and methods of irrigation
- To emphasis the significance of ground water irrigation
- To illustrate the need of irrigation scheduling and water management

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Estimate the water requirement and prepare the irrigation schedule for crops
2. Identify and apply the appropriate irrigation methods
3. Classify canals and design the impounding structures for irrigation purpose.
4. Evaluate the discharge of tube wells based on the hydraulic properties of aquifers.
5. Analyze the causes of water logging and identify the suitable drain layout.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2	1	2					1					
3	2	1	3									
4	2	3										
5	1	2	2									

UNIT I **8 Hours**

IMPORTANCE OF IRRIGATION

Purpose and benefits of irrigation - historical background - national water policy - standards of irrigation water - consumptive use of water - duty, delta, base period - factors affecting duty - water requirement by crops - irrigation efficiency - irrigation scheduling

UNIT II **10 Hours**

METHODS OF IRRIGATION

Classification of irrigation methods - types of surface irrigation - furrow irrigation - border strip irrigation - basin irrigation - tank irrigation - merit and demerits of subsurface irrigation - lift irrigation - design aspects of micro-irrigation - sprinkler irrigation -drip irrigation -fertigation

UNIT III **10 Hours**

IRRIGATION CANALS AND IMPOUNDING STRUCTURES

Classification of canals - design of surplus weir - design of tank sluice with tower head - design of canal drops and regulators - lining and maintenance of canals - canal alignment and head works - types of impounding structures - design of gravity dams - functions of spillways and energy dissipaters

UNIT IV **10 Hours**

GROUNDWATER IRRIGATION

Fundamentals of groundwater flow - Darcy's law - types of aquifers - hydraulic properties of aquifer - steady-state flow and Dupit's assumptions - types of tube wells - yield and discharge of tube wells - pumping and recuperation tests - well shrouding and well development

UNIT V **7 Hours**

WATER LOGGING AND DRAINAGE

Causes, ill effects and control of water logging - drainage behind canal lines - objectives of drainage - classification of drains - drainage materials and pipes - design considerations for surface drains - advantages and maintenance of tile drains - layout and installation of drains

FOR FURTHER READING

Water losses during irrigation - water quality problems - irrigation management, climate change and adaptation - modern tools and techniques of soil management

Total: 45 Hours

Reference(s)

1. H. M. Raghunath, Irrigation Engieering, Wiley India (P) Ltd,2011
2. S. K. Garg, Irrigation Engineering and Hydraulic Structure, 19th Edition, Khanna Publishers, 2005
3. B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain, Irrigation and Water Power Engineering, 16th Edition, Laxmi Publications (P) Ltd,2009
4. S. K. Sharma, Principles and Practices of Irrigation Engineering, S Chand & company Ltd,1987
5. S. R. Sahasrabudhe, A Textbook of Irrigation Engineering, S. K. Kataria& Sons,2013
6. G. S. Birdie, Ram Chandra Das, Irrigation Engineering, DhanpatRai Publishing Company (P) Ltd,2001

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3	5				5				5															18
2		2				5				2	3	2			3			3					2		22
3		3					6			2	3			2	3			2					2		23
4		3				4				5	2			3				2				3			22
5		2				4				2	3			2	2										15
																								Total	100

Assessment Questions
Remember

1. Defineirrigation.
2. Define rotationperiod.
3. List the factors on which dutydepends.
4. Name the techniques for water distribution in thefarms.
5. Define duty anddelta.
6. Define irrigationefficiency.
7. Name the methods to improve theduty.
8. Recall the methods to measure consumptive use ofwater.
9. Define field capacity and saturationcapacity.
10. Recall effectiverainfall.
11. Reproduce the definition ofmicro-irrigation.
12. State Darcy'slaw.
13. Recall confinedaquifer.
14. Define gravitydam.
15. Define yield of awell.
16. Define storagecoefficient.
17. Definetransmissibility.
18. Define welldevelopment.
19. Recall lining ofcanal.
20. State Dupit'sassumptions.

Understand

1. Indicate the relationship between duty anddelta.
2. Explain the factors affecting consumptive use ofwater.
3. Compare the merits and demerits of surfaceirrigations.
4. Identify the specific advantages of canallining.
5. Explain the functioning of a sprinkler irrigationsystem.
6. Formulate groundwater flow in a simpleform.
7. Infer the design of damspillways.
8. Explain energy dissipation throughspillway.
9. Compare lift and flowirrigation.
10. Identify the ill-effects of waterlogging.
11. Exemplify the methods to fix the FSL of irrigation canal at itshead.
12. Explain canalsiphoning.
13. Infer energy dissipation from hydraulicjump.
14. Illustrate seepage pressure variation according to Khosla'screeptheory.
15. Classify diversion head works of a canal irrigationsystem.

16. Compare silting andscouring.
17. Explain Kennedy’s theory onsiltation.
18. Classify soil moisture according to the capillary pressurerange.
19. Explain permanent wiltingpoint.
20. Discuss the factors affecting field capacity ofsoil.

Apply

1. Assess the ways to control salinity by proper drainage.
2. Show that the width of a canal can be fixed based on siltationtheory.
3. Compute root zone aeration in terms of the principle ofdrainage.
4. Choose the suitable structure when a canal and drainage are approaching each other at the same level.
5. Find the stability of a structure against seepagepressure.
6. Demonstrate the design of major hydraulic structures on acanal.
7. Assess the physico-chemical nature of a water-loggedsoil.
8. Select the suitable structure to provide when a canal flowing under pressure is carried below a natural drainage such that its FSL does not touch the underside of the supportingstructure.
9. Find the effect on to the canal bed if the ground slope exceeds the designed bedslope.
10. Predict the depth of water required at the canal outlet based on the actual depth ofwatering.

Analyse

1. There are four wells A,B,C,D of 20 cm diameter each on four sides of a square plot having sides of 20 m. Pumping has been started at a rate of 2500 lpm from another well of 20 cm diameter which is located at the centre of the plot. Storage coefficient of the aquifer is 0.005. Compare the drawdown in four wells, if transmissibility of the aquifer is 1800lpm/m.
2. A canal was designed to supply the irrigation needs of 2000 ha of land growing wheat (of 90 days base period) and having a delta of 60 cm. If the canal water is used to irrigate rice (of base period 150 days) and having a delta of 120 cm, justify the irrigation based on the area under irrigation.
3. A soil has a field capacity of 30%, permanent wilting point of 18% and porosity of 40%. If the depth of root zone is 100 cm, justify the available moisture holding capacity of thesoil.
4. A stream which is diverted from a canal receiving 95 l/s at the arm gate delivered 72 l/s to the field. During irrigation to wheat crop for 8 h, 350 and 158 cu.m of water respectively were lost by runoff and deep percolation. Justify the performance based on farm conveyance efficiency and field water applicationefficiency.
5. What will be the minimum base width of the elementary profile of a gravity dam with the following data? Height of a gravity dam is 90m, specific gravity of dam material is 2.4, seepage coefficient at the base is 0.75, and sliding coefficient at the base is 0.6. Attribute the minimum base width required based on the givendata.

Evaluate

1. Judge the performance of a well based on the hydraulic parameters of the aquifer from pumping testdata.
2. Check the suitability of calculating the yield of a tube well by using the radial flow equation for a confinedaquifer.
3. Determine the effectiveness of measuring discharge at a point in a stream using the current meter data (depth above bed andvelocity).
4. Determine the area that can be irrigated if duty at the field and canal flow rate is known. Recalculate if the transit loss is taken intoaccount.

5. Judge the sprinkler nozzle discharge rating by measuring the nozzle diameter and nozzle pressure. State the importance of assuming a suitable nozzlecoefficient.

Create

1. Relate crop factor in soil-waterrelationship.
2. Generate irrigation scheduling for perennial crops in TamilNadu.

15CE407 FLUID MECHANICS LABORATORY 0 0 2 1

Course Objectives

- To impart knowledge on flow measurements in pipes and openchannels
- To carry out performance studies on hydraulicmachineries
- At the end of the course the students will be able to design pipe layouts and design pumps for residentialbuildings

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Measure the flow of water inpipes
2. Determine the characteristics of turbines &pumps
3. Understand the application of Bernoulli'stheorem

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1			1									
2			1		2							
3	1		1		2							

1 **3 Hours**

EXPERIMENT 1

Determination of Co-efficient of discharge of Orifice meter

2 **2 Hours**

EXPERIMENT 2

Determination of Co-efficient of discharge of Venturimeter

3 **2 Hours**

EXPERIMENT 3

Determination of Co-efficient of discharge through orifice

4 **2 Hours**

EXPERIMENT 4

Determination of Co-efficient of discharge of V- notch

5 **2 Hours**

EXPERIMENT 5

Determination of Co-efficient of Impact Jet

6 **3 Hours**

EXPERIMENT 6

Determination of friction factor in a pipe

7 **3 Hours**

EXPERIMENT 7

Study on Performance Characteristics of Centrifugal pump

8 **3 Hours**

EXPERIMENT 8

Study on Performance Characteristics of Reciprocating pump

9 **3Hours**

EXPERIMENT 9

Study on performance characteristics of Pelton Wheel Turbine

10 **3 Hours**

EXPERIMENT 10

Study on performance characteristics of Francis Turbine

11 **3 Hours**

EXPERIMENT 11

Study on performance characteristics of Kaplan Turbine

Total: 30 Hours

Reference(s)

1. Applied hydraulics and hydraulic machinery byDr.R.K.Rajput.
2. Subramanya, K., 1991. Flow in open channels, Tata McGraw-Hill NewDelhi.
3. Applied hydraulics and hydraulic machinery byDr.R.K.bansal

15CE408 SURVEYING - II LABORATORY 0 0 2 1

Course Objectives

- To impart basic knowledge on designing simplecurve
- To acquire knowledge on finding horizontal angle, vertical angle and distance using totalstation

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. an ability to design and conduct experiments, as well as to analyze and interpretdata
2. an ability to design a system, component, or process to meet desired needs within realistic constraints
3. an ability to a design a system, economic, environmental, social, political,ethical

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1		1									
2		1		1	2							
3	1											

1 **4 Hours**

EXPERIMENT 1

Setting out a simple circular curve using chains

2 **4 Hours**

EXPERIMENT 2

Setting out a simple circular curve using RankineÃ¢??s method

3 **4 Hours**

EXPERIMENT 3

Setting out a transition curve

4 **4 Hours**

EXPERIMENT 4

Determination of azimuth of a line by observation on the sun

5 **4 Hours**

EXPERIMENT 5

Setting out of Combined curve

6 **4 Hours**

EXPERIMENT 6

Experimental Study on Foundation marking

7 **3 Hours**

EXPERIMENT 7

Experimental study on Theodolite traverse

8 **3 Hours**

EXPERIMENT 8

Measurements using Total Station

Total: 30 Hours

15CE409 CONCRETE TECHNOLOGY LABORATORY 0 0 2 1

Course Objectives

- To impart a sound Technical knowledge on the ingredients of special and conventional concrete andadmixtures
- To impart basic knowledge on the properties of fresh and hardened concrete and to provide a basic understanding on the usage of admixtures used inconcrete

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Imparts the knowledge about the properties of concrete making materials and their testing methods
2. Can design the concrete mix for fieldrequirements
3. Demonstrate the properties of concrete in plastic and hardened state and application of special concretes

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		2					1					
2		2		1								
3		1		2								

1 5 Hours

PHYSICAL TESTS ON CEMENT

Fineness, Standard consistency, Initial

2 4 Hours

TESTS ON FINE AGGREGATE

Sieve analysis, Specific gravity, Bulk density and Bulking

3 **5 Hours**

TESTS ON COARSE AGGREGATE

Sieve analysis, Bulk density, Aggregate crushing strength, Aggregate impact, Abrasion, Flakiness index and Elongation index

4 **5 Hours**

TESTS ON FRESH CONCRETE

Slump test, Compaction factor, Vee bee consist meter

5 **5 Hours**

TESTS ON HARDENED CONCRETE

Compressive strength: Cube - Cylinder Split tensile strength and Modulus of rupture

6 **3 Hours**

NON DESTRUCTIVE TEST

Rebound hammer test Ultrasonic pulse velocity test

7 **3 Hours**

MIX DESIGN

Mix Design of concrete

Total: 30 Hours

eference(s)

1. A.R.Santhakumar, Concrete Technology, Oxford University Press, New Delhi,2007
2. M.L.Gambhir, Concrete Technology, Tata McGraw Hill Publishing Co., Ltd. NewDelhi,2007
3. M.S.Shetty, Concrete Technology, S.Chand and Co., Ltd., NewDelhi,2003
4. A.M.Neville, Properties of Concrete, Tata McGrawHill publishers,2003
5. P.KumarMehta and Paulo J.M. Monteiro, Concrete - Micro structure, Properties and Materials, Indian Concrete Institute,Chennai,1997
6. P.D.Kulkarni, Text book of Concrete Technology, New Age International (P) Ltd.2007

15CE410 MINI PROJECT II 0 0 2 1

Course Objectives

- To develop knowledge to formulate a real world problem and project goals
- To identify the various task of the project to determine standard procedures
- To identify and learn new tools, algorithm and techniques

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present oral demonstrations

Total: 30 Hours

15CE501 DESIGN OF STEEL STRUCTURES 3 0 0 3

Course Objectives

- To impart knowledge on Limit State Design Methods for steelStructures
- To impart knowledge on the codal provisions for the design of steelstructures
- To impart knowledge on the design of connections, tension members, compression members, beams and rooftrusses

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Calculate the strength of connections and design the bolted and weldedconnections.
2. Determine the strength of tension member and Design tension members, Splices &Lugangles.
3. Compute the strength of compression member and Design Struts, Latticed column and Column base.
4. Calculate the strength of beams and Design laterally supported and unsupported Beams, Built-up Beams and PlateGirders.
5. Determine the strength of beam column, truss members & gantry girder and Design Beam columns, Roof trusses &Gantrygirders.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1									
2	3	2	1									
3	3	2	1									
4	3	2	1									
5	3	2	1									

UNIT I **9 Hours**

INTRODUCTION

Introduction to steel structures - Use of relevant Indian standard codes - Comparison of Working stress and Limit state method of design - Properties of steel - Structural steel sections - Types of connections - Design of bolted and welded connections for axial load - Efficiency of joint.

UNIT II **9 Hours**

TENSION MEMBERS

Introduction to types of Tension Members - Calculation of net area - Net effective sections for angles and Tee in tension - Design of tension members - Design of tension splices, Lug Angles and Gussets

UNIT III **9 Hours**

COMPRESSION MEMBERS

Introduction to types of compression members - Theory of column: Loads on compression member - Failure modes of an axially loaded column - Influence of Effective length and slenderness ratio on the strength of column - Codal provisions for compression members - Design of Compression Members - Design of lacings and battens - Design of column base: Slab Base - Gussetted Base.

UNIT IV **9 Hours**

DESIGN OF BEAMS

Introduction to design of flexural members - Design of laterally supported and unsupported beams - Design of Compound beams - Design of plate girders - Intermediate and bearing stiffeners.

UNIT V **9 Hours**

MISCELLANEOUS TOPICS

Introduction to Beam Columns - Design of Beam Columns - Loading specifications and components of an industrial building - Design of roof trusses and purlins - Introduction to gantry girder - Design of gantrygirder.

FOR FURTHER READING

Corrosion Protection of Steel Structures - Fire Resistant Design - Steel-Concrete- Composite Constructions

Reference(s)

Total: 45 Hours

1. N. Subramanian, Design of Steel Structures, Oxford University Press2011
2. S. K. Duggal, Limit State Design of Steel Structures, Tata , McGrawHill Education Pvt Ltd, New Delhi,2014
3. S.S.Bhavakatti, Design of Steel Structures, IK publications, New Delhi, ThirdEdition.
4. K. S. SaiRam, Design of Steel Structures, Dorling Kindersley (India) Pvt. Ltd, Pearson Education in SouthAsia.
5. IS 800 - 2007, IS 800 - 1984 General Construction in Steel - Code of Practice, BIS, New Delhi
6. R. Murugesan and A. P. Arulmanickam, Steel Tables in SI Units, Pratheeba Publishers, Coimbatore,2009

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3				3				3				4			4									17
2			5				5					5					5								20
3		4				4				4				5				5							22
4		4			4				3			5				5									21
5		5					5				4				4			2							20
																								Total	100

Assessment Questions
Remember

1. Define the term blockshear.
2. What are the types of boltedjoint?
3. Name the types of tensionmember.
4. How will you find net sectional area in chainriveting?
5. Give the Euler's formula to calculate the bucklingload.
6. Define slendernessratio.
7. Write down the formula to find Elastic criticalstress.
8. What is built up beams? Mention itstypes.
9. Describe the assumptions made in analysis of rooftrusses.
10. Define beamcolumn.

Understand

1. Differentiate between Characteristic load and factoredload.
2. What do you mean by pryingforce?
3. When tension splices are needed in the tensionmember?
4. Why lug angles are provided in the tensionmember?
5. What do you mean by 'Webcrippling'?
6. When splicing of a column becomesnecessary?
7. What is the difference between laterally supported and laterally unsupportedbeams?
8. How the loads are transferred by abeam?
9. Distinguish between determinate and indeterminatetrusses.
10. What is the function of abracing?

Apply

1. How will you calculate Nominal diameter of thebolt?
2. How the effective throat thickness will be computed in case of incomplete penetration buttweld?
3. How the design strength of tension member iscalculated?
4. What is the radiousof gyration for a hollow steel shaft, outside diameter 150mm and inside diameter 100mm is to be used as acolumn.

Analyse

1. How can you calculate maximum slenderness ratio for flat bars of width b and thickness t used forlacingsystem?
2. How will you calculate permissible bending stress in compression and tension for laterally supportedbeams?
3. How will you calculate permissible bending stress in compression and tension for laterally unsupportedbeams?
4. How will you calculate design bending moment for I – sectionpurlin?
5. How will you find maximum bending moment for anglesection?

Evaluate

1. Design a single angle discontinuous strut for a roof truss to carry a load of 95kN. The length of the strut between the centresof intersection is2.50m.

15CE502 STRUCTURAL ANALYSIS - I 3 0 0 3

Course Objectives

- To impart knowledge on the different methods of analysis of statically indeterminatestructures
- To impart knowledge on moving loads and influence linediagrams.
- To provide a thorough understanding on arches and influence linediagram
- At the end of the course students will be conversant with classical method ofanalysis.

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Compute the member forces and deflection of determinate and indeterminatestructures
2. Analyse the bending moment and shear force for beam, sway and non-sway frame by slope deflectionmethod.
3. Analyse the bending moment and shear force for beam, sway and non-sway frame by moment distributionmethod.
4. Identify the vertical reaction, horizontal thrust and bending moment for two and three hinged arches.
5. Represent the ILD for Simply supported and over hanging beams subjected to movingload.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1										
2		2										
3		2										
4		1										
5		2										

UNIT I **9 Hours**

DEFLECTION OF DETERMINATE STRUCTURES

Definition and Determination of Static and Kinematic Indeterminacies in Beams, plane and space Trusses and Frames - Degree of Freedom - Analysis of plane trusses by method of joint ,method of section and tension coefficient method - Castigliano's First and Second Theorems - Deflection of statically determinate beams, pin jointed trusses and rigid jointed frames by energy method and unit load method. - Analysis of pin connected indeterminate trusses by consistent deformation method - Betti's reciprocal theorem.

UNIT II **9 Hours**

SLOPE DEFLECTION METHOD

Derivation of slope deflection equations - Application to Continuous beams and rigid frames (with and without sway) - Effect of Support displacements.

UNIT III **9 Hours**

MOMENT DISTRIBUTION METHOD

Absolute and relative stiffness and carry over factors - Analysis of continuous beams - Plane rigid jointed frames with and without sway - Effect of settlement of supports - Nayler's simplification.

UNIT IV **9 Hours**

ARCHES

Arches as structural forms - Examples of arch structures - Types of arches - Analysis of three hinged, two hinged and fixed arches having parabolic and circular shapes - Settlement and temperature effects.

UNIT V **9 Hours**

MOVING LOADS AND INFLUENCE LINES

Influence Lines: Introduction - Construction of ILD for shear force and bending moment at a sections- determination of load positions for maximum shear force and bending moments for simply supported and overhanging beams with several point loads and UDL and determination of their values - Sketching of absolute maximum BMD. Muller -Breslau principle: Application to determinate and redundantstructures.

FOR FURTHER READING

Analysis of multi-storeyed building frame for horizontal loads by portal method and cantilever method. Analysis of multi-storeyed building frame for vertical loads by two cycle moment distribution method- using substitute frames.

Total: 45 Hours

Reference(s)

1. C.S. Reddy, Basic structural analysis, Second edition, Tata McGraw Hill publishing company limited,1996
2. SS Bhavikatti ,Structural Analysis , ,Third edition, Volume I Second Edition Volume II , VikasPublishing House (p) ltd,2009
3. RamamruthamS,Theoryofstructures,Ninthedition,DhanpatRaiPublishingcompany(p)ltd ,2014
4. Vaidyanathan.R, Perumal.P, â€œComprehensive Structural Analysisâ€• , VolI & II, Laxmi Publications,2008

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1		2				2									16										20
2		2				2									16										20
3		2				2									16										20
4	2					2									16										20
5	2				2										16										20
																								Total	100

Assessment Questions

Remember

1. What is meant byILD?
2. Name the different types of arch as per structure configuration
3. Explain the transfer of load to thearches.
4. Write down the expression for the horizontal thrust when the two hinged arch is subjected to uniformly distributed load thought thespan.
5. State relative merit of moment distribution method over slope deflectionmethod.
6. Name the three classical force methods used in the analysis of continuousbeams.
7. What are the limitations of slope deflectionmethod?
8. Write down the equilibrium equations used in slope deflectionmethods
9. Why is slope deflection equation method known as stiffnessmethod?
10. What are the basic assumptions made in slope deflectionmethod?

Understand

1. What are the uses of influence linediagrams?
2. In the context of rolling loads, what do you understand by the term equivalent uniformly distributedload?
3. How will you obtain degree of static determinacy?
4. What is degree of kinematicindeterminacy
5. State the typesofarches.
6. What is a three hingedarch?
7. Write the equation to define the centre line of a circulararch?
8. Give an expression for the determination of horizontal thrust of a two hinged arch considering bending deformationonly
9. Differentiate between the cable andarch.
10. What the degree of redundancy of two hinged arch?
11. Explain the term Horizontalthrust.
12. Draw the deflected shape of the simply supportedbeam
13. State Muller Breslau'sprinciple.
14. Sketch the influence line diagram for shear force at any section of a simply supportedbeam.
15. A symmetrical three hinged arch (circular) supports a load 'W' at the crown. What is the value of H?

Analyse

1. A single rolling load of 100 kN moves on a girder of span 20m. (a) Construct the influence lines for (i) Shear force and (ii) Bending moment for a section 5m from the left support. (b) Construct the influence lines for points at which the maximum shears and maximum bending moment develop. Determine these maximumvalues.
2. Derive the influence diagram for reactions and bending moment at any section of a simply supported beam. Using the ILD, determine the support reactions and find bending moment at 2m, 4m and 6m for a simply supported beam of span 8m subjected to three point loads of 10kN, 15kN and 5kN placed at 1m, 4.5m and 6.5mrespectively.
3. Two concentrated rolling loads of 12 kNand 6 kNplaced 4.5 m apart, travel along a freely supported girder of 16m span. Draw the diagrams for maximum positive shear force, maximum negative shear force and maximum bendingmoment.
4. A train concentrated rolling load of 8kN, 15 kN, 15 kN,and 10kN the spacing of 2m, 2m, and 2m moves from left to right on a simply supported beam girder of span 16m leading load of 10kN. Determine Maximum positive shear force, maximum negative shear force and maximum bending moment.
5. Two concentrated rolling loads of 12 kNand 6 kN, 10 kNplaced 2m and 1m apart, travel along a freely supported girder of 20 m span. Draw the diagrams for maximum positive shear force, maximum negative shear force maximum bendingmoment.

6. A uniformly distributed load of 15kN/m the distance of 6m moves on a girder of span 30m moves from left to right.Determine
   (i) Maximum positive and negative Shear forceand
   (ii) Bending moment for a section 5m from the leftsupport
7. A three hinged parabolic arch of span 100m and rise 20m carries a uniformly distributed load of 2KN/m length on the right half of the span. Determine the maximum bending moment in thearch.
8. A two hinged parabolic arch of span 20m and rise 4m carries a uniformly distributed load of 5t/m on the left half of span as shown in figure. The moment of inertia I of the arch section at any section at any point is given by I = I0 sec q where q = inclination of the tangent at the point with the horizontal and I0 is the moment of inertia at the crown.Find
   (c) The value of the maximum bending moment in the arch.
9. A three hinged symmetric parabolic arch hinged at the crown and springing, has a span of 15m with a central rise of 3m. It carries a distributed load which varies uniformly form 32kN/m (horizontal span) over the left hand half of the span. Calculate the normal thrust; shear force and bending moment at 5 meters from the left endhinge.
10. A two hinged parabolic arch of span 30m and central rise 5m carries a uniformly distributed load of 20kN/m over the left half of the span. Determine the position and value of maximum bending moment. Also find the normal thrust and radial shear force at the section. Assume that the moment of inertia at a section varies as secant of the inclination at thesection.
11. A three hinged parabolic arch, hinged at the crown and springing has a horizontal of 15m with a central rise of 3m. If carries audlof 40kN/m over the left hand of the span. Calculate normal thrust, radial shear and bending moment at 5m from the left handhinge.
12. A parabolic two hinged arch has a span L and central rise ‘r’. Calculate the horizontal thrust at the hinges due to UDL ‘w’ over the wholespan.
13. A three hinged parabolic arch of span 20 m and rise 4m carries a UDL of 20 kN/m over the left half of the span. Draw theBMD.
14. Analyze the three span continuous beam one end fixed other end simply supported. The span AB 5 m, BC = 6m and CD = 4m. The UDL of 15 kN/m load acting the spans AB, point load acting 40 kNspan CD and 60 kNload acting 2m from the support B by slope deflection method and draw the B.M.D &S.F.D
15. Analyze the three span continuous beams both end simply supported. The span AB 5 m, BC = 5m and CD = 4m. The UDL of 15 kN/m load acting the spans AB, point load acting 40 kNspan CD and 60 kNload acting 2m from the support B by slope deflection method and drawthe
    B.M.D &S.F.D .the moment of inertia the span AB 2I ,BC = 3I ,CD = I
16. Analyze the portal frame by slope deflection method and draw the B.M.D. The column AB & CD both ends are fixed supported. The column AB = 4m ,BC= 3m & CD = 4m. The udlof 6kN/m load acting the span BC the moment of inertia column AB , CD = I & BC = 2I . by slope deflection method and draw theB.M.D.
17. Analyze the portal frame by slope deflection method and draw the B.M.D. The column AB & CD both ends are fixed supported. The column AB = 3m ,BC= 2m & CD = 3m. The udlof 15kN/m load acting the span BC and point load 10 kNacting from 2m from the support A & D. The moment of inertia column AB, CD = I & BC = 2I by slope deflection method and draw the B.M.D.
18. Analyze the portal frame by slope deflection method and draw the B.M.D. The column AB & CD both ends are fixed supported. The column AB = 3m, BC= 6m & CD = 3m. The udlof 6kN/m load acting the spanBC.
19. Analyze the portal frame by slope deflection method and draw the B.M.D. The column A & D both ends is fixed supported. The column AB = 4m, BC= 4m & CD = 4m. The eccentricity load of 2.5 kNacting a distance of 1m from the support B. The moment ofinertia column AB, BC = 2I & CD =I.

20. Analyze two span Continuous overhanging beam bu slope deflection method. The span AB = 4 m, BC = 6m and the cantilever portion 2m distanced and point load 25 kN acting the free end. The UDL of 25 kN/m load acting the spans AB and span BC eccentricity load of 40 KN at distance of 4m from supportB.
21. Analyze Continuous overhanging beam by slope deflection method. The span AB = 10m and the cantilever portion 4m distanced and UDL of 25 kN/ m entire span length.

15CE503 SOIL MECHANICS 3 0 0 3

Course Objectives

- To make the students gain adequate knowledge on the properties ofsoils
- To make them know the significance of the soilproperties

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Determine the index properties of soil and classify the type ofsoil
2. Determine the permeability and seepage characteristics ofsoil
3. Determine the compressibility characteristics ofsoil.
4. Evaluate the vertical stress & shear strength parameters ofsoil
5. Analyze the stability of slopes and provide slope protectionmethods

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1		2								
2	3	1	1	2								
3	3	2		2								
4	3	1										
5	3	1				1						

UNIT I **9 Hours**

INDEX PROPERTIES AND CLASSIFICATION OF SOIL

Nature of soils - Phase diagrams - Basic definitions and inter-relationships - Index properties of soils and their determinations: Specific gravity - Water content - Density -Field density - Relative density - Sieve analysis - Particle size distribution - Sedimentation analysis - Consistency of soils - Atterberg limits and indices - Classification of soils: Need - Classification based on BIS classification- Field Identification of Soils

UNIT II **9 Hours**

SOIL WATER AND WATER FLOW

Soil water - Various forms - Static pressure in water - Capillary flow - Suction - Effective stress concept - Total - Neutral and effective stress distribution in soils - Flow of water through soils - Darcy's law; Assumptions and validity - Permeability - Coefficient of permeability - Laboratory test and Field test - Factors affecting permeability: Permeability of stratified deposits of soils - Seepage - Laplace equation - Introduction to Flow nets.

UNIT III **9 Hours**

COMPRESSIBILITY OF SOILS

Compaction - Factors affecting compaction - Effect of compaction on soil properties - Proctor and modified Proctor tests - Zero air void lines - Field compaction and its control - Consolidation - Fundamental definitions - Spring analogy - Terzaghi's one dimensional consolidation theory - Assumptions, limitations and applications - Pre-consolidation pressure and its determination - Normally, under and over consolidated soils

UNIT IV **10 Hours**

VERTICAL STRESS AND SHEAR STRENGTH

Stresses in soils: Boussinesq's and Wester Guard's theories of stresses due to concentrated loads - Circular, Rectangular load - Strip load - New Mark's chart - Pressure bulbs - Shear strength - Factors affecting shear strength of soils- Mohr - Coulomb theory - Measurement of shear parameters - Direct shear - Unconfined compression - Triaxial - Drained and un-drained conditions - Vane sheartests

UNIT V **8 Hours**

STABILITY OF SLOPES

Types of slopes - Failure mechanism of slopes - Total and effective stress analysis - Finite slopes - Stability analysis for purely cohesive and c-phi soils - Method of slices - Friction circle method - Taylor's Stability number - Slope protection methods

FOR FURTHER READING

Problems encountered in different types of soils - Collapsible soil - Expansive soil - Quick sand phenomena - Case studies on failure of structures due to settlements - Case studies

Total: 45 Hours

Reference(s)

1. B. N. D. NarasingaRao, Soil Mechanics and Foundation Engineering, Wiley India Pvt. Ltd., New Delhi,2015.
2. B. C. Punmia, Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd., New Delhi,2005.
3. Alam Singh, Soil Engineering in Theory and Practice, Asia Publishing House, Bombay, 2ndEdition,2009.

4. Braja M. Das, Principles of Geotechnical Engineering, Thomson Brooks/Cole, Australia, 8th Edition,2015.
5. Karl Terzaghi, Soil Mechanics in Engineering Practice, 3rd edition, John Wiley & Sons, Inc, 1995.
6. IS Codes: IS 1498: 1970, IS 2810: 1979, IS 2809: 1972, IS 2720 : Part 1 to Part 41

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3	2			2	3			2	5	3														20
2	2	1	2		3	2	2		4	2	2														20
3	1	2	1		4	3			4	6															21
4	4		2		3	1			2	4	5														21
5	3	4			3	5					3														18
																								Total	100

Assessment Questions
Remember

1. Define void ratio and porosity ofsoil.
2. Reproduce the relation between void ratio andporosity.
3. State Stoke'slaw
4. State Darcy'slaw.
5. Define co-efficient of permeability in a soilmass.
6. List the factors affecting permeability ofsoils.
7. Give the relation between seepage velocity and dischargevelocity.
8. What are the index properties of a coarse grainedsoil?
9. Define liquidlimit.
10. List three different types of soilwater.
11. Define effective stress and neutral stress.
12. What are all the clayminerals?
13. What is a flownet?
14. Definecompaction.
15. What are the factors that affectcompaction?
16. What is a compactioncurve?
17. What is the coefficient ofconsolidation?
18. List the assumptions of Terzhaghi's theory ofconsolidation.
19. Define preconsolidationpressure
20. Give the relation between dry density and bulk density ofsoil.
21. DefineIsochrones.
22. Define pressurebulb.
23. Give any two assumptions of Boussinesq's Stressdistribution
24. What is Newmark's influencechart?
25. List different tests to determine shear strengthparameters.
26. State Mohr Coloumbs equation for determination of shear strength of soils both for total and effective stressconditions.
27. Define shear strength ofsoil.
28. What is pore pressureparameter?
29. What is stresspath?

30. DefineIsobar.
31. What are different types of slopefailure?
32. Define stabilitynumber.
33. Write short notes on slope protectionmeasures.
34. What are finiteslopes?
35. What are the assumptions that are generally made in the analysis of the stability ofslopes?
36. What is criticalheight?
37. State the conditions to classify coarse grained soil by ISmethod.
38. State the various corrections required for a hydrometerreading
39. What type of soil will undergo largerconsolidation?
40. State the components of settlement and its predominance soiltype.
41. Sketch different types of stress paths that can be obtained in a triaxialtest.

Understand

1. What are all the methods available to determine the water content of a soil inlaboratory?
2. How would you determine the bulk density of a soil specimen in alaboratory?
3. Draw the phase diagram for fully saturatedsoil.
4. What is relativedensity?
5. What is particle size distributioncurve?
6. What are different methods for determination of the co-efficient of permeability in alaboratory?
7. What is a quick sandphenomenon?
8. What is meant by over consolidationratio?
9. What are the factors influencing the shear strength ofsoil?
10. What are different factors of safety used in the stability ofslopes?
11. What are the three conditions for which stability analysis of an earth dam is carriedout?
12. What is meant by rotational failure and itstypes?
13. How to determine the bulk density of a soil infield?
14. What is the use of classification ofsoils?
15. What are the three most common clay minerals? Which one usually causes the most problems for engineers?
16. How to construct the flow net when the soil is anisotropicsoil?
17. What is the effect of surcharge and the capillary action the effectivestress?
18. How to determine the average permeability of a soil deposit consisting of a number oflayers?
19. Differentiate between compaction andconsolidation.
20. What is O.M.C? Explain its practical significance.
21. What are different causes of preconsolidation in soils? What is the effect of preconsolidation on thesettlement?
22. What is the effect of compaction on the engineering properties of the soil? How would you decide whether the soil should be compacted the dry of optimum or the wet ofoptimum?
23. What is contact pressure? Draw the contact pressure distribution diagram for flexible and rigid footings on sand and clayeysoils.
24. What is unconfined compression test? What are its advantages over triaxialtest.
25. What is meant by geostatic stresses? How are thesedetermined?
26. Differentiate between slope failure and base failure. When does each of the above typeoccur?
27. Explain how factor of safety is obtained for a finite slope made of purely cohesive soil by total stressmethod.

Apply

1. What are the different methods of compaction adopted in thefield?
2. Write the uses of flow net? How would you determine the quantity of seepage from flownet?

3. Show by an example, the effect of sudden drawdown on stability of slopes. How is stability determined?
4. Compute the factor of safety of a slope of infinite extent having angle of slope with horizontal = 29°. The slope consists of a soil, having effective values of C= 0 KN/m^2; and angle of shearing resistance=32°.
5. Discuss the field identification methods ofsoils.
6. What is the use of classification ofsoils?
7. How soil suction is measured? What are the factors that affect soilsuction?
8. Describe pumping out methods for the determination of the coefficient of permeability in the field. What are their advantages anddisadvantages?
9. What is quick sand? How would you calculate the hydraulic gradient required to create quick sand conditions in a sample of sand?
10. Explain the mechanics of piping in hydraulic structures. What methods are used to increase the factor of safety againstpiping?
11. How to determine the time-settlement curve in thefield?

Analyse

1. If the liquidity index of a soil is zero, find its consistent cyindex.
2. Discuss the shear characteristics of cohesionless soils and cohesivesoils.
3. How a slope is analyzed using Swedish circle method? Derive an expression for the factor of safety.
4. Find the average horizontal and vertical permeabilitiesof a soil mass made up of three horizontal layers. The first and second layers have the same thickness of 0.5 m each. The third layer is 1.0 m thick. The coefficients of permeability of the first, second and third layers, respectively are 1×10^{-3} cm/sec, 2×10^{-2}, and 5×10^{-4}cm/sec.
5. A 8m thick clay layer with single drainage settles by 120 mm in 2 years. The co-efficient of consolidation for the clay was found to be 6×10^{-3} cm^2 /s. calculate the likely ultimate consolidation settlement and find out how long it will take to undergo 90% of thesettlement.

Evaluate

1. The atterberg's limit for a clay soil used as for filling an earth dam are liquid limit 60%, plastic limit 40%, and shrinkage limit 25%.If a specimen of the soil of volume 10 cc at the liquid limit has a volume of 6.5 cc when dried, what would be the specific gravity of the soilparticles?
2. For a soil with a specific gravity of grains 2.65, determine the dry density at (i) a moisture content of 15% with 80% saturation; (ii) a moisture content of 12% with 85%saturation.
3. Undrainedtriaxial tests are carried out on 4 identical specimens of clay and the following results areobtained.

Cell pressure (kN/m^2)	50	100	150	200
Deviator stress (kN/m^2)	340	430	540	620
Pore pressure (kN/m^2)	4.8	9	11	17

4. Determine the effective angle of shearing resistance and cohesion intercept by drawing failure envelope.
5. A concentrated load of 30 kNacts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 8 m and (i) directly under the load; (ii) at a horizontal distance of 6m.
6. Compute the safe height for an embankment rising at angle of 60 degree to the horizontal, and to be made with a soil having unit weight of 20 kN/m^3, angle of shearing resistance =15, and Cohesion= 20 kN/m^2. Factor of safety may be considered as 2.5. Make use of Taylor's stability chart

Create

1. Sketch the variation in total stress, effective stress and pore water pressure up to a depth of 6m below ground level given the following data. The water table is 2m below the ground level. The dry unit weight of the soil is 17 KN/m^3, water content is 12 %, and specific gravity is 2.65. What would be the change in these stresses, if water table drops by 1m?
2. Why the grids are arranged by keeping the serration at right angles to the direction of shear in direct shear test?

15CE504 DESIGN OF RCC ELEMENTS 3 0 0 3

Course Objectives

- To introduce the basic concepts and steps for reinforced concrete sectional design mainly in accordance with Indian Standard codes ofpractice
- To underline and discuss basic principles of mechanics regarding the design of reinforced concrete systems andelements

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Understand the behavior and different design methods for analysis and design of RC structural elements.
2. Design of beam for flexure as per the limit state method
3. Design of beam for shear and torsion as per the limit statemethod
4. Evaluate the deflection and crack width of beam for serviceabilityconditions.
5. Design of column sections as per limit statemethod.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1									
2	2	3	1		1							
3	2	3	1									
4	2	3	1									
5	2	3	1									

UNIT I **9 Hours**

INTRODUCTION TO DESIGN METHODS

Aims of design - Method of design - Assumptions - Stress strain behaviour of steel and concrete - Stress block parameters - Provisions of IS-456 code for design of RC elements - Analysis and design of singly and doubly reinforced rectangular sections by working stress method - Design of RC rectangular one and two way slabs subjected to uniformly distributed load by limit state method.

UNIT II **9 Hours**

LIMIT STATE DESIGN OF BEAMS FOR FLEXURE

Principles - Characteristic load and strength - Partial safety factor - Neutral axis-Balanced-Under Reinforced-Over Reinforced Sections- Analysis of singly reinforced rectangular section- Design of singly reinforced rectangular section - Analysis and design of doubly reinforced rectangular section - Analysis and design of flanged beams

UNIT III **9 Hours**

LIMIT STATE DESIGN OF BEAMS FORSHEAR

Shear and Bond design of RCC - Shear forces in RC - Shear Resistance of RC - Design of vertical stirrups - Bent-up bars - Development length. Design of beam section subjected to the combined action of bending moment, transverse shear andtorsion

UNIT IV **9 Hours**

LIMIT STATE OF SERVICEABILITY

Parameters considered in limit state of serviceability - Short term deflection - Long term deflection - Calculation of deflections in beams under working loads - Check for deflection - Calculation of crack width in beams - Check for crack width

UNIT V **9 Hours**

LIMIT STATE DESIGN OF COLUMNS

Types of columns - Design of rectangular and circular columns for axial load - Provisions of IS-456 code for the design of columns subjected to axial load and uniaxial bending - Design of short and long columns subjected to axial load and biaxial bending moment using interaction charts.

FOR FURTHER READING

Comparison of design methods - Ultimate moment of resistance of sections as per Whitney's theory

Total: 45 Hours

Reference(s)

1. B. C. Punmia, A. K. Jain, Limit State Design of Reinforced Concrete, Laxmi Publication (p) LTD, New Delhi,2007
2. N. Krishna Raju, Reinforced Concrete Design IS 456-2000 Principles and Practice, New Age International Publishers, New Delhi,2008
3. S. UnnikrishnaPillai and DevedasMenon, Reinforced Concrete Design,Tata McGraw Hill,2009
4. P. C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India Ltd., New Delhi,2002
5. S. N. Sinha, Reinforced Concrete Design, Tata McGrawâ€“Hill Publishing Company Ltd., New Delhi,1996
6. IS 456:2000 Plain and reinforced concrete-Code ofPractice.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1		2			2	4					12														20
2	2					4	2							12											20
3	2				3	3					12														20
4		2			2	2	2							12											20
5		2			4	2					12														20
																								Total	100

Assessment Questions

Remember

1. What are the three basic methods using factor of safety to achieve safe workablestructures?
2. What is meant by hangerbar?
3. What is the purpose of providing distribution reinforcements in RCslabs?
4. What is the code provision for maximum spacing of vertical stirrups in RCbeams?
5. What will be the minimum and maximum area of tension reinforcement in abeam?
6. Define developmentlength.
7. Write any two functions of lateral ties in a RCcolumn
8. What will be the minimum and maximum area of reinforcement in a RCcolumn?
9. What is meant by secondary reinforcement provided in one-way RCslabs?
10. What is modularratio?
11. What do you mean by balanced reinforcementsection?

Understand

1. Why IS 456-2000 not recommending ultimate load method ofdesign?
2. Discuss the merits and demerits of the traditional working stress method ofdesign
3. Why two limit states are considered in the limit statedesign?
4. Mention the difference in design principle for L beam and Tbeam
5. Under what circumstances are doubly reinforced beams resortedto?
6. Classify the slab on the basis of spanning direction. Explain in detail withsketches.
7. Under what situations do the following modes of cracking occur in reinforced concrete beams (a) flexural cracks (b) diagonal tension cracks (c) flexural shear cracks (d) splittingcracks?
8. Write the effects of moments influencing the load carrying capacity of eccentricity loaded columns.
9. Explain the need for corner reinforcement in two way-rectangular slabs, whose corners are prevented from liftingup.
10. Give percentage of tension steel (pi) and compression steel (pc) of a doubly reinforced section, how is it possible to decide whether the beam is under reinforced or over reinforced at the ultimate limitstate.
11. Why is the design shear strength of concrete related to the percentage tension steel(pt)?

Apply

1. A simply supported beam of effective span 7m is to carry a live load of 15kN/m and dead load of 7kN/m. Design the mild span section by working stress method for a concrete of grade M25 and steel of gradeFe415.
2. Design a two way slab 4 m x 5 m with adjacent edges continues and the rest two adjacent edges discontinuous. The slab is subjected to a live load of 5kN/m2. Use M20 concrete and Fe 415 steel.

3. A RCC section 250mm x 450mm is subjected to the following factored forces: bending moment of 70kNm torsion moment of 25kNm and a transverse shear of 65kN. Assuming M25 grade concrete and Fe415 bars, determine the reinforcements required according to IS 456provisions.
4. A RC beam 300mm wide, 400mm effective deep is reinforced on tension side with 4nos 20mm dia bars of grade Fe250 with an effective cover of 50mm. The beam is subjected to a shear of 295kN. Design the shear reinforcement (i) using vertical stirrups (ii) bending 2 bar at an angle of 45degree.
5. A simply supported beam of rectangular section spanning over 4.5m has a width of 295mm and effective depth of 450mm. The beam is reinforced with 4 bars of 20mm diameter on the tension side spaced at 65mm C/C which is subjected to a working load moment of 160kN-m. Consider effective cover as 50mm. Use M30 concrete and Fe 415 steel. Check the beam for the serviceability limits state ofcracking.
6. Design the reinforcements for a column with effective lengths lex=ley=3.5m and size 300mm x 500mm, subjected to a factored axial load of 1350kN with factored biaxial moment of 168kNm and 100kNm with respect to the major axis and minor axis respectively. Assume M25 concrete and Fe 415steel.
7. A simply supported beam of effective span 7m is to carry a live load of 15kN/m and dead load of 7kN/m. Design the mild span section by working stress method for a concrete of grade M25 and steel of gradeFe415.
8. Design a two way slab 6 m x 5 m with adjacent edges continues and the rest two adjacent edges discontinuous. The slab is subjected to a live load of 5kN/m2. Use M20 concrete and Fe 415steel
9. A RC beam 300mm wide, 400mm effective deep is reinforced on tension side with 4nos 20mm dia bars of grade Fe250 with an effective cover of 50mm. The beam is subjected to a shear of 295kN. Design the shear reinforcement along with 2 bent up bars.
10. A rectangular beam 250mm wide, 450 mm depth is subjected to a sagging bending moment of 40kNm, shear force of 61kN and twisting moment of 37kNm at a given section. Design the reinforcement at the section. Use M25 concrete and mild steel reinforcement. Assume effective cover =45mm.
11. Design an interior span of a continuous one way slab for an office floor which has continuous Tee beams. The Tee beams are spaced at 4.0 m c/c.use a live load of 3.0kN/sq.m and total dead load of 2.5 kN/sq.m. Use M25 andFe25
12. Design the reinforcements to be provided in a short RC column given the following data, by limitstate method: Size of column = 300 x 600 mm, Factored load = 1200 kN, FactoredmomentM$_{ux}$ =160 kN.m, M$_{uy}$= 80 kN.m
13. A reinforced concrete beam 500mm deep and 230 mm wide is reinforced with 8 nosof 20mm dia bars at mid span to carry a UDL of 22.5kN/m (inclusive of its own weight) over simple span of 8m. Assuming concrete grade M20 and steel grade Fe415, load factor 1.5 and width of support 230mm. (i) determine the minimum development length required for 20mm diabar to develop full strength. (ii) Apply check for flexural development length at support assuming all bar to continue at support. (iii) Determine the minimum number of bars required at support for development length inflexure.

Analyse

1. Differentiate between safety factor in WSD and partial safety factor SD.
2. Distinguish between over reinforced and under reinforcedsections.
3. A rectangular beam of 250mm width and effective depth 550mm has 4 nosof 16mm diameter bars on tension side and 4 nosof 12mm diameter bars on compression side. Determine the moment of resistances of the cross section by working stress method. Consider effective cover of compression reinforcement as 50mm. Use M20 grade concrete and Fe415 gradesteel.
4. The flange of a T-beam is 1000 mm x 100 mm and the rib below is 250 mm x 300 mm. It is

reinforcedwith4numbersof25mmdiameterFe415steelbarsintensionside,ataneffective cover of 50 mm. The grade of concrete adopted is M20. Determine the moment of resistance of T-beam section

5. Determine the area of steel required for a Tee beam with the following dimensions. Depth of slab 100 mm, breadth of flange is 900 mm, breadth of web 250 mm, the total depth of beam 600 mm. The beam is subjected to an ultimate moment of resistance of 155kNm. Use M25 and Fe415 grade steel of 16 mm diameter.
6. Calculate the moment of resistances of RC beam of rectangular section 230mm wide, 450mm effective deep is reinforced on tension side with 4nos 20mm diabars of grade Fe415 with an nominal cover of 25mm and 2nos 20mm dia bars on compressionside.
7. A simply supported beam of rectangular section, spanning over 5m has a width of 350mm and effective depth of 550mm. The beam is reinforced with 3 bars of 25mm dia on the tension side and two hanger bars of 12mm dia on the compression side. The self weightof beam together with the dead load on the beam is 5kN/m and service live load of 10kN/m. Use M20 concrete and Fe 415 steel. Calculate the total central deflection of thebeam.

Evaluate

1. Determine the area of steel required for a Tee beam with the following dimensions. Depth of slab 100 mm, breadth of flange is 250 mm, breadth of web 250 mm, the total depth of beam 600 mm. The beam is subjected to an ultimate moment of resistance of 525kNm. Use M25 and Fe415 grade steel of 16 mm diameter.
2. A simply supported beam of rectangular section, spanning over 3.5m has a width of 300mm and effective depth of 350mm. The beam is reinforced with 4 bars of 20mm diameter on the tension side and two hanger bars of 12mm diameter on the compression side. The self weightof beam together with the dead load on the beam is 5kN/m and service live load of 10kN/m. Use M20 concrete and Fe 250 steel. Calculate the central deflection of thebeam.
3. Calculate the load carrying capacity of a short axially loaded circular column 350 mm diameter reinforced with 6 nos. of 22 mm diameter bars of grade Fe 415. The helical reinforcement consists of 8 mm bars of Fe 415 grade spaced at 40 mm c/c. Assume clear cover to main steel equal to 40 mm and grade of concrete usedM25.
4. A doubly reinforced rectangular section of 375mm x 475mm is reinforced with 6 bars of 18mm diameter tensile steel and 3 bars of 12mm diameter compression steel, both having an effective cover of 50mm and effective span of 7.2m. Determine the moment of resistances of section when M25 concrete and Fe415 steel areused.
5. Determine the area of steel required for a Tee beam with the following dimensions. Depth of slab 100 mm, breadth of flange is 600 mm, breadth of web 250 mm, the total depth of beam 600 mm. The beam is subjected to an ultimate moment of resistance of 125 kNm. Use M25 and Fe415 grade steel of 16 mm diameter.
6. Calculate the ultimate strength in axial compression of a column 400mm in diameter and reinforced with 8nos of 20mm diaof grade Fe415 when the column is helically reinforced by 8mm dia at (i) 60mm pitch (ii) 30mm pitch. Assume concrete of grade M20. Assume clear cover equal to40mm.

Create

1. A short column located at the corner of a two storied school building. The size of slab is 5m x 5m subjected to live load acting on slab is 5kN/sq.m. The slab is supproted by floor beam on both axisof size 250mm x 400mm. Generate the suitable section and reinforcement of shortcolumn.
2. The floor slab for a hall consists of 150 mm thick RC slab supported by beams spaced at 3 m intervals. The beams are simply supported over a span of 7 m. load due to floor finish is 1.0 kN/m^2 and live load is 3 kN/m^2. Generate the flanged beam; depth of beam is restricted to 400mm. Use limit state method with M20 andFe415.

15CE507 IRRIGATION AND PUBLIC HEALTH DRAWING

0 0 2 1

Course Objectives

- To provide basic knowledge on the components, special features and design of important irrigationstructures.
- To impart knowledge about components and design procedure for important water treatment units.

ProgrammeOutcomes(POs)

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Design the components of some important irrigation structures.
2. Design the components of some important water treatmentunits.
3. Prepare detailed drawings for the irrigation and water treatmentstructures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1					1		1					
2					2		1					
3					1		1					

1 **4 Hours**

EXPERIMENT 1

Design and Drawing of Surplus weir

2 **4 Hours**

EXPERIMENT 2

Design and drawing of Tank sluice with Tower Head

3 **4 Hours**

EXPERIMENT 3

Design and drawing of Canal Drop

4 **4 Hours**

EXPERIMENT 4

Design and drawing of Canal Regulator

5 **3 Hours**

EXPERIMENT 5
Design and drawing of Primary Clarifier

6 **4 Hours**

EXPERIMENT 6
Design and drawing of Aeration Tank

7 **4 Hours**

EXPERIMENT 7
Design and drawing of Rapid Sand Filter

8 **3 Hours**

EXPERIMENT 8
Design and drawing of Septic tank

Total: 30 Hours

Reference(s)

1. S. K. Garg, Irrigation Engineering, Khanna Publishers,2007
2. R. K. Sharma and T. K. Sharma, Irrigation Engineering, S. Chand & Co,2006
3. S. K. Garg, Water Supply Engineering, Khanna Publishers, New Delhi,2008
4. S. K. Garg, Sewage Disposal and Air Pollution Engineering , KhannaPublishers, New Delhi, 2008

15CE508 SURVEY CAMP **0 0 2 1**

Course Objectives

- To make give practical exposure on the application of various basic principles of survey in the field.
- To provide hands on experience to handle modern surveying equipments using totalstation

Programme Outcomes (POs)

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Locate various station points for a theodolitesurvey.
2. Acquire knowledge on using total station and to prepare maps for the givenfield.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1					1							
2					2							

1 **3 Hours**

EXPERIMENT 1

Theodolite traversing for a field

2 **3 Hours**

EXPERIMENT 2

Block contouring for a non uniform terrain

3 **3 Hours**

EXPERIMENT 3

Radial contouring for a hilly terrain

4 **3 Hours**

EXPERIMENT 4

Highway project for road alignment

5 **3 Hours**

EXPERIMENT 5

Triangulation to calculate area by angular measurements

6 **3 Hours**

EXPERIMENT 6
Trilateration - area of a field by linear measurements

7 **3 Hours**

EXPERIMENT 7
Azimuth of a line by observation on the sun

8 **3 Hours**

EXPERIMENT 8
Fixing gradient for a pipe line

9 **3 Hours**

EXPERIMENT 9
Fly leveling for finding difference in levels

10 **3 Hours**

EXPERIMENT 10
Surveying using total station

Total: 30 Hours

Reference(s)

1. K. R. Arora, Surveying, Vol. I & II, Standard Book House,2008
2. N.N. Basak, Surveying, Tata McGraw Hill,2007
3. T. P. Kanetkar, Surveying and Levelling, Vol. I & II, United Book Corporation,2002
4. B. C. Punmia, Surveying, Vol. I & II, Laxmi Publications, New Delhi,2005
5. Karl Terzaghi, Soil Mechanics in Engineering Practice, 3rd edition, John Wiley & Sons, Inc, 1995.
6. IS Codes: IS 1498: 1970, IS 2810: 1979, IS 2809: 1972, IS 2720 : Part 1 to Part 41

15CE509 SOIL MECHANICS LABORATORY 0 0 2 1

Course Objectives

- To make the students determine experimentally the fundamental properties of soils that are needed for the classification of soils, determining the strength and seepagecharacteristics
- To determine the safe bearing capacity of soil at a given site using the knowledge of the fundamental properties ofsoils

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Determine the properties of the given soilsample.
2. Identification of soilsample.
3. Determine the strength of givensoil

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1			1									
2		1	2	1								
3			1	2								

1 **3 Hours**

GRAIN SIZE DISTRIBUTION

Sieve analysis and Hydrometer analysis

2 **3 Hours**

SPECIFIC GRAVITY

Specific gravity of soil grains and relative density of sand

3 **3 Hours**

ATTERBERG LIMITS TEST

Liquid limit
Plastic limit
Shrinkage limit

4 **3 Hours**

STANDARD PROCTOR TEST
Determination of moisture - Density relationship using Standard Proctor test

5 **3 Hours**

PERMEABILITY DETERMINATION
Constant head and falling head methods

6 **4 Hours**

DETERMINATION OF SHEAR STRENGTH PARAMETERS
a) Direct shear test on cohesionlesssoil
b) Unconfined compression test on cohesivesoil
c) Triaxial compressiontest
d) Vane sheartest

7 **3 Hours**

ONE DIMENSIONAL CONSOLIDATION TEST
Determination of co-efficient of consolidation
only

8 **3 Hours**

FIELD DENSITY TEST
Core cutter and sand replacement methods

9 **4 Hours**

CBR TEST
Estimation of CBR value for pavement design at a given site

Total:30 Hours

Reference(s)

1. IS 2720-PART V- 1970 Determination Of Liquid Limit And Plastic Limit
2. IS 2720-PART IV- 1975-Grain Size analysis
3. IS 1498- 1970 Classification Of soil
4. IS 2720-PART III- 1980 Specific Gravity Of soil
5. IS 2720-PART X- 1973 Determination Of Unconfined Compressive strength
6. IS 2720-PART XIII- 1972 Direct Shear test

15CE510 TECHNICAL SEMINAR I 0 0 2 1

Course Objectives

- To develop knowledge to formulate a real world problem and project goals
- To identify the various task of the project to determine standard procedures
- To identify and learn new tools, algorithm and techniques

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Refer and utilize various technical resources available from multiple fields
2. Improve the technical presentation and communication skills
3. Analyze the importance of intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds.
4. Interact and share their technical knowledge to enhance the leadership skills
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		2				2						
2					1			3	3	2		2
3										3		1
4		2				2		1	2	2		1
5								2	2	2		2

Total: 30 Hours

15CE511 MINI PROJECT III 0 0 2 1

Course Objectives

- To develop knowledge to formulate a real world problem and project goals
- To identify the various task of the project to determine standard procedures
- To identify and learn new tools, algorithm and techniques

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present oral demonstrations

Total: 30Hours

15GE601 PROFESSIONAL ETHICS 2 0 0 2

Course Objectives

- To understand Human values, ethical theory, codes of ethics, work place responsibilities, rights, engineering experimentation, global issues and contemporary ethicalissues.
- To understand personal ethics, legal ethics, cultural associated ethics and engineer's responsibility

Programme Outcomes (POs)

h. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

k. **ProjectManagement and Finance**: Demonstrate knowledge and understandingof the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes (COs)

1. Articulate engineering ethics theory with sustained lifelong learning to strengthen autonomous engineeringdecisions
2. Be an example of faith, character and high professional ethics, and cherish the workplace responsibilities, rights of others, publics welfare, health andsafety
3. Contribute to shape a better world by taking responsible and ethical actions to improve the environment and the lives of worldcommunity
4. Fortify the competency with facts and evidences to responsibly confront moral issues raised by technological activities, and serve in responsible positions ofleadership
5. Be Proficient in analytical abilities for moral problem solving in engineering situations through exploration and assessment of ethical problems supported by establishedexperiments

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1								3			2	
2								2			2	
3											3	
4								2			2	
5								2			2	

UNIT I **6 Hours**

HUMAN VALUES

Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others - Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment - Empathy.

UNIT II **6 Hours**

ENGINEERING ETHICS AND PROFESSIONALISM

Scope of 'Engineering Ethics'- Variety of moral issues - Types of inquiry - Accepting and sharing responsibility - Ethical dilemmas - Moral autonomy - Kohlberg's and Gilligan's theory - Consensus and controversy - Profession and Professionalism - Models of Professional Roles - Right action theories - Senses of corporate responsibility - Codes of ethics: Importance - justification - limitation - Abuse - Sample codes NSPE - IEEE - Institution of Engineers (India).

UNIT III **6 Hours**

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - Engineers as responsible experimenters - Balanced outlook on law - Cautious optimism - Safety and risk - Assessing and reducing risk - Safe exits - The Challenger case study - Bhopal Gas Tragedy - The Three Mile Island andChernobyl.

UNIT IV **6 Hours**

WORKPLACE RESPONSIBILITIES AND RIGHTS

Fundamental Rights - Responsibilities and Duties of Indian Citizens - Teamwork - Ethical corporate climate - Collegiality and loyalty - Managing conflict - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Professional rights - Employee rights.

UNIT V **6 Hours**

GLOBAL ISSUES

Multinational corporations: Technology transfer and appropriate technology - International rights - promoting morally just measures - Environmental ethics: Engineering, ecology - economics - Human and sentient centred - and bio and eco centric ethics - Computer ethics and internet - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership.

FOR FURTHER READING

The Challenger case study - Bhopal Gas Tragedy - The Three Mile Island and Chernobyl case studies - Fundamental Rights, Responsibilities and Duties of Indian Citizens -Sample code of ethics like IETE, ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management.

Total: 30 Hours

Reference(s)

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014.
2. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi,2012.
3. R S Naagarazan, A text book on professional ethics and human values, New age international (P) limited, NewDelhi,2006.
4. Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey,2004.
5. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States,2005.
6. http://www.slideworld.org/slidestag.aspx/human-values-and- Professional-ethics

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5	5				5					5														20
2		5			5						5										5				20
3		5					10				5														20
4	5									5											5	5			20
5	5					5				5					5										20
																								Total	100

Assessment Questions

Remember

1. Define HumanValues.
2. What are Morals andValues?
3. What do you mean by Civic virtue and Respect forothers?
4. Write the various meanings ofSpirituality.
5. List four different types ofVirtues.
6. Mention different Humanvalues.
7. What is meant by moral autonomy?
8. Classify the types ofinquiry
9. What are the steps needed in confronting moraldilemmas?
10. List the levels of moral development suggested byKohlberg
11. What do you understand by self-interest and ethicalegoism?
12. What are the steps needed in confronting moraldilemmas?
13. What are the three virtues ofreligion?
14. What are the professionalresponsibilities?

Understand

1. Which are the practical skills that will help to produce effective independent thought about moral issues?
2. Why does engineering have to be viewed as an experimentalprocess?
3. Why isn't engineering possible to follow a random selection in productdesign?
4. Why is the code of ethics important for engineers in theirprofession?
5. What does the Balanced Outlook on Law stress in directing engineeringpractice?
6. Are the engineers responsible to educate the public for safe operation of the equipment?How?
7. What kind of responsibility should the engineer have to avoid mistakes that may lead to accident due to the design of theirproduct?
8. What is the use of knowledge of risk acceptance toengineers?
9. Why is Environmental Ethics so important to create environmental awareness to the general public?
10. Why do the engineers refuse to do war works sometimes?

Apply

1. How does the consideration of engineering as a social experimentation help to keep a sense of autonomous participation is a person'swork?
2. How does the code of ethics provide discipline among theengineers?
3. Exemplify the space shuttle Challenger caseaccident?
4. How does the manufacturer understand the risk in a product catalog ormanual?

15CE602 STRUCTURAL ANALYSIS - II 3 2 0 4

Course Objectives

- To impart a thorough knowledge about the matrix methods of structuralanalysis
- To impart knowledge on moving loads and influence linediagrams
- To impart knowledge on finite element analysis and tension co-efficientmethod
- To introduce plastic analysis ofstructures

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Analyze and construct influence line for the trusses and symmetricalarches.
2. Analyze the internal forces in the Cables and Suspensionbridges.
3. Compute the forces for continuous beams, frames and trusses using flexibilitymethod.
4. Determine the displacement for continuous beams, frames and trusses using stiffnessmethod.
5. Analyze beams, frames and trusses by Kani's method and mechanismmethod.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2	1	2										
3	1											
4	1											
5	1	2										

UNIT I **15 Hours**

INFLUENCE LINES FOR FORCES IN PLANE TRUSSES AND STRESS RESULTANTS IN ARCHES

N type truss - Pratt truss with parallel chords - Pratt truss with inclined chords - Warren truss with inclined chords. Symmetrical arches: Influence lines for horizontal thrust - Influence lines for B.M - Influence lines for S.F, B.M and normal thrust for moving concentrated loads andUDL.

UNIT II **15 Hours**

CABLES AND SUSPENSION BRIDGES

Components and their Functions - Analysis of cable under concentrated loads and UDL - Shape of cable under self weight - Anchorage of suspension cables - Bending Moment and Shear Force in suspension bridges with three hinged stiffened girders - Max Bending Moment due to moving single concentrated load and UDL - Influence lines for Bending Moment and Shear Force - Analysis of suspension bridges with two hinged stiffening girders.

UNIT III **15 Hours**

MATRIX FLEXIBILITY METHOD

Introduction - Computation of flexibility matrices - Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of static indeterminacy.

UNIT IV **15 Hours**

MATRIX STIFFNESS METHOD

Introduction - equilibrium and compatibility - Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of kinematic indeterminacy.

UNIT V **15 Hours**

MISCELLANEOUS TOPICS

Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of static indeterminacy by Kani'smethod.Plastic analysis of structures - Assumptions - Moment redistribution - Analysis of fixed and continuous beams and portal frames by mechanismmethod.

FOR FURTHER READING

Unsymmetrical arches - Influence lines for horizontal thrust.

Total: 75Hours

Reference(s)

1. William weaver Jr.James M .Gare , Matrix Analysis Framed Structures, Third edition Tata McGraw Hill publishing company limited,2007.
2. SS Bhavikatti ,Structural Analysis , ,Third edition, Volume I Second Edition Volume II , VikasPublishing House (p) ltd,2009
3. Vaidyanathan.R, Perumal.P, â€œComprehensive Structural Analysisâ€• , Vol I & II Laxmi Publications,2008
4. C.K. Wang, Intermediate structural analysis Tata McGraw Hill publishing company limited, 1986.
5. Rajasekaran S and Sankarasubramaniyan R â€œComputional structural mechanicsâ€• Prentice Hall of India , New Delhi,2008

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1		2				2									16										20
2		2				2									16										20
3		2				2									16										20
4	2					2									16										20
5	2				2										16										20
																								Total	100

Assessment Questions
Remember

1. Write any two important assumptions made in the analysis oftrusses?
2. Differentiate perfect and imperfect russes?
3. Write the difference between deficient and redundantframes?
4. What are the situations wherein sway will occur in portalframes?
5. Define degrees offreedom.
6. State Castiglione's firsttheorem?
7. Define Flexural Rigidity ofBeams
8. Differentiate between the cable and suspensionbridges.
9. List the application ofcables.
10. Why we are called cables one dimensionalstructures?
11. Which forces acting the main cable and subcables.

Understand

1. What is 'H' of the symmetrical two hinged parabolic arch due to UDL extending to the full length of span? Take central rise = 1/8span
2. List the application of suspensonbridges.
3. Why we are called three hinged stiffening girder statically determinatestructures?

Analyse

1. Determine the influence line for bending moment at mid point 'D' of span BC of the continuous beam. The span AB = 6 m and BC = 8m. Compute influence line ordinates at 2mintervals
2. Determine the influence line for R_B for the propped cantilever beam of span AB = 10 m Compute influence line ordinates at 2mintervals.
3. Determine the influence line for unit moment at support 'A' for the propped cantilever beam of span AB = 10 m Compute influence line ordinates at 2mintervals.
4. A symmetrical parabolic arch spans 40m and central rise 10m is hinged to the abutments and the crown. It carries a linearly varying load of 300 N/m at each of the abutments to zero at the crown. Calculate the horizontal and vertical reactions at the abutments and the position and magnitude of maximum bending moment.
5. A three hinged stiffening girder of a suspension bridge of span 100m is subjected to two points loads of 200 kNand 300 kNat a distance of 25 m and 50 m from the left end. Find the shear force and bending moment for thegirder.
6. In a simply supported girder AB of span 20m, determine the maximum bending moment and maximum shear force at a section 5m from A, due to passage of a uniformly distributed load of intensity 20 kN/m, longer than thespan.
7. A three hinged arch with hinges at aA, B and C. The distributed load of 2000N/m acts on CE and a concentrated load of 4000N at D. Calculate the horizontal thrust and plotBMD.

15CE603 FOUNDATION ENGINEERING 3 0 0 3

Course Objectives

- To impart fundamental knowledge on investigation of the site and selection of suitable foundation
- To impart knowledge on the design concepts of different types of foundations

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)

1. Prepare soil investigation report using lab and field test results for selection of foundation.
2. Compute the bearing capacity and settlement of soil
3. Evaluate the size of shallow foundations
4. Estimate the load carrying capacity of piles and settlement of pile groups
5. Analyse the lateral earth pressure on retaining wall

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1		2								
2	2	3	2									
3	2	1	2									
4	2	3	2									
5	3	2										

UNIT I **9 Hours**

SITE INVESTIGATION AND SELECTION OF FOUNDATION

Scope & Objectives-Methods of exploration- Depth and spacing of bore holes - Sampling of soil - Methods of sampling -Penetration tests (SPT,SCPT and DCPT)-Interpretation -Bore log report - Requirements of good foundation - Factors governing location and depth of foundation-Types &Selection of foundation

UNIT II **10 Hours**

SHALLOW FOUNDATION

Bearing capacity of shallow foundation on homogeneous deposits - Terzaghi's formula and BIS formula - Bearing Capacity from insitu tests (SPT, SCPT and Plate load) - Settlement - Components of settlement -

Determination of settlement of foundations on granular and clay deposits - Allowable settlements (As per IS Codal provisions) -Methods of minimising total and differential settlement.

UNIT III **8 Hours**

FOOTINGS AND RAFT

Contact pressure distribution below footings - Isolated, combined footings & Mat foundation- Types, uses and proportioning - Allowable bearing pressure for raft foundation as per IS Codal provisions.

UNIT IV **9 Hours**

PILE FOUNDATIONS

Types of piles and their function - Factors influencing the selection of pile - Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering news and Hiley's) - Capacity from insitu tests (SPT, SCPT and Pile load test) - Negative skin friction -Group capacity by different methods (Feld's rule and block failure criterion) - Settlement of pile groups

UNIT V **9 Hours**

EARTH PRESSURE

Active and passive earth pressure - Rankine's theory - Coloumb's wedge theory - Earth pressure on retaining walls including the effect of surcharge for c and c-phi soil under dry and saturated conditionsActive and passive earth pressure - Rankine's theory - Coloumb's wedge theory -Earth pressure on retaining walls including the effect of surcharge for phi, c and c-phi soil under dry and saturated conditions

FOR FURTHER READING

Special Foundations - Foundation on expansive soils -Reinforced earth **Total: 45 Hours**

Reference(s)

1. V.N.S.Murthy, Advanced FoundationEngineering,CBSPublishers&Distributors,NewDelhi,2007
2. Donald P. Coduto, Foundation Design Principles & Practices, 2nd Edition, Prentice-Hall of India, 2001.
3. B.M. Das, Principles of Foundation Engineering, 8thEdition, Cengage Learning,2015
4. P.C.Varghese, Foundation Engineering, Prentice-Hall of India Private Ltd, New Delhi,2006
5. B.N.D NarasingaRao, Soil Mechanics & Foundation Engineering, Wiley,2015
6. B. C. Punmiaand A.K. Jain, Soil Mechanics & Foundations, 16th Edition, Laxmi Publications, New Delhi,2005

Assessment Pattern

Unit/RBT	**Remember**				**Understand**				**Apply**				**Analyse**				**Evaluate**				**Create**				**Total**
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	3	2			4	6				1			1	3				1							21
2	4	1			4	7				4			1	2				1							24
3	3				4	6	2						2	2				1							20
4	1	2			3	7	1		1	1			1	4											21
5	1	2			2	5				1				3											14
																								Total	100

Assessment Questions
Remember

1. What are the types of soil samples?
2. Define net ultimate bearingcapacity.
3. What is piledriver?
4. Mention the factors that affect the sampledisturbance.
5. Define arearatio
6. State 3 stages of soilexploration
7. List any two types ofsamplers
8. State the conditions under which a mat foundarion isused
9. List any 3 bearing capacitytheories
10. List any three assumptions in Terzaghi'stheory
11. Define recoveryratio
12. Name any 2 geophysicalinvestigations
13. DefineSPT

Understand

1. What are the corrections to be applied to the standard penetration number?
2. What are the types of shearfailure?
3. What are methods to determine the load carrying capacity of apile?
4. Discuss basic principles of design of machinefoundation.
5. Explain various types of machinefoundation.
6. Where mat foundation isused?
7. How would you determine the natural frequency of foundation-soilsystem?
8. Describe any two earth retaining structures with the evaluation of lateral earthpressure
9. State the differences between disturbed and undisturbedsamples

Apply

1. Under what circumstances, a strap footing isadopted?
2. How would you decide the depth of exploration and the lateral extent of theinvestigations?
3. Discuss the effect of water table on the bearing capacity of thesoil.
4. What types of shear failure of soil is more likely to happen in the case of very densesoil?
5. How would you estimate the load carrying capacity of a pile in cohesion less and cohesivesoils?
6. Indicate the circumstances under which the pile foundations are used for buildingconstruction.
7. Discuss the occasions under which mat foundation is preferred over pilefoundation
8. Evaluate the importance of pile foundations in marinesoil

Analyse

1. What are the conditions where a pile foundation is more suitable than a shallowfoundation?
2. What are the necessary data required for plotting the bore log for any soil investigationproject.
3. Define area ratio and recovery ratio and explain how they are used to find whether the sample collected in a sampler is undisturbed ornot.
4. Explain how water table influences the bearingcapacity.

Evaluate

1. Discuss the importance of soil exploration before the start of any type of constructionactivities.
2. If the soil is relatively good and the structural load on the soil is small then what type of foundation would you prefer?Why?

15CE604 DESIGN OF RCC STRUCTURES 3 0 0 3

Course Objectives

- To impart knowledge on the basic design philosophy of R.C.Cstructures
- To make students be familiar about the codal provisions for the design of R.C.Cstructures

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Design various types offoundation.
2. Analyze multi bay, multi storied frames and design deep beam, corbels andstairs.
3. Identify the suitable retaining wall and design cantilever, counter fort retainingwall.
4. Design various types of liquid storage structures as per Indian standard codalprovision.
5. Design deck slab and T beam bridges by evaluating the criticalload

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1		3									
2	1	2	3									
3	1	2	3									
4	1		3									
5	1	2	3									

UNIT I **9 Hours**

FOUNDATIONS

Isolated footings -Combined footings of rectangular and trapezoidal shape - Strap beam footings - Principles of design of mat foundation. Design of isolated footing subjected to uniaxial and biaxial moments

UNIT II **9 Hours**

BUILDING FRAMES

Steps involved in the design of multibay, multistoreyed frames - Elastic analysis using suitable substitute frames for gravity loadings - Portal and Cantilever methods of analysis for wind forces - Design of frame components -Design of Deep Beams-Design of Corbels-Design of stairs spanning horizontally - Design of doglegged stair Detailing ofjoints

UNIT III **9 Hours**

EARTH RETAINING STRUCTURES

Design of cantilever and counterfort retaining walls for any type of back fill - Stability requirements of retaining walls Effect of surcharge loading in the design of retaining wall

UNIT IV **9 Hours**

LIQUID STORAGE STRUCTURES

Design of underground and on ground rectangular water tanks- Use of Parts I, II and IV of I.S.3370 Codes - Overhead tanks of rectangular shape and circular shape with domical roof - Design of all components including staging and foundation. Design of underground and on ground circular watertanks

UNIT V **9 Hours**

BRIDGES

Types of bridges - IRC loadings - Design of single span slab bridge deck for class A loading - Design of the deck of T - beam and slab bridge for class AA loading Design of single span slab bridge deck for class AA loading

FOR FURTHER READING

Case studies on foundation design, Presentation on intze type water tank

Total: 45 Hours

Reference(s)

1. N.Krishnaraju, Advanced Reinforced Concrete Design (IS: 456-2000), (Second Edition), CBS Publishers & Distributors, New Delhi,2013
2. B.C.Punmia, Ashok Kumar Jain and Arunkumar Jain, Limit State Design of Reinforced Concrete, Laxmi Publications (P) Ltd., New Delhi,2015.
3. UnnikrishnaPillai and DevedasMenon, Reinforced Concrete Design, Tata McGraw Hill Publishing Co.Ltd., New Delhi,2003.
4. M.L.Gambhir, Design of reinforced concrete structures, PHI learning Pvt. Ltd., New Delhi,2011.
5. P.C.Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India Pvt. Ltd., New Delhi,2008.
6. IS 456:2000 Plain and reinforced concrete Code ofPractice

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1		2			2	4					12														20
2	2					4	2							12											20
3	2				3	3					12														20
4		2			2	2	2							12											20
5		2			4	2					12														20
																								Total	100

Assessment Questions
Remember

1. List out the different types offootings.
2. Define the termFoundation
3. State the assumptions involved in Cantilever method of analysis of frames for lateralloads.
4. Name the nature of earth pressure on wall and shear key of a retainingwall.
5. When a wall of a water tank is to be designed as uncrackedsection?
6. List out the different methods for determining the load distributions for concretebridges.
7. State the assumptions made in design offoundation.
8. Define the termPedestal
9. Outline the procedure of cantilever methods of analysis for windforces.
10. What is the purpose of Shear key in retainingwalls?

Understand

1. Recall the effective span lengths of stairswhen
   a. The flight of stair with landing slabs spanning over wallsupports
   b. The flight of stairs spanning over the edge of the landing slabs (landing slab spanning parallel toriser
2. Mention the purpose of constructing retaining wallstructure.
3. What are the three factors must be considered while designing a water retainingstructure?
4. When IRC class AA loading is to be considered in the design ofbridges?
5. Distinguish between the terms Shallow foundation and Deepfoundation.
6. Why the punching shear is termed as two wayshear?
7. Sketch the critical loading cases for maximum moments in columns, in a substituteframe.
8. Bring out the difference between IRC class A and Class AAloading.
9. Under what circumstances, the mat or raft footings areprovided?
10. Sketch the reinforcement detailing of the connections of heel, toe and stem of a cantilever retainingwall.

Apply

1. Sketch the substitute frame and loading condition for maximum negative bending moment at mid span of the 4th bay multistoriedframe.
2. Give the step by step procedure involved in the design of multibaystructures.
3. A Rectangular water tank has dimensions 3m x 5m. The tank is open at top. The wall of the tank is monolithic with the base slab. Design the thickness and the reinforcement for the short wall for the design forces in the vertical direction only. The height (inner height) of the tank is3m.
4. Design the super structure for a T beam bridge of clear span 20m to be built on a national highway for IRC class AA loading. Clear roadway is 8.0m, there are 3 T beams spaced at 3m c/c. Use M20 grade concrete and Fe415 HYSDbars.
5. Explain briefly the load transfer mechanism in two column combinedfooting.

Analyse

1. Sketch the load positions for maximum shear force and calculate the design shear force. Assume the overall thickness of slab as 500mm and the width of each support for the bridge as500mm.
2. A RC rectangular footing supports a column 250mm x250mm (placed concentric to the footing). The column transfers an axial load of 1500 kNat service state. The size of the footing is 2.75m x 4m and the thickness of the footing (uniform throughout) is 670 mm (total thickness). Design the footing for its reinforcement (flexure only) and sketch the reinforcementdetails.
3. A dog-logged staircase is to be provided in a staircase room with inner dimensions 5m x 2.5m. Floortofloorheightis3.5m.Liveloadonstairsis3kN/m2.Plananarrangementforthestairs

and sketch the layout. Design a flight of the staircases. Assume that the waist slab is supported on the landing slabs.

4. A counterfort retaining wall has the followingparameters:
   a. Height of stem above base slab =8.5m
   b. Thickness of stem = 300mm
   c. Level of earth retained =horizontal
   d. Weight of soil = 15kN/m3
   e. Angle of repose of soil =30º
   f. Base slab width = 4.5m
   g. Thickness of base slab =300mm
   h. Toe projection =2.15m
   i. Spacing of counterforts (c/c) =3m
   Design and detail the toe slab, heel slab, stem and counterfeits.
5. A cylindrical water tank is 3m inner diameter and open at top. The tank is an elevated tank. The inner height of the wall is 3m. The junction of the wall and base slab of the tank shall be assumed as fixed. Design the thickness and reinforcements of the wall (for the design forces in the vertical directiononly).

Create

1. Design the footing for a square concrete column of side 225mm, to carry an axial load of 500 kN.The safe bearing capacity of the soil may be taken as 100 kN/ m^2. Use M20 grade concrete and Fe 415 HYSDbars.
2. Design a simple slab bridge for the followingrequirements.
   a. Clear span =8m,
   b. Clear width of carriage way =7.5m
   c. Live load = Class Aloading
   Use M20 grade concrete and Fe 415 steel

15CE607 COMPUTER AIDED ANALYSIS, DESIGN AND DRAWING LABORATORY – I(STEEL)

0 0 2 1

Course Objectives

- To impart fundamental knowledge on Design and Detailing of structuralcomponents.
- To impart a thorough knowledge on the computer aided analysis and design of steel structural components.
- To enhance the capability of the students to draw the plan, elevation and sectional view of various steel structural elements usingsoftwares

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Design connections in steelmembers
2. Design battened column with gussetedbase
3. Design Industrial Components (plate and gantry girder) and Design roof truss using steelmaterial

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2			1					3			
2	2			1					3			
3	2			1					3			

1 **5Hours**

EXPERIMENT 1

Design and detailing of Axially loaded member with bolted and welded connection

2 **5 Hours**

EXPERIMENT 2

Design and detailing of Columns with Battens and Lacings

3 **5 Hours**

EXPERIMENT 3

Design and detailing of Columns with gusseted bases

4 **5 Hours**

EXPERIMENT 4

Design and detailing of Gantry Girder

5 **5 Hours**

EXPERIMENT 5

Design and detailing of Plate Girder

6 **5 Hours**

EXPERIMENT 6

Design and detailing of Roof Trusses

Total: 30 Hours

Reference(s)

1. S.K.Duggal, Limit state design of steel structures, McGraw hill education (India) private limited, new delgi,2013
2. Subramanian, Design of steel structures, Oxford higher education,2014

15CE608 GIS LABORATORY **0 0 2 1**

Course Objectives

- To make the students to know about components of Geographic information system
- To impart knowledge on the land use and spatial map using GIS.
- To learn the vector and Raster images

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Prepare the thematic map using digitize method.
2. Prepare Geo reference on a map
3. Prepare the spatial map on groundwater studies,Add and display X,Y data

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	3	-								
2	1		3	-	2							
3	1			-	2							

1 **3 Hours**

DIGITIZATION OF POINTS AND LINES
To digitizie vector and raster images

2 **3 Hours**

EDITING MAP ELEMENTS
To use Arc map 3.2 software for edit point, line and polygon features

3 **3 Hours**

ATTRIBUTE DATA ENTRY AND MANIPULATION
To create data table for attribute details entry

4 **3 Hours**

CLEANING, BUILDING AND TRANSFORMATION
Reshape and modify the shape file features

5 **3 Hours**

DATA ANALYSISâ€“OVERLAY, BUFFER
To use Arc tools box in spatial analyst

6 **3 Hours**

MAP GENERATION WITH PATTERNS AND LEGENDS
To learn map layout and map properties

7 **3 Hours**

BUFFER ANALYSIS
3D analyst used to proximity and buffer analysis for map

8 **3 Hours**

CONTOUR MAP PREPARATION
To use Gps data for prepare contour map

9 **3 Hours**

SPATIAL ANALYSIS USING ARC TOOL BOX
To learn Arc tool box for hydrology investigation in spatial mapping

10 **3 Hours**

PREPARE LANDUSE MAP
Using fiels survey or raster images for prepare landuse map for particular area

Total: 30 Hours

Text Book(s)

1. M. Anji Reddy, Remote sensing and Geographical Info rmation Systems , Third Edition, BS Publications, India, 2012

Reference(s)

1. T.M. Lillesand and R.W. Kicter, Remote Sensing and Image interpretation , John Willey and sons, inc. New York, 2002
2. BhattaRemotesensing and Gis Third edition, Oxford publication, 2002

15CE609 TECHNICAL SEMINAR II 0 0 2 1

Course Objectives

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Refer and utilize various technical resources available from multiple fields
2. Improve the technical presentation and communication skills
3. Analyze the importance of intonation, word and sentence stress for improving communicative competence, identifying and overcoming problem sounds.
4. Interact and share their technical knowledge to enhance the leadership skills
5. Prepare report and present oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		2				2						
2					1			3	3	2		2
3										3		1
4		2				2		1	2	2		1
5								2	2	2		2

Total: 30 Hours

15CE610 MINI PROJECT IV 0 0 2 1

Course Objectives

- To develop knowledge to formulate a real world problem and project goals
- To identify the various task of the project to determine standard procedures
- To identify and learn new tools, algorithm and techniques

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions.
2. Identify technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
5. Prepare report and present oral demonstrations

Total: 30 Hours

15GE701 ENGINEERING ECONOMICS 3 0 0 3

Course Objectives

- To introduce the concepts of micro, macro economic systems and business decisions in organizations.
- To acquire knowledge on laws of demand & supply and methods of forecasting the demand
- To emphasis the systematic evaluation of the costs, breakeven point for return on economics and diseconomies
- To acquaint in pricing methods, payback and competition in modern market structure
- To obtain knowledge on macro economics, various taxes and financial accounting procedures

Programme Outcomes (POs)

f.**TheEngineer and Society:** Apply reasoning informed by the contextualknowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, ademonstrate the knowledge of, and need for sustainable development.
k. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary

Course Outcomes (COs)

1. Explain the micro economic environment for creating a favourable businessenvironment.
2. Make use of the major concepts and techniques of engineering economic analysis in real time applications.
3. Compare the cost of multiple projects by using the methods learned, and make a quantitative decision between alternate facilities and/orsystems.
4. Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-costratio.
5. Examine and evaluate the issues in macro-economicanalysis.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1	2									
2	1	1	2									
3						1	2	3				
4				2	3							
5			2	2	3							

UNIT I **9 Hours**

INTRODUCTION

Introduction to Micro and Macro economics - Kinds of Economic Systems - Production

Possibility Frontier - Opportunity Cost - Objective of Organizations - Kinds of Organization.

UNIT II **9 Hours**

DEMAND AND SUPPLY

Functions of Demand and Supply - Law of diminishing Marginal Utility - Law of Demand and Supply - Elasticity of Demand - Demand Forecasting Methods - Indifference curve.

UNIT III **9 Hours**

PRODUCTION AND COST

Production Function - Returns to Scale - Law of Variable Proportion - Cost and Revenue concepts and Cost Curves - Revenue curves - Economies and Dis-economies of scale - Break Even point.

UNIT IV **9 Hours**

MARKET STRUCTURE

Market Structure - Perfect Competition - Monopoly - Monopolistic - Oligopoly - Components of Pricing - Methods of Pricing - Capital Budgeting IRR - ARR - NPV - Return on Investment - Payback Period.

UNIT V **9 Hours**

INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL ACCOUNTING

National Income - Calculation Methods - Problems - Inflation - Deflation - Business Cycle - Taxes - Direct and Indirect Taxes - Fiscal and monetary policies.

FOR FURTHER READING

Nature and characteristics of Indian Economy - Role and functions of Central bank - LPG - GATT - WTO.

Total: 45 Hours

Reference(s)

1. A RamachandraAryasri and V VRamana Murthy, Engineering Economics and Financial Accounting, Tata McGraw Hill Publishing Company Limited, New Delhi,2006.
2. V L Samuel Paul and G S Gupta,Managerial Economics Concepts and Cases, Tata McGraw Hill Publishing Company Limited, New Delhi,1981.
3. R Kesavan, C Elanchezhian and T Sunder Selwyn, Engineering Economics and Financial Accounting, Laxmi Publication (P) Ltd, New Delhi, 2005.
4. S N Maheswari, Financial and Management Accounting, SultanChand
5. V L Samuel Paul and G S Gupta, Managerial Economics-Concepts andCases

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					2					8			6											18
2		2					2			8					6				4						22
3			2			2				8								4							16
4	2						2		8						6				4						22
5		2				2				8				6				4							22
																								Total	100

Assessment
Questions Remember

1. Define Economics
2. What is opportunity cost?
3. List the types of Demand.
4. State the law of Demand.
5. Define Elasticity of Demand.
6. State the different degrees of elasticity of Demand?
7. List the factors determining Elasticity of Demand?
8. State the Law Of Diminishing Marginal Utility.
9. Define Replacement Cost and Historic Cost
10. Define Monopoly.
11. Define Oligopoly
12. Name the two types of Oligopoly.
13. List the objectives of Pricing?
14. Define Accounting
15. Define inflation

Understand

1. Explain the nature and scope of Economics.
2. List and explain the focus areas of Managerial economics.
3. Give reasons why mangers aim to maximize sales even at the cost of a lower profit.
4. Explain the nature of Demand.
5. What are the assumptions made when talking about the Law of Diminishing Marginal Utility?
6. Explain the characteristics of the Indifference Curve with examples
7. What are the characteristic features of an oligopoly industry?
8. What causes Oligopoly?
9. Explain the types and features of Cost Based Pricing.
10. Explain the types and features of Demand Based Pricing.
11. Under what conditions does a company go in for Cross Subsidization pricing?
12. What is the role of the Central bank in control ling inflation?

Apply

1. Explain decisions based on the degree of certainty of the outcome with examples.
2. Give examples of products falling under the various kinds of competition, and the reasons they are able to survive in the market.
3. Give six examples of products that fall under Monopolistic Competitive pricing.
4. Give six examples of products that fall under Oligopolistic pricing
5. Pick any six Consumer Items and based on your knowledge of the markets, explain the pricing

Analyse

1. Differentiate between Macro and Microeconomics
2. Differentiate between Extension and Increase in Demand.
3. Distinguish between Cost and Price
4. Compare the merits and demerits of the Deductive Method and the Inductive Method of Investigation
5. The per-capita income of farmers in the country has to be raised by 20% this year to prevent their migration to cities. Discuss this statement from the point of view of Positive

and Normative Economics.

6. Decision making improves with age and experience-Discuss.
7. Do a survey of the automotive (only cars) industry and analyze the reasons and timing for discounts offered from the point of view of elasticity of demand
8. How would you modify a sealed bid pricing system to take care of different technical approaches by different bidders for a project for which bids are called for, given that the cost varies depending on the technical approach?

Create

1. Create a matrix consolidating the definitions of the word Economics as defined by the leading Economists in the prescribed textbook. Using this define economics the way you understand it, in less than 50words.
2. Study the price of a commodity over a period of one year and explain the possible reasons for the fluctuations from an economist‘s point of view
3. You are in a job which is paying you adequately. You are called for an interview for a job that double your salary. Unfortunately you miss the only train that will take you in time for the interview. How will you justify the cost of taking a flight considering the cost concepts you have learnt.
4. Due to cancellation of an export order, you are stuck with a huge stock of jeans of international quality. Device a pricing strategy for disposing this stock without incurring a loss, considering that it is a very competitivemarket.

15CE702 ENVIRONMENTAL ENGINEERING 3 0 0 3

Course Objectives

- To impart knowledge on the various issues pertaining to quality and quantity of water.
- To impart knowledge to select suitable method of water treatment and to find the capacity of water treatment plant.
- To impart knowledge on various system of collection of domestic and municipal wastewater treatment
- To emphasize the need for sewage treatment

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
d. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Estimate the population and to examine the given water sample.
2. Arrive the quantity of water for given city and to estimate the storage requirements of reservoir.
3. Design of various types water treatment units.
4. Identify the quantity and quality of water from various sources
5. Determine the sewage characteristics and design various sewage treatment plants

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2	1	1								
2	2	3	1									
3	2			1								
4		3	1									
5		2		1								

UNIT I **10 Hours**

QUANTITY AND QUALITY OF WATER

Introduction: Scope for Environmental Engineering - Need for protected water supply - Quantity of Water -Population Forecasts - Types of water demands - Domestic demand - Institutional and Commercial demands - Public uses - Fire demand - Per capita consumption - Examination of water - objectives - Physical - chemical and microbiological examinations - Water borne diseases - BIS & WHO water standards.

UNIT II **9 Hours**

SOURCE, CONVEYANCE AND TREATMENTOF WATER

Intake structures - Different types of intakes - Factor of selection and location of intakes - pipes - Design of the economical diameter of the rising main - Nomograms- Use - Pipe appurtenances - Objectives of water treatment - Typical flow chart of a water treatment plant - Aeration - Objectives - Principles of aeration - Types of aerators - Sedimentation - Theory - Settling tanks -Types - Design - sedimentation aided - with coagulants - Dosages - Chemical feeding - Flash mixing -Flocculators.

UNIT III **8 Hours**

FILTRATION, DISINFECTION AND DISTRIBUTION

Filtration - Mechanism - Theory of filtration - Design of sand filters - Rapid sand and slow sand filters including construction and operation - Disinfection - Methods of disinfection - Chlorination - Chlorine demand - Residual chlorine. Requirements of good distribution system - Layouts of distribution system - Distribution reservoirs - Storage capacity of distribution reservoirs.

UNIT IV **9 Hours**

QUANTITY OF SEWAGE

Types of sewerage systems suitability - Dry weather flow - Factors effecting dry weather flow - Computation of design flow - Estimation of storm flow: Rational method and empirical formulae -Time of concentration - Design of storm water drain - Physical, chemical and biological characteristics - Concepts of Aerobic and Anaerobic activity - Manholes -Water seal system - Dilution - Self-purification phenomenon - Oxygen sag curve - Zones of purification - Sewage farming, sewage sickness.

UNIT V

TREATMENT OF SEWAGE

Types of Treatment - Flow diagram of a typical municipal sewage treatment plant - Primary Treatment -Screening - Grit chambers - Skimming tanks - Primary sedimentation tanks - Sludge deposit - Secondary treatment - Trickling filter - Theory and operation - Types and designs - Activated sludge process - Principle and flow diagram - Methods of aeration -Modifications - F/M ratio - Designs of ASP - Secondary sedimentation tanks - Tertiary treatment - Sludge digestion and filter beds - Methods of sludge disposal.

FOR FURTHER READING

Public awareness about drinking water - Water softening technology - Use of bleaching powder for disinfection - Design of hydraulic elements for circular sewers flowing partially full- Disposal of Effluents - Oxidation pond and oxidation ditch - Septic tanks with soak pits.

Total: 45 Hours

Reference(s)

1. Garg, S.K., Water Supply Engineering, Khanna Publishers, New Delhi, 2014.
2. Garg, S.K.,Environmental Engineering - II, Khanna Publishers, New Delhi, 2014.
3. Birdie, G.S. and Birdie, J.S., Water Supply and Sanitary Engineering, DhanpatRai and Sons, New Delhi, 1992.
4. Hussain, S.K., A Text Book on Water Supply and Sanitary Engineering, Oxford & IBH Publishing Co, New Delhi, 2009.
5. Babbit, H.E and Donald J.J., Water Supply Engineering, McGraw-Hill, New Delhi, 2011.
6. Hussain, S.K., A Text Book on Water Supply and Sanitary Engineering, Oxford & IBH Publishing Co, New Delhi, 2009.

Total: 45 Hours

Reference(s)

1. Garg, S.K., Water Supply Engineering, Khanna Publishers, New Delhi,2014.
2. Garg, S.K.,Environmental Engineering - II, Khanna Publishers, New Delhi,2014.
3. Birdie, G.S. and Birdie, J.S., Water Supply and Sanitary Engineering, DhanpatRai and Sons, New Delhi,1992.
4. Hussain, S.K., A Text Book on Water Supply and Sanitary Engineering, Oxford &IBH Publishing Co, New Delhi, 2009.
5. Babbit, H.E and Donald J.J., Water Supply Engineering, McGraw-Hill, New Delhi,2011.
6. Hussain, S.K., A Text Book on Water Supply and Sanitary Engineering, Oxford &IBH Publishing Co, New Delhi, 2009.

Assessment Pattern

Unit/RBT	**Remember**				**Understand**				**Apply**				**Analyse**				**Evaluate**				**Create**				**Total**
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	4	2				2			6	6															20
2	2	2			2	2					6			6											20
3	2					6					6				6										20
4		2				4	2				6			6											20
5	2	2				2	2				6				6										20
Total																									100

Assessment Questions

Remember

1. Define the scope of EnvironmentalEngineering
2. List out the human activities in Environmentalpollution.
3. List out the population forecastingmethods.
4. How will the time of concentration influence the design of storm water drain?
5. List out the population forecastingmethods.
6. Compare between Domestic and Industrial waterdemand.
7. List out the objectives of watertreatment.
8. What do you mean by dry weatherflow?
9. Interpret the activated sludgeprocess.
10. Discuss about the necessity of planned watersupplies.

Understand

1. Define intakestructures.
2. List out the factors to select the intakestructures.
3. List out the pipeappurtenances.
4. Which types of sources is suitable for watersupply?
5. Which methods of population forecasting aresuitable?
6. Which types of sources is suitable for watersupply?
7. List out the factors to select the intakestructures.
8. Which types of filtering mechanism is suitable for watersupply?
9. Why back washing is needed infiltering?
10. Define:Self-purification
11. How will you predict the storm flow into thesewer?

12. What are the methods of sludgedisposal?
13. Compare COD andBOD

Apply

1. List out the mechanism offiltering.
2. List out the theory offilteration.
3. Compare the various treatment techniques for treating thesewage.
4. What are the effects of human activities in Environmentalpollutions?
5. Define the necessity of protected watersupply.
6. List out the functions of sedimentation aided with coagulants.
7. How will you find the quality of drinkingwater?
8. How will you find the bacterial removal efficiency ofwater?
9. How will you find the back washing time of slow sandfilter?
10. List out the disposal standards of sewage inwater
11. Define:Manhole.
12. Compare the various treatment techniques for treating thesewage.
13. Explain the process ofchlorination.

Analyse

1. Analyze human activities in waterpollutions.
2. Outline the fluctuations in demand of water in a givencity.
3. Paraphrase some of the primary treatmentunits
4. Compare the types ofchlorination.
5. Outline F/Mratio

Evaluate

1. Write the methods of testing thesewers
2. Compare the various treatment techniques for treating the sewage.
3. Explain Self-purificationphenomenon
4. What is way to increase O2 content inwater?
5. Why modification in ASP isrequired?

Create

1. Relate the physical, chemical and bacteriological characteristics of drinkingwater?
2. Generalize the function of disinfection and explain methods ofdisinfection.

15CE703 ESTIMATION AND COSTING 3 0 0 3

Course Objectives

- To impart knowledge on the principles of estimation of quantities of buildingmaterials.
- To make the students understand the methods of estimating the cost ofbuildings

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Perform rate analysis of materials ofconstruction
2. Estimate the quantities of materials ofconstruction
3. Estimate the cost buildings
4. Estimate the total cost of buildings by using software
5. Estimate the total cost of construction and plan of building

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1			1	2	1		1					
2		1		1	2							
3				1								
4	1											
5	1											

UNIT I **9 Hours**

ANALYSIS OFRATES

Labour required for: Earthwork - Cement Concrete work - R.C.C. work - Stone work - Brick work – Wood work -Ironwork -Flooring- Finishing work MaterialsforDifferent item ofworks Rates of Materials and Labour

UNIT II **9 Hours**

ESTIMATION OF COST OF UNIT QUANTITIES OF:

Earth work excavation, Sand filling, Lime concrete, Cement concrete, R.C.C work, Cement mortar, Brick work, Reinforced brickwork, Stone masonry, Plastering, Painting, Flooring, White and colour washing, Distempering, Varnishing, Wood work, Cantering, Shuttering and formwork for R.C.C works, AC sheet roofing, etc.

UNIT III **9 Hours**

CALCULATION OF QUANTITIES OF MATERIALS

Earthwork excavation, Foundation concrete, Sand filling, Masonry work, R.C.C work, Plastering work, Doors and Windows, Painting and White washing, Weathering course, Flooring work, Roofing, etc.

UNIT IV **9 Hours**

ESTIMATION USING SOFTWARES

Estimation of Total Cost of a Building & Use of Software Packages

UNIT V **9 Hours**

EXERCISES

Given the plan and details of the following types of buildings.-To estimate the total cost of construction of each.

1. A single storey residential building with R.C.C. slab supported by masonry walls.
2. A two storeyed residential building supported by R.C.C beams and columns.
3. An Industrial shed with metallic roofing sheet supported by steel purlins, steel trusses and steel columns.
4. A community hall

Total: 45 Hours

Reference(s)

1. B.N. Dutta, "Estimating and Costing in Civil Engineering" Theory and Practice Including Specifications and Valuations, Twenty sixth Revised Edition, UBSPD,2007.
2. K. S. Randwala and K.K. Rangwala "Elements of Estimating and Costing", Chavotar Publishing House, India,1995.
3. Gurcharan Singh and Jagdish Singh "A Text Book of Estimating, Costing and Valuation", Standard Publishers Distributors, Delhi,1998

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					2					6				4					6					20
2	4					4				2				6						4					20
3	2				10					4					4										20
4	4					6				4					6										20
5	4					4				12															20
Total																									100

15CE704 HIGHWAY ENGINEERING 3 0 0 3

Course Objectives

- To provide a basic knowledge on highway planning and highway materials.
- To impart a basic knowledge on geometric design and design of pavements
- To provide a basic knowledge on economic evaluation of highway projects.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Acquisition of skills in selecting the best highway alignment and the highwayproposal
2. Planning of various highway cross sectionalelements
3. Design flexible and rigid pavements as per IRCcodes
4. Prepare Environmental Impact Assessment for any highwayproject.
5. Better assessment of the proposals because of the cost-benefit analysisknowledge.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1			1									
2	1											
3			2									
4			1									
5				2								

UNIT I **9 Hours**

HIGHWAY PLANNING ANDALIGNMENT

Introduction - Institutions for highway planning and implementation at different levels - Jayakar committee recommendations - Requirements of ideal alignment - Factors controlling highway alignment - Engineering surveys for alignment - Conventional methods and modern methods (Remote Sensing, GIS and GPS techniques) - Highway cross sectional elements - Right of Way, carriage way, camber, kerbs, shoulders and footpaths [IRC Standards]

UNIT II **9 Hours**

GEOMETRIC DESIGN OF HIGHWAYS

Design of horizontal alignments: Super elevation, Widening of pavements on horizontal curves and transition curves [Derivation of Formulae and Problems]. Design of vertical alignments-gradients, summit and valley curves - Sight distances: Factors affecting sight distances, PIEV Theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), [Derivations and Problems in SSD and OSD] - Geometric design of hill roads [IRC Standards Only]

UNIT III **9 Hours**

HIGHWAY DESIGN AND CONSTRUCTION

Design principles of flexible and rigid pavements - Design of flexible and rigid pavement (IRC Recommendations - Problems) - Construction of WBM, Premix carpet, Surface dressing, bituminous concrete roads and cement concrete roads - Desirable Properties and Testing of Highway Materials-Soil: California Bearing Ratio Test -Aggregate: Crushing, Abrasion and Impact Tests - Bitumen: Penetration, Ductility, Viscosity, Binder Content and Softening Point Tests

UNIT IV **9 Hours**

HIGHWAY MAINTENANCE

Types of defects in flexible pavements: Surface defects, cracks, deformation and disintegration - Symptoms, causes and treatments - Types of pavement failures in rigid pavements: Scaling, shrinkage, warping, structural cracks, spalling of joints and mud pumping - Overlays - Overlay design - Benkelman beam method - Pavement Management process - Analysis, evaluation and selection - Alternative materials and construction procedure ofpavements

UNIT V **9 Hours**

ECONOMIC EVALUATION OF HIGHWAYPROJECTS

Evaluation of Highway Projects - Methods and basic principles of economic evaluation - Types of evaluation techniques -Cost Benefit Analysis (Benefit Cost Ratio, Net Present Value, International Rate of Returns (Problems) - Environmental Impact Assessment - Cash flow analysis (Basicprinciples)

FOR FURTHER READING

Highway Development in India - Classification and cross section of urban and rural roads (IRC)- Sight distance at intersections, intermediate sight distance and illumination sight distance - Field density test - Introduction to software's used in road design Special repairs - Case studies related to PMS- Build, Operate and Transfer for Highway Projects (Basic Concepts only)

Total: 45 Hours

Reference(s)

1. S. K. Khanna and C. E. G. Justo, Highway Engineering, Nem Chand and Bros., Roorkee,2009
2. K. P. Subramaniam, Highway, Railway, Airport and Harbour Engineering, Scitech Publications, Chennai,2011
3. IRC 37, 2001, Guidelines for the Design of FlexiblePavements
4. IRC 58- 2002, Guidelines for the Design of Plain Jointed RigidPavements
5. S. K. Khannaand C. E. G. Justo, Highway Material Testing Manual, Nem Chand and Bros., Roorkee,2002
6. L. R. Kadiyali, Principles and Practice of Highway Engineering, Khanna Publishers Ltd., New Delhi,2000

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					2					6				4				6						20
2	4					4				2				6					4						20
3	2				10					4					4										20
4	4					6				4					6										20
5	4					4				12															20
																								Total	100

Assessment Questions

Remember

1. List out the recommendations of Jayakar committee
2. Outline the classification of urbanroads.
3. Describe the importance of pavementunevenness
4. State the COURSE OBJECTIVES (COs) of providingcamber
5. Describe the PIEV theory with a neatsketch
6. Name the IRC empirical formula for calculating the length of transitioncurve
7. Define offtracking.
8. State how the following factors influence the design of ahighway
   a) Designspeed
   b) Rulinggradient
   c) Overall dimension ofvehicle
9. Describe the various factors affecting the pavementdesign.
10. List out the limitations of CBR method of pavementdesign.

Understand

1. Classify the roads based on Lucknow roadplan
2. Explain the functions of CRRI and IRC in highway development ofIndia
3. Draw the cross section of a NH in embankment in rural area and name the various components of theroad
4. Identify the locations where the effect of negative superelevation will be greater than the positive superelevation.
5. Discuss the factors to be considered in calculating the length of transitioncurve.
6. Distinguish between flexible and rigidpavement.
7. Describe the significance of CBR inflexible pavementdesign.
8. Summarize the step by step procedure of construction of cement concreteroads
9. Explain the California Bearing Ratio test for evaluating the stability ofsubgrade
10. Explain the remedial measures taken to avoid mudpumping
11. Under what circumstances the provision of overlay can bejustified?

Apply

1. Relate the application of remote sensing and satellite imagery in highway trackalignment.
2. Illustrate with neat sketches the method of introducing the extra widening incurves.
3. Design the rate of superelevation to be provided for a horizontal curve of radius 325 m on a NH in a plain terrain. Also, calculate the length of the transition curve to beprovided.
4. Illustrate the different types of overlay with neatsketches
5. Reproduce the classification chart of various evaluationtechniques

Analyse

1. Design the length of a valley curve formed by a descending gradient of 1 in 35 meeting an ascending gradient of 1 in 30 to fulfill both comfort condition and head light sight distance requirements for a design speed of 90 kmph. Assume allowable rate of change of centrifugal acceleration as 0.57m/sec^2
2. Design a flexible pavement for a NH (two lane single carriageway) using the following data:
   CBR of subgrade soil = 10%
   Annual rate of growth of traffic = 9 %
   Period of construction = 4 years
   Design period = 15 years
   Assume any other data required
3. How GIS can be applied in highway trackalignment?
4. Analyze how the obligatory points affect the highwayalignment.

Evaluate

1. Prepare a Environmental Impact Assessment report for construction of a newroad.
2. Compare the merits and demerits of conventional methods with modern methods of highway alignment.
3. The speeds of overtaking and overtaken vehicles are 80 and 60 kmphrespectively. If the acceleration of the overtaking vehicle is 2.5 kmphper second, calculate the safe passing distance for one way traffic and two-waytraffic.
4. A single lane road 50 km long is to be widened to two lanes at a cost of Rs. 45 lakhs per km including al improvements. The cost of operation of vehicles on the single lane road is Rs.3.00 per vehicle km and Rs. 2.50 per vehicle km for the improved facility. The average traffic may be assumed as 5000 vehicles per day over the design period of 10 years. The interest rate is 8 percent per annum. The cost of maintenance is Rs.15, 000 per km on the existing road and Rs.20, 000 per km on the improved road. Analyze whether the investment isworthwhile.
5. Describe the merits and demerits of B.O.Tprojects.

Create

1. Contrast skid and slip and list out the factors influencing the friction.

15CE707 ENVIRONMENTAL ENGINEERING LABORATORY

0 0 2 1

Course Objectives

- To provide basic knowledge on the various methods of analysis of water andwastewater
- To emphasize the need for water and wastewatertreatment

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Demonstrate the various characteristics of water and wastewatersample
2. Analyse the watersample

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3										
2	1	2										

1 **3 Hours**

EXPERIMENT 1

Determination of Hardness, pH, Acidity, Alkalinity,Turbidity, Dissolved oxygen content of water and wastewater samples

2 **3 Hours**

EXPERIMENT 2

Estimation of chlorides and total dissolved solids in water and wastewater

3 **3 Hours**

EXPERIMENT 3

Determination of available chlorine in bleaching powder

4 **3 Hours**

EXPERIMENT 4

Analysis of sulphates in water and wastewater samples

5 **3 Hours**

EXPERIMENT 5

To find the optimum coagulant dosage

6 **3 Hours**

EXPERIMENT 6

Calculation of amount of nitrates present in drinking water for a given sample.

7 **6 Hours**

EXPERIMENT 7

Estimation of BOD and COD

8 **6 Hours**

EXPERIMENT 8

To examine whether a given water sample is potable as per Indian Standards

Total: 30 Hours

Reference(s)

1. Garg, S.K., Water Supply Engineering, Khanna Publishers, New Delhi,2014.
2. Garg, S.K., Environmental Engineering - II, KhannaPublishers, New Delhi,2014.

15CE708 COMPUTER AIDED ANALYSIS, DESIGN AND DRAWING LABORATORY - II(RCC)

0 0 2 1

Course Objectives

- To impart fundamental knowledge on Design and Detailing of structuralcomponents
- To impart a thorough knowledge on the computer aided analysis and design of RCC structural components.
- To enhance the capability of the students to draw the plan, elevation and sectional view of various RCC structural elements usingsoftwares.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Design RCC building components (slabs, beams andcolumns)
2. Design footings for asuperstructure
3. Design retaining walls and water tanks and T beambridges

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1			1					1			
2	1			2					1			
3	2			1					2			

1 **4 Hours**

EXPERIMENT 1

Design and detailing of Floor slab system with T beam

2 **4 Hours**

EXPERIMENT 2

Design and detailing of Columns

3 **4 Hours**

EXPERIMENT 3

Design and detailing of Isolated footings

4 **5 Hours**

EXPERIMENT

Design and detailing of Combined rectangular footings

5 **5 Hours**

EXPERIMENT 5

Design and detailing of Cantilever retaining wall

6 **7 Hours**

EXPERIMENT 6

Design and detailing of Counterfort retaining wall

7 **8 Hours**

EXPERIMENT 7

Design and detailing of Elevated circular water tank

8 **8 Hours**

EXPERIMENT 8

Design and detailing of Reinforced Concrete T Beam Bridge Deck

Total: 45 Hours

Reference(s)

1. krishnaraju, structural design and drawing, universities press,2010
2. S.N.Sinha, reinforced concrete design, Tata Mcgraw hill education,2002

15CE709 HIGHWAY ENGINEERING LABORATORY 0 0 2 1

Course Objectives

- To provide a basic knowledge on highway planning and highwaymaterials
- To impart a basic knowledge on geometric design and design ofpavements
- To provide a basic knowledge on economic evaluation of highwayprojects.

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinaryenvironments.

Course Outcomes (COs)

1. Acquisition of skills in selecting the best highway alignment and the highwayproposal
2. Planning of various highway cross sectional elements
3. Design flexible and rigid pavements as per IRCcodes.
4. Prepare Environmental Impact Assessment for any highwayproject.
5. Better assessment of the proposals because of the cost-benefit analysisknowledge.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1			1									
2				2								
3		3										
4											2	
5			1									

4 Hours

EXPERIMENT 1

Determination of penetration using California Bearing ratio test

4 Hours

EXPERIMENT 2

Determination of granular particles using Triaxial test apparatus

4 Hours

EXPERIMENT 3
Field density test - Core cutter method and sand replacement method

5 Hours

EXPERIMENT 4
Marshall apparatus - determine of bitumen stability flow tests

5 Hours

EXPERIMENT 5
Determine the viscosity of cut-back bitumen by Standard Tar viscometer

4 Hours

EXPERIMENT 6
Determination Softening Point of Bitumen using Ring-and-Ball Apparatus

4 Hours

EXPERIMENT 7
Penetration of weighted needles or cones by Universal Penetrometer

Total: 30 Hours

15CE710 MINI PROJECT V 0 0 2 1

Course Objectives

- To develop knowledge to formulate a real-world problem and the project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To understand the guideline to Prepare a report for oral demonstrations.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Formulate a real-world problem, identify the requirements and develop the design solutions.
2. Express the technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
4. Test and validate through conformance of the developed prototype and analysis the cost-effectiveness
5. Prepare report and present the oral demonstrations.

Total: 30 Hours

15CE804 PROJECT WORK 0 0 0 9

Course Objectives

- To develop knowledge to formulate a real world problem and project's goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outcomes (COs)

1. Formulate a real world problem, identify the requirement and develop the design solutions
2. Express the technical ideas, strategies and methodologies.
3. Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project
4. Test and validate through conformance of the developed prototype and analysis the cost effectiveness

LANGUAGE ELECTIVES

15LE101 BASIC ENGLISH I 3 0 0 3

Course Objectives

- To offer students the basics of the English Language in a gradedmanner.
- To promote efficiency in English Language by offering extensive opportunities for the development of all the four language skills (LSRW) within theclassroom.
- To focus on improving and increasingvocabulary.
- To improve spelling and pronunciation by offering students rigorous practice andexercises.

Course Outcomes (COs)

1. Converse in English with moreconfidence.

UNIT I **7.5 Hours**

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
1	Basic words- 12 most used words in English, usage and pronunciation	Starting a conversation and talking about what one does	Sentence construction bolstered by mother tongue
2	Basic words- 20 often used words, usage and pronunciation	Analysing an action plan	Creating and presenting one's own action plan
3	Basic words with a focus on spelling	Discriminative listening	Informal conversation
4	Basic words- 10 oft used words, usage and pronunciation	Content listening and Intonation	Reading comprehension
5	Unit Test I		

UNIT II **7.5 Hours**

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
6	Basic words + greetings to be used at different times of the day	Formal conversation	Intonation to be used in formal address
7	Last 28 of the 100 most used words	Informal conversation between equals	Reading practice and peer learning
8	Using the 14 target words to form bigger words	Informal dialogues using contracted forms	Guided speaking- talking to peers using contracted forms

9	Palindromes, greetings- good luck, festivals	Placing a word within its context- culling out meaning	Offering congratulations
10	Unit Test II		

UNIT III **7.5 Hours**

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
11	Homophones	Formal and informal methods of self-introduction	Let's Talk is a group activity that gives them some important pointers of speech
12	Homophone partners, matching words with their meanings	Contracted forms of the –be verbs, 've and 's	Translating English sentences to Tamil
13	Briefcase words- finding smaller words from a big word	Formal and informal ways of introducing others	Team work- speaking activity involvinggroup work, softskills
14	Compound words and pronunciation pointers	Giving personal details about oneself	Using the lexicon
15	Unit Test III		

UNIT IV **7.5 Hours**

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
16	Proper and common nouns	Asking for personal information and details	Pronunciation pointers- an informal introduction to the IPA
17	Pronouns	Telephone skills and etiquette	Reading aloud and comprehension
18	Abstract and common nouns	Dealing with a wrong number	Reading practice and comprehension
19	Group names of animals, adjectives	Taking and leaving messages on the telephone	Pronunciation pointers
20	Unit Test IV		

UNIT V **7.5 Hours**

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
21	Determiners	Interrupting a conversation politely- formal and informal	Pair work reading comprehension

22	Conjugation of the verb 'to be'- positive and negative forms	Thanking and responding to thanks	Comprehension questions that test scanning, skimming and deep reading
23	Am/is/are questions	Giving instructions and seeking clarifications	Small group activity that develops dialogue writing
24	Present continuous tense-form and usage	Making inquiries on the telephone	Finishing sentences with appropriate verbs
25	Unit Test V		

UNIT VI

7.5 Hours

Module	Vocabulary/ Grammar	Skills Sets	Skill Sets
26	Words with silent 'b' Present continuous questions	Calling for help in an emergency	Dialogue writing
27	Words with silent 'c' Simple present tense- form and usage	Making requests and responding to them politely	Identifying elements of grammar in text extract
28	Simple present tense- rules	Describing people	Guided writing
29	Words with silent 'g' Questions in the simple present tense	Describing places	Filling in the blanks with correct markers of tense
30	Unit Test VI		

Total: 45 Hours

Reference(s)

1. Basic English Module, L&L Education Resources, Chennai,2011.

15LE102 COMMUNICATIVE ENGLISH I 3 0 0 3

Course Objectives

- To acquire effective listening and readingskills
- To develop speaking and writingskills
- To improve their understanding of grammar, vocabulary andpronunciation

Course Outcomes (COs)

1. Develop their fluency and language competency in English

UNIT I **9 Hours**

GRAMMAR

Content words- Structural words - Subject - Verbs and verb phrase - Subject - Verb agreement - Tenses - Active voice and passive voice - Sentence types (declarative, imperative, exclamatory & interrogative) - Framing questions - Comparative adjective

UNIT II **9 Hours**

LISTENING

Listening for specific information: Short conversations / monologues - Gap filling - Telephone conversations - Note-taking - Listening for gist / interviews - Listening to songs and completing the lyrics - Clear individual sounds - Word stress - Telephoneetiquette

UNIT III **9 Hours**

READING

Prediction - Skimming for gist - Scanning for specific information - Understanding text and sentence structure

UNIT IV **9 Hours**

WRITING

Short documents: E-mail - memo - note - message- notice -advertisement -Short reports / proposals - Principles of writing a good paragraph: Unity, cohesion and coherence -Identifying the topic sentence and controlling ideas - Paragraph writing (descriptive, narrative, expository & persuasive)

UNIT V **9 Hours**

SPEAKING

Self-introduction -Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Mini-presentation - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes - Speculation - Tongue twisters

FOR FURTHER READING

Novel Reading -Book Review

Total: 45 Hours

Reference(s)

1. Murphy, Raymond. English Grammar in Use - A Self-Study Reference and Practice Book For Intermediate Learners Of English .IVed. United Kingdom: Cambridge University Press.2012.
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
3. Anderson, Kenneth etal. Study Speaking: A Course in Spoken English for AcademicPurposes. United Kingdom: Cambridge University Press.2004.

15LE201 BASIC ENGLISH II 3 0 0 3

Course Objectives

- To give room for a natural acquisition of Basic English Grammar through sample listening, reading and writinginputs
- To specifically focus on speaking and conversation skills with an aim to increase speakingability
- To improve Spelling and Pronunciation by offering rigorous practice andexercises

Course Outcomes (COs)

1. Communicate better with improved fluency, vocabulary and pronunciation.

UNIT I			**7.5 Hours**
Module	***Vocabulary/ Grammar***	***Skills Sets***	***Skill Sets***
31	Difference between Present Continuous and Simple Present tense.	Calling for help in an emergency	Reporting an event-journalistic style
32	Verbs ‘have’ and ‘have got’	Describing animals	Asking for and giving directions
33	Simple Past Tense	Inviting people, accepting and declining invitations	Self- enquiry and offering one’s opinion on a given topic.
34	Spelling rules & table of Irregular Verbs	Refusing an invitation	Reading and practicing pre-written dialogues
35	Unit Test I		
UNIT II			**7.5 Hours**
Module	***Vocabulary/ Grammar***	***Skills Sets***	***Skill Sets***

36	Questions and the negative form of the simple past tense	Apologizing and responding to an apology	(Reading) conversation practice
37	Asking questions in the simple past tense	Reading comprehension	Seeking, granting and refusing permission
38	Past continuous tense	Paying compliments and responding to them	Pair work: writing dialogues and presenting them
39	Difference between simple past and past continuous- when and where to use each	Describing daily routines	Reading and comprehension skills
40	Unit Test II		
UNITIII			**7.5Hours**
Module	***Vocabulary/ Grammar***	***Skills Sets***	***Skill Sets***
41	Simple future tense	Talking about the weather	Making plans- applying grammar theory to written work
42	Simple future tense- more aspects, possessive pronouns	Talking about possessions	Opening up and expressing one's emotions
43	Future continuous tense	Talking about current activities	Listening comprehension
44	Revision of future tense- simple and continuous forms, prepositions used with time and date	Asking for the time and date	Discussion- analyzing and debating a given topic
45	Unit Test III		

UNIT IV			**7.5 Hours**
Module	***Vocabulary/ Grammar***	***Skills Sets***	***Skill Sets***
46	Articles a/an	Writing, speaking and presentation skills	Transcribing dictation

47	Singular- Plural (usage of a/an)	Reading practice- independent and shared reading	Comprehension –logical analysis, process analysis and subjective expression
48	Countable and uncountable nouns- a/an and some	Listening comprehension	Vocabulary: using context tools to decipher meaning
49	Articles- the	Sequencing sentences in a paragraph	Listening to a poem being recited, answer questions on it and practice reciting the same
50	Unit Test IV		

UNIT V			**7.5 Hours**
Module	**Vocabulary/ Grammar**	**Skills Sets**	**Skill Sets**
51	Articles- the: usage and avoidance	Speaking: sharing stories about family, village/town, childhood, etc. 10 students	Listening: comprehend and follow multiple step instructions read out by the teacher
52	Articles- the: usage and avoidance with like and hate	Speaking: sharing stories about family, village/town, childhood, etc. 10 students	Reading: make inferences from the story about the plot, setting and characters
53	Articles- the: usage and avoidance with names of places	Speaking: sharing stories about family, village/town, childhood, etc. 10 students	Comprehension passage
54	This/ that/ these and those	Writing a notice-announcement	Speaking: Debate
55	Unit Test V		

UNIT VI			**7.5 Hours**
Module	***Vocabulary/ Grammar***	***Skills Sets***	***Skill Sets***
56	One and ones	Collaborative learning- problem solving	Writing short answers to questions based on reading
57	Capitalization and punctuation	Controlled writing	Listen to a story and respond to its mainelements

58	Syntax and sentence construction- rearrange	Guided writing	Listen to a poem and discuss its elements
	jumbled sentences		
59	Cloze	Free writing	Frame simple yet purposeful questions about a given passage
60	Unit Test VI		

Total: 45 Hours

Reference(s)

1. Basic English Module, L&L Education Resources, Chennai, 2011.

15LE202 COMMUNICATIVE ENGLISH II 3 0 0 3

Course Objectives

- To acquire skills for using English in workplaceeffectively
- To communicate for essential businessneeds
- To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment (CELA)
- To enhance the communicative ability from Intermediate to Upper Intermediatelevel

Course Outcomes (COs)

1. To enable students to get International recognition for work andstudy.
2. To use English confidently in the International businessenvironments.
3. To be able to take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand businessconversations.

UNIT I **9 Hours**

GRAMMAR AND VOCABULARY

Simple, compound and complex sentences - Direct and indirect speech - Conditionals - Business vocabulary - Collocations -Discourse markers

UNIT II **9 Hours**

LISTENING

Listening to identify topic, content, function - Sentence stress - Rhythm - Intonation

UNIT III **9 Hours**

READING

Reading graphs and charts - Skimming and scanning texts - Job advertisements - Read business articles for specific information - Understanding the structure of a text - Erroridentification

UNIT IV **9 Hours**

WRITING

Formal and Informal English - Longer Documents: writing individual paragraphs to longer text, Business Correspondence, Reports and Proposals - Transcoding

UNIT V **9 Hours**

SPEAKING

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging information - Language Functions: suggesting - comparing and contrasting - expressing - Finding out facts, attitudes and opinions - Commonly mispronounced words

FOR FURTHER READING

Reading Novels (The Monk Who Sold His Ferrari by Robin Sharma; Three Mistakes of my Life by Chetan Bhagat; The Fountainhead by Ayn Rand)

Total: 45 Hours

Reference(s)

1. Jeremy Comfort, Pamela Rogerson, Trish Stott, and Derek Utley, Speaking Effectively Developing Speaking Skills for Business English, Cambridge: Cambridge University Press,2002.
2. Eric H. Glendinning and Beverly Holmstrom, Study Reading: A Course In Reading for Academic Purposes.United Kingdom: Cambridge University Press,2004.

15LC203 CHINESE 3 0 0 3

Course Objectives

- To help students acquire the basics of Chineselanguage
- To teach them how to converse in Chinese in variousoccasions
- To teach the students the Chinese cultural facets and socialetiquettes

Course Outcomes (COs)

1. An ability to communicate effectively (a)Improve fluency in Chinese (b)Clarity on the basic sounds of the ChineseLanguage

UNIT I **9 Hours**

Nǐ hǎo - 你 好

Xuéhuìwènhòudejīběnbiǎodáyòngyǔ - 学会问候的基本表达用语 ; Xuéhuìjièshàozìjǐde xìngmíng,guójí - 学会介绍自己的姓名，国际 ; Xuéhuìhànyǔpīnyīndeshèngmǔ - 学会汉语拼音的圣母 ; yùnmǔhéshēngdiào - 韵母和声调 ; Pīndúhéshēngdiàoliànxí - 拼读和声调练习

UNIT II **9 Hours**

Xiànzài jǐ diǎn - 现在几点

Xuéhuì shíjiān, rìqí de biǎodá - 学会时间，日期的表达 ; Rèshēn - 热身 ; Shēngcí - 生词 ; Jùzi - 句子 ; Huìhuà - 会话 ;Huódòng - 活动 ; Kàntúwánchénghuìhuà - 看图完成会话 ; Xuécíyǔ shuō shíjiān ; Tìhuàn liànxí - 替 换 练 习 Dú yī dú ránhòu lián xiàn - 读 一 读 然 后 连 线 ; Bǎ xiàmiànde cíànzhèngquède shùnxùpáiliè chéngjù - 把下面的词按正确的顺序排列成句

UNIT III **9 Hours**

Nà jiàn máoyī zěnme mài? - 那件毛衣怎么卖？

Xúnwènjiàqiánjíqián debiǎodá - 询问价钱及钱的表达；Tǎojiàhuánjià - 讨价还价；Tíchūduì suǒ mǎi dōngxī dàxiǎo, yánsè děng děng jùtǐ yāoqiú - 提出对所买东西大小，颜色等等具体要求 ； ShēngcíHuódòng - 活动 ； Kàntúwánchéng huìhuà - 看图完成会话；Xuécíyǔshuōshíjiān;Dúyīdúránhòuliánxiàn - 读一读然后连线 ;Tīng lùyīn xuǎnzé zhèngquè dá'àn - 听录音选择正确答案 ; Bǔchōng cíyǔ biǎo - 补充词语表

UNIT IV **9 Hours**

Xuéhuìxúnwèn jiātíngqíngkuàng,zhíyèhéniánlíng - 学会询问家庭情况，职业和年龄 Xuéhuì diǎn cài tí yāoqiú jiézhàng - 学 会 点 菜 提 要 求 结 账 ; Shēngcí - 生 词 ; Jùzi - 句 子 ; Huìhuà - 会 话 ;Huódòng - 活 动 ; Kàn tú wánchéng huìhuà - 看 图 完 成 会 话 ; Xué cíyǔ shuō shíjiān ;Dú yī dú ránhòu lián xiàn - 读 一 读 然 后 连 线 ;Tīng lùyīn xuǎnzé zhèngquè dá'àn - 听录音选择正确答案 ; Bǔchōngcíyǔbiǎo - 补充词语表Juésèbànyǎn - 角色扮演 ; Tīnglùyīn pànduànduìcuò - 听录音判断对错

UNIT V **9 Hours**

Nǐ zài nǎ'er gōngzuò - 你在哪儿工作

Xuéhuìxúnwènjiātíngqíngkuàng,zhíyèhéniánlíng - 学会询问家庭情况，职业和年龄Shēngcí - 生 词 ; Jùzi - 句 子 ; Huìhuà - 会 话 ; Huódòng - 活 动 ; Kàn tú wánchéng huìhuà - 看图完成会话 ;Tīnglùyīnxuǎnzézhèngquèdá'àn - 听录音选择正确答案 ; Bǔchōng cíyǔ biǎo - 补充词语表 - Tīnglùyīnxuǎnzézhèngquèdá'àn - 听录音选择正确答案 ; Bǔchōngcíyǔbiǎo - 补充词语表

Total: 45 Hours

Reference(s)

1. TiyanHanyuShenghuoPian "Experiencing Chinese" Ying Yu Ban Di 1 Ban. Beijing: Higher Education Press: Gaodengjiaohuchu ban she.2011
2. 1.Mandarine Day - Hancel Don : Chinese learning Software 2.My Chinese Classroom - David J. White
3. www.chinesexp.com.cnwww.yiwen.com.cn

15LF203 FRENCH **3 0 0 3**

Course objectives

- To help students acquire the basics of Frenchlanguage
- To teach them how to converse in French in variousoccasions

Course Outcomes (COs)

1. The students will become familiar with the basics of French language and start conversing in French.

UNIT I **6 Hours**

Alphabet Français (alphabets) - Les Accents Français (the accents in French) - aigu - grave - circonflexe - tréma cédille - écrire son nom dans le français (spellingone-sname in French) - Les noms de jours de la semaine (Days of the week)

UNIT II **6 Hours**

Les noms de mois de l'année (Months) - Numéro 1 à 100 (Numbers 1 to 100) GRAMMAIRE :Conjugaison

UNIT III **10 Hours**

Moyens de transport (Transport) - Noms de Professions (Professions) - Noms d'endroits communs (Places)-Nationalités(Nationalities) ECOUTER:(Listening)Écouter l- alphabet associéà des prénoms français - Écouter et répondre PARLER (Speaking)Présntation - même /Présentez-Vous(Introducingoneself) LIRE :Lireles phrases simples

UNIT IV **12 Hours**

Pronoms (Pronouns) - Noms communs masculins et de femme (Common masculine and Femininenouns) - Verbes communs (Common verbs)COUTER :couter et crier les prnoms - Observer les dessins et couter les dialogues LIRE : Lire les profils d'utilisateurs d'interlingua (alter ego)PARLER :Parler de sa ville - Parler de saprofession

UNIT V **11 Hours**

Narration de son nom et l'endroit où on vit - Son âge et date de naissance - Numéro de téléphone et'dresse - Narration du temps - La France en Europe PARLER :Conversation entre deux amis - Jouer la scène ÉCOUTER :Ecouter les conversations (CD alter ego)ÉCRIRE :Écrireune cartepostale

Total: 45 Hours

Reference(s)

1. Grammaire Progressive du Français, CLE international,2010
2. Collins Easy Learning French Verbs& Practice, Harpercollins,2012
3. Barron's Learn French, 3rdedition
4. FrançaisLinguaphone, Linguaphone Institute Ltd., London, 2000. FrançaisI.Harrisonburg: The Rosetta stone: Fairfield Language Technologies,2001.
5. Alter ego+ Niveau a1 ,Catherine Hugot,, HACHETTE LIVRE2012
6. Cahier alterego+

15LG203 GERMAN 3 0 0 3

Course objectives

- To help students acquire the basics of Germanlanguage
- To teach them how to converse in German in variousoccasions

Course Outcomes (COs)

1. An ability to communicate effectively with: (a) Clarity on the basic sounds of the German language (b) Improved fluency in German (c) Propervocabulary

UNIT I **9 Hours**

GRAMMAR

Introduction to German language: Alphabets, Numbers - Nouns - Pronouns Verbs and Conjugations - definite and indefinite article - Negation - Working with Dictionary - Nominative - Accusative and dative case - propositions - adjectives - modal auxiliaries - Imperative case - Possessive articles.

UNIT II **9 Hours**

LISTENING

Listening to CD supplied with the books, paying special attention to pronunciation: Includes all lessons in the book - Greetings - talking about name - country - studies - nationalities - ordering in restaurants - travel office - Interaction with correction of pronunciation.

UNIT III **9 Hours**

SPEAKING

Speaking about oneself - about family - studies - questions and answers - dialogue and group conversation on topics in textbooks - talks on chosen topics.

UNIT IV **9 Hours**

READING:

Reading lessons and exercises in the class - pronunciation exercises: Alphabet: name, country, people, profession, family, shopping, travel, numbers, friends, restaurant, studies - festivals

UNIT V **9 Hours**

WRITING

Alphabets, numbers - words and sentences - Exercises in the books - control exercises - writing on chosen topics such as one self, family, studies - country.

Total: 45 Hours

Reference(s)

1. Grundkurs DEUTSCH A Short Modern German Grammar Workbook and Glossary, VERLAG FUR DEUTSCH, Munichen,2007.
2. Grundkurs, DEUTSCH Lehrbuch Hueber Munichen,2007.
3. Cassel Language Guides - German: Christine Eckhard, Black & Ruth Whittle, Continuum, London / New York,1992.

15LH203 HINDI 3 0 0 3

Course Objectives

- To help the students to acuire the basics of Hindi
- To teach them how to converse in Hindi on variousoccasions
- To help learners acquire the ability to understand a simple technical text inHindi

Course Outcomes (COs)

1. An ability to communicate effectively with: (a) Improved fluency in Hindi (b) Clarity on the basic sounds of the Hindi language (c) Propervocabulary

UNIT I **9 Hours**

HINDI ALPHABET

Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu&Visarg -Table of Alphabet -Vocabulary.

UNIT II **9 Hours**

NOUNS IN HINDI

Genders (Masculine & Feminine Nouns ending in a, e, i, o, u,) - Masculine & Feminine - Reading Exercises.

UNIT III **9 Hours**

PRONOUNS AND TENSES

Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - InterrogativeSentences.

UNIT IV **9 Hours**

CLASSIFIED VOCABULARY

Parts of body - Relatives - Spices- Eatables- Fruit & Vegetables - Clothes - Directions-Seasons - Professions.

UNIT V **9 Hours**

SPEAKING

Model Sentences - Speaking practice for various occasions.

Total: 45 Hours

Reference(s)

1. Syed, PrayojanMulak Hindi, RahamathullahVaniPrakasan, New Delhi,2002.
2. Ramdev, VyakaranPradeep, SaraswathiPrakasan, Varanasi,2004.
3. B. R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi,2009.

15LJ203 JAPANESE 3 0 0 3

Course Objectives

- To help students acquire the basics of Japaneselanguage
- To teach them how to converse in Japanese in variousoccasions
- To teach the students the Japanese cultural facets and socialetiquettes

Course Outcomes (COs)

1. An ability to communicate effectively with: (a) Improved fluency in Japanese (b) Clarity on the basic sounds of the Japanese language (c) Proper vocabulary

UNIT I **9 Hours**

Introduction to Japanese - Japanese script - Pronunciation of Japanese(Hiragana) - Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions - Numerals. N1 waN2 des - N1 wa N2 ja arimasen - S ka - N1mo - N1 no N2 - .san - Kanji - Technical Japanese Vocabulary (25 Numbers) - Phonetic and semantic resemblances between Tamil andJapanese

UNIT II **9 Hours**

Introduction - Kore - Sore - are - Kono N1 - Sono N1 - ano N1 - so des - so ja arimasen - S1 ka - S2 ka - N1 no N1 - so des ka ' koko - soko - asoko - kochira - sochira - achira - N1 wa N2 (Place) des - dhoko-N1 no N2 - Kanji-10 - ima-.ji-fun des - Introduction of verb - V mas - V masen - V mashitha - V masen deshitha - N1(Time) ne V - N1 kara N2 des - N1 tho N2 / S ne Kanji-10 - Technical Japanese Vocabulary (25 Numbers) - Dictionary Usage.

UNIT III **9 Hours**

N1(Place) ye ikimas - ki mas - kayerimasu - Dhoko ye mo ikimasen - ikimasendheshitha - N1(vehicle) de ikimasu - kimasu - kayerimasu - N1(Personal or Animal) tho V ithsu - S yo. - N1 wo V (Transitive) - N1 wo shimus - Nani wo shimasu ka - Nan & Nani - N1(Place) de V - V masen ka - V masho - Oo. Kanji-10 , N1(tool - means) de V - Word / Sentence wa go nan des ka - N1(Person) ne agemus - N1(Person) ne moraimus - mo V shimashitha - , Kanji-10 - Japanese Typewriting using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

UNIT IV **9 Hours**

Introduction to Adjectives - N1wanaadj des. N1 wa ii adj des - naadjna N1 - ii adj ii N1 - Thothemo - amari - N1 wadho des ka - N1 wadhonna N2 des ka - S1 ka S2 - dhore - N1 gaarimasu - wakarimasu - N1 ga suki masu - N1 gakiraimasu - jozu des - hetha des - dhonna N1 - Usages of yoku - dhaithai - thakusan - sukoshi - amari - zenzen - S1 kara S2 - dhoshithe, N1 gaarimasu - imasu - N1(Place) ne N2 gaarimasu - iimasu - N1 wa N2(Place) ne arimasu - iimasu - N1(Person,Place,or Thing) no N2 (Position) - N1 ya N2, Kanji-10 - Japanese Dictionary usage using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

UNIT V **9 Hours**

Saying Numbers , Counter Suffixes , Usages of Quantifiers -Interrogatives - Dhonokurai - gurai - Quantifier-(Period) ne -.kai V - Quantifier dhake / N1 dhake Kanji - Past tense of Noun sentences and na Adjective sentences - Past tense of ii-adj sentences - N1 wa N2 yoriadj des - N1 tho N2 tho Dhochiragaadj des ka and its answering method - N1 [no naka] de {nani/dhoko/dhare/ithsu} ga ichiban adj des ka - answering -N1 gahoshi des - V1 mas form dhake mas - N1 (Place) ye V masu form ne ikimasu/kimasu/kayerimasu - N1 ne V/N1 wo V - Dhokoka - Nanika - gojumo - Technical Japanese Vocabulary (25Numbers)

Total: 45 Hours

Reference(s)

1. Japanese for Everyone: Elementary Main Textbook1-1, Goyal Publishers and Distributors Pvt. Ltd., Delhi,2007.
2. Japanese for Everyone: Elementary Main Textbook 1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi,2007.
3. Software: Nihongo Shogo-1, Nihongo Shogo-2, JWPCESoftware
4. www.japaneselifestyle.com
5. www.learn-japanese.info/
6. www.kanjisite.com/
7. www.learn-hiragana-katakana.com/typing-hiragana-characters

PHYSICS ELECTIVES

15PH201 PHYSICS OF MATERIALS 3 0 2 4

Course Objectives

- To understand the physical properties of conductors, semiconductors andsuperconductors
- To recognize the basic principles of interaction of light with matter and working of optical devices
- To classify the types of dielectric, magnetic materials and polarization mechanisms with their properties

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Analyze the properties of conductors and superconductors for differentapplications
2. Apply the concepts and types of semiconductors for solar cellapplications
3. Discuss the types, properties and applications of dielectric materials
4. Explain the properties of optical materials, working mechanism of LEDs andLCDs
5. Classify the magnetic materials with their properties and apply in the data storagedevices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1							2			
2	2	1							2			
3	2	1										
4	2	1										
5	2	1							2			

UNIT I **9 Hours**

CONDUCTING AND SUPERCONDUCTING MATERIALS

Electrical and thermal conductivity of metals - Wiedemann Franz law - band theory of metals - density of states. Superconductors: properties - types - High Tc superconductors- applications.

UNIT II **10 Hours**

SEMICONDUCTORS

Elemental and compound semiconductors - intrinsic semiconductors: carrier concentration - electrical conductivity- band gap. Extrinsic semiconductors: carrier concentration - variation of Fermi level. Hall effect: theory and experimental determination -applications:Solar cells

UNIT III **9 Hours**

DIELECTRIC MATERIALS

Types of polarization: electronic, ionic, orientation and space charge polarization mechanisms - Langevin-Debye equation - frequency and temperature effects on polarization - dielectric strength and loss -dielectric breakdown mechanisms - active dielectric materials: pizo, pyro and ferroelectricity - applications.

UNIT IV **9 Hours**

OPTICAL MATERIALS

Interaction of light with materials - optical absorption - transmission - Luminescence in solids - Fluorescence and Phosphorescence - Optical band gap - LED ,LCD.

UNIT V **8 Hours**

MAGNETIC MATERIALS

Classification and properties - domain theory - hard and soft magnetic materials - anti-ferro and ferri magnetic materials - applications: magnetic recording and memories.

FOR FURTHER READING

Photonic crystals - LIFI

1 **2 Hours**

INTRODUCTION

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 1

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

3 **4 Hours**

EXPERIMENT 2

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.

4 **4 Hours**

EXPERIMENT 3

With the aid of travelling microscope, find the refractive index of a transparent solid and liquid material.

5 **4 Hours**

EXPERIMENT 4

Determine the wavelength of polychromatic source in the visible region using spectrometer.

6 **4 Hours**

EXPERIMENT 5

Based on Hall effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

7 **4 Hours**

EXPERIMENT 6

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

8 **4 Hours**

EXPERIMENT 7

Determine the V-I characteristics of a solar cell.

Total: 75 Hours

Reference(s)

1. Saxena, Gupta, Saxena, Mandal, Solid State Physics, Pragati Prakashan Educational Publishers, 13th revised edition, Meerut, India,2013.
2. M.N. Avadhanulu and P.G. Kshirsagar, A Text Book of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2011.
3. S. O. Pillai, Solid State Physics, New Age International Publications, New Delhi,2010.
4. M.A. Wahab, N.K. Mehta, Solid state physics-structure and properties of materials, Narosa publishing house Pvt. Ltd, 6th edition, 2010.
5. Semiconductor Physics and Devices, Donald A. Neamen , Mc Graw-Hill,2011.
6. P.K. Palanisamy, Materials Science, Scitech Publications India Pvt. Ltd,2014.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	4	2		1	4	2		1	2			1	1											20
2	2		2		2		4		5	3			4												22
3	1	2	1		3	4			3	4			2												20
4	2	2			2	5			2	5			2												20
5	1	3			3	2	3		3	1			2												18
																								Total	100

Assessment Questions

Remember

1. State Meissnereffect
2. List six properties of superconductingmaterials
3. Define photovoltaiceffect
4. List the six common applications of dielectricmaterials
5. Retrieve optical absorption inmetals
6. Reproduce the principle of LCD in displaydevices

7. Recall the term hysteresis in ferromagneticmaterials
8. List four applications of magneticmaterials
9. Recognize the need of optical band gap in differentiating thematerials
10. Reproduce five applications of hard magnetic materials in day to daylife

Understand

1. Explain the principle, construction and working ofLED
2. Classify the three types of materials based on band gapenergy
3. Interpret the working mechanism and characteristics of a solarcell
4. Illustrate Hall effect experiment used to find the concentration of charge carriers in n- type semiconductors and hence explain the necessarytheory
5. Summarize the various dielectric breakdown mechanisms observed in dielectricmaterials
6. Infer the principle involved in working of magneticlevitation
7. Classify the two types of luminescence in solids with appropriate energy leveldiagrams
8. Subsume the four types of polarization mechanisms involved in dielectric materials
9. Illustrate the V-I characteristics of a solarcell
10. Extrapolate the Clausius Mosotti equation for the dielectric material which is subjected to external electricfield

Apply

1. Free electron density of aluminum is 18.10x1028 m-3. Calculate its Fermi energy at 0K. Planck’s constant and mass of free electron are 6.62x10-34 Js and 9.1x10-31Kg.
2. Compute the relation between Remanence andCoercivity.
3. Demonstrate the domain theory offerromagnetism.
4. Derive the expressions for electrical and thermal conductivity of metals and hence compute the Wiedemann Frantzlaw.
5. Compute the carrier concentration in intrinsic and extrinsicsemiconductors.
6. Calculate the number of free electrons per unit volume in a metal in terms of Fermienergy.
7. Assess the Magnetic levitation and SQUIDS in day to daylife.
8. Show the importance of dielectric breakdown mechanisms indielectrics.
9. Implement the applications of dielectric materials in real worldproblems.
10. Compute the relation between polarization vector (P) and electric field(E).

Analyse

1. Differentiate Phosphorescence andFluorescence.
2. Can we increase the orientation polarization with increase in temperature?Justify.
3. Justify the principle, construction, working, advantages and disadvantages ofLCD.
4. Compare hard and soft magneticmaterials.
5. Differentiate the ferromagnetic and anti-ferromagnetic materials withexamples.
6. Compare dia, para and ferromagnetic materials.
7. Distinguish between polarization andpolarizability.
8. Differentiate elemental and compoundsemiconductors.
9. Compare type I and type IIsuperconductors.
10. Compare LED andLCD.

15PH202 APPLIED PHYSICS 3 0 2 4

Course Objectives

- To understand conducting, semiconducting, dielectric and magnetic properties of materials and exemplify theirapplications
- To analyze the basic concepts of thermodynamics and heat transfer withillustrations
- To gain knowledge about acoustical standards of buildings

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Analyze the physical properties of conducting and semiconductingmaterials
2. Discuss the physical properties of dielectric and magnetic materials with theirapplications
3. Apply the thermodynamic processes and laws to compute the efficiency of heatengines
4. Compare the different heat transfer modes with real time applications ofconduction
5. Explain the characteristics of music and select proper sound absorbing materials for good acoustic ofbuildings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	1							2			
2	2	1							2			
3	2	1										
4	2	1										
5	2	1							2			

UNIT I **11 Hours**

CONDUCTORS AND SEMICONDUCTORS

Conductors: Classical free electron theory - electrical and thermal conductivity- Wiedemann - Franz law - merits and demerits of classical free electron theory - band theory - density of states. Semiconductors: Elemental and compound semiconductors - intrinsic semiconductors -Fermi level and electrical conductivity - band gap energy - extrinsic semiconductors - n-type and p-type semiconductors: variation of Fermi level with temperature (qualitative) - Hall effect -applications.

UNIT II **9 Hours**

DIELECTRIC AND MAGNETIC MATERIALS

Dielectrics: Fundamental terminologies - electronic and ionic polarizations - orientation polarization mechanism (qualitative) - space charge polarization - Langevin -Debye equation - dielectric loss -

Applications ofdielectric and insulating materials. Magnetic Materials: Properties of dia, para and ferromagnetic materials - domain theory of ferromagnetism - hysteresis curve - hard and soft magnetic materials -applications

UNIT III **9 Hours**

THERMODYNAMICS

Zeroth law of thermodynamics - Heat - equilibrium and quasistatic process - path functions -comparison between heat and work - internal energy - first law of thermodynamics - isothermal and adiabatic process - work done - reversible and irreversible process - second law of thermodynamics - entropy - enthalpy - Carnot ideal engine and its efficiency - Carnot's theorem-actual heat engine: Diesel engine and its efficiency

UNIT IV **9 Hours**

HEAT TRANSFER

Modes of heat transfer - thermal conductivity - heat capacity and diffusivity - rectilinear flow of heat - conduction through bodies in series and parallel - determination of thermal conductivity: good conductor: Searle's method - bad conductor: Lee's disc method - applications of heat transfer: formation of ice in ponds - conductivity of earth's crust and age of earth - practical applications

UNIT V **7 Hours**

ACOUSTICS

Classification of sound based on frequency - characteristics of audible sound - reverberation time: Sabine's formula - determination of absorption coefficient - Erying's formula (qualitative). Sound insulation - sound absorbing materials - factors affecting the acoustics of building -remedies

FOR FURTHER READING

Nanomaterials and its applications

1 **2 Hours**

INTRODUCTION

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 1

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

3 **4 Hours**

EXPERIMENT 2

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the givensemiconductor.

4 **4 Hours**

EXPERIMENT 3

With the aid of traveling microscope, find the refractive index of a transparent solid and liquid material

5 **4 Hours**

EXPERIMENT 4

Determine the wavelength of polychromatic source in the visible region using spectrometer

6 **4 Hours**

EXPERIMENT 5

Based on Hall effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

7 **4 Hours**

EXPERIMENT 6

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

8 **4 Hours**

EXPERIMENT 7

Determine the V-I characteristics of a solar cell.

Total: 75 Hours

Reference(s)

1. William D. Callister, Materials Science and Engineering an Introduction, John Wiley and Sons,Inc,2010
2. BrijLal, N. Subrahmanyam and P. S. Hemne, Heat, Thermodynamics & Statistical Physics, S. Chand & Company Ltd., New Delhi, 2012
3. Saxena, Gupta, Saxena, Mandal, Solid State Physics, Pragati Prakashan Educational Publishers, 13threvised edition, Meerut, India,2013
4. P.K. Mittal, Applied Physics, I.K. International Publishing House Pvt. Ltd,2008
5. Donald A. Neamen, Semiconductor Physics and Devices,McGraw-Hill,2011

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3	4				3				4	4			2					4						24
2	2	2				4	2			2	4			4											20
3	2	4				4	2			4	2			2											20
4	2	2				4	2			2	4			4											20
5	2	2				2	2			4					4										16
																								Total	100

Assessment Questions
Remember

1. State Ohm'slaw.
2. Define driftvelocity.
3. List the two drawbacks of classical free electrontheory.
4. State Wiedemann-Franzlaw.
5. Mention the practical unit used for electron's magneticmoment.
6. Recall the term hysteresis in ferromagneticmaterials.
7. List the four uses of magneticmaterials.
8. State Zeroth law ofthermodynamics.
9. State the Kelvin's statement of second law ofthermodynamics.
10. Name the threeÂ modes of heat transfer.
11. State Echeloneffect.

Understand

1. Illustrate the significance of Fermienergy.
2. Why indirect gap semiconductors are preferred in fabricatingtransistors?
3. Classify the types of magneticmaterials.
4. Outline the term retentivity andcoercivity.
5. Compare dia, para and ferro magneticmaterials.
6. Point out the ideal conditions required for dieselcycle.
7. Sketch the isothermal and adiabatic processes in P-Vdiagram.
8. Is it possible for a practical engine to have 100% efficiency?Justify.
9. Ice kept in saw dust or wrapper in a blanket will not melt.Why?
10. Classify the types of soundwaves.
11. Explain the three characteristics of musicalsound.

Apply

1. The average energy of a conduction electron in copper at 300 K is 4.23 eV. Calculate the Fermi energy of copper at 300K.
2. Determine the carrier concentration of *p*-type semiconductor whose hall coefficient is 3.6610-4 m3/C.
3. Compute the efficiency of Carnot's engine operating between the temperatures 3270C and270C.
4. Point out practical applications of heatconduction.
5. Compute the efficiency of Carnot's engine working the steam point and the icepoint.
6. Assess the reason for the formation ice on pondsurface.
7. The intensity of sound produced by thunder is 0.1 Wm-2.Calculate the intensity level indecibels.
8. Calculate Sabine's mathematical relation for reverberation time of thehall.
9. Compute the minimum wavelength of audible sound at zero degreecentigrade.

Analyse

1. Distinguish between relaxation time and collisiontime.
2. Differentiate between electrical and thermalconductivity.
3. List the various applications of soft and hard magnetic materials for day to daylife.
4. Analysis the six properties of hard and soft magneticmaterials.
5. If the system and surrounding are in thermal equilibrium, is it necessary they are in same state? Comment thestatement.
6. Differentiate isothermal and adiabaticprocess.
7. Entropy remains constant in an adiabatic process. Justify thestatement.

8. Compare Carnot's cycle and dieselcycle.
9. Distinguish between loudness and intensity of sound.
10. Compare reverberation andecho.
11. How do you maintain optimum reverberation in a hall?Justify.

15PH203 MATERIALS SCIENCE 3 0 2 4

Course Objectives

- To explain the properties of conducting, semiconducting and dielectricmaterials
- To impart fundamental knowledge in opticalmaterials
- To understand the nature and applications of different magneticmaterials

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. distinguish electrical properties of different kinds of conductingmaterials
2. identify the different types of semiconductors and itsapplications
3. categorize the various polarization mechanisms indielectrics
4. choose the suitable material for the construction of displaydevices
5. select appropriate magnetic materials for magnetic storagedevices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3											
2	2											
3	1											
4	1											
5	1											

UNIT I **8 Hours**

ELECTRICAL PROPERTIES OF METALS

Quantum free electron theory: Fermi-Dirac distribution function - Fermi energy and its variation with temperature - density of energy states - calculation of density of electrons and fermi energy at 0K - mean energy of electrons at 0K - problems.

UNIT II **10 Hours**

SEMICONDUCTING MATERIALS

Introduction - elemental and compound semiconductors - intrinsic semiconductors: expressions for number of electrons and holes - determination of carrier concentration and position of Fermi energy - electrical conductivity - band gap energy determination - carrier concentration in extrinsic semiconductors. Hall effect: theory and experimental determination - uses -problems.

UNIT III **9 Hours**

DIELECTRICS

Introduction - fundamental definitions in dielectrics - expressions for electronic and ionic polarizations - orientation polarization (qualitative) - space charge polarization - Langevin - Debye equation - frequency and temperature effects on polarization - internal field - expression for internal field (cubic structure) - Clausius-Mosotti equation and its importance - applications of dielectric materials - problems.

UNIT IV **9 Hours**

OPTICAL MATERIALS

Introduction - optical absorption in metals, semiconductors and insulators. Fluorescence and phosphorescence. Light emitting diode: principle, construction, working and applications. Liquid crystal display: general properties - dynamic scattering display - twisted nematic display - applications - comparison between LED and LCD. Blue ray disc - principle - working.

UNIT V **9 Hours**

MAGNETIC MATERIALS

Introduction - orbital and spin magnetic moments - Bohr magneton - basic definitions - classification of magnetic materials - domain theory of ferromagnetism - process of domain magnetization - explanation of hysteresis curve based on domain theory - hard and soft magnetic materials.

FOR FURTHER READING

Optical data storage and Giant magnetoresistance

1 **2 Hours**

INTRODUCTION

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 1

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

3 **4 Hours**

EXPERIMENT 2

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the givensemiconductor.

4 **4 Hours**

EXPERIMENT 3

With the aid of traveling microscope, find the refractive index of a transparent solid and liquid material.

5 **4 Hours**

EXPERIMENT 4

Determine the wavelength of polychromatic source in the visible region using spectrometer.

6 **4 Hours**

EXPERIMENT 5

Based on Hall effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

7 **4 Hours**

EXPERIMENT 6

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

8 **4 Hours**

EXPERIMENT 7

Determine the V-I characteristics of a solar cell. **Total: 75 Hours**

Reference(s)

1. William D. Callister, Materials Science and Engineering an Introduction, John Wiley and Sons, Inc,2010.
2. S.O. Pillai, Solid State Physics, New Age International Publications, New Delhi,2014.
3. M.N. Avadhanulu and P.G. Kshirsagar, A Text Book of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2011.
4. P.K. Palanisamy, Physics For Engineers, Scitech Publications (India) Pvt. Ltd., Chennai,2010.
5. V. Raghavan, Materials Science and Engineering, Prentice Hall of India, New Delhi,2010.
6. R.K.Gaur and S.L.Gupta, Engineering Physics, Dhanpat Rai publications, New Delhi,2010.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	5	2		1	5	2		1																18
2	2		2		2	3	2		5		2		4												22
3	1	2	1		3	3			3	5			2												20
4	2	3			3	3			2	5			2												20
5	1	3			3	2	5		3	1			2												20
																								Total	100

Assessment Questions

Remember

1. Define density of electron energy states inmetals.
2. Recall Fermi energy.
3. State HallEffect.
4. List out the four advantages ofsemiconductors.
5. Define dielectricconstant
6. Recall electricpolarization.
7. DefineFluorescence.
8. Recognize hard and soft magneticmaterials.
9. State the working principle ofLED.
10. Define Bohrmagnetron.

Understand

1. Classify three types of free electrontheory

2. Represent the variation of Fermi level withtemperature
3. Explain Clausius-Mosottirelation.
4. Compare element and compound typesemiconductors.
5. Illustrate the variation of Fermi level with temperature in n-typesemiconductors.
6. Distinguish between a dielectric andinsulator.Mention the technique to increase the emission time inphosphorescence.
7. Exemplify hysteresis on the basis of domain theory offerromagnetism.
8. Identify four examples for hard magneticmaterials.
9. Identify four properties of ferromagneticmaterials.

Apply

1. Compute the Fermi direc function for energy kT above the Fermienergy.
2. Asses the Fermi-Dirac distributionfunction.
3. Energy level of p-type and n-type semiconductors and justify theresults
4. Compute the carrier concentration of intrinsicsemiconductors
5. Explain the principle, construction and working of HallEffect
6. Show that electronic and ionic polarizabilities are independent of temperature.
7. Calculate the polarization of an atom above valuefive.
8. Differentiate the dia, para and ferromagneticmaterials.
9. Compute the B-H Hysteresis curve on the basis of domaintheory.

Analyse

1. Discriminate drift velocity and thermal velocity of anelectron
2. Difference between p-type and n-typesemiconductors.
3. Obtain the expression for concentration of charge carriers in p-typesemiconductor.
4. In practical dielectrics, the current does not exactly lead the voltage by 90?.Justify.
5. Local field is the space and time average of the electric field acting on a particular molecule Justify theresult.
6. Justify the special features of magnetic blue raydisks.
7. Analyze the role of energies in the domaingrowth.
8. Explain the roll of activators in opticalmaterials
9. Describe the working of twisted pneumatic displaydevice.
10. Compare LED andLCD.

15PH204 PHYSICS OF ENGINEERING MATERIALS 3 0 2 4

Course Objectives

- To familiarize with the physical properties ofmaterials
- To gain practical applications of modern spectroscopy and microscopytechniques
- To understand the preparation of bio andnanomaterials

Programme Outcomes (POs)
a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. identify the electrical and thermal properties of conducting and semiconductingmaterials
2. analyze the various polarization mechanisms indielectrics
3. choose specific materials for optical and magnetic data storagedevices
4. investigate the specimen with the aid of suitable spectroscopictechniques
5. realize the methods adopted for preparing nanomaterials

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3											
2	2											
3	1											
4	3											
5	2											

UNIT I **10 Hours**

CONDUCTING AND SEMICONDUCTING PROPERTIES
Quantum free electron theory - Fermi-Dirac distribution function - effect of temperature on Fermi function - density of energy states - calculation of density of electrons and Fermi energy at 0 K. Intrinsic semiconductors: expressions for density of electrons and holes - intrinsic carrier concentration - band gap energy. Extrinsic semiconductors: carrier concentration in n-type and p-type semiconductors - variation of Fermi level with temperature and impurity concentration -problems.

UNIT II **9 Hours**

DIELECTRIC PROPERTIES
Introduction: fundamental definitions in dielectrics - types of polarization - expressions for electronic and ionic polarization mechanisms - orientation polarization (qualitative) - Langevin-Debye equation - frequency and temperature effects on polarization - dielectric loss - dielectric breakdown mechanisms - active dielectric materials - applications of dielectric materials - problems.

UNIT III **10 Hours**

OPTICAL AND MAGNETIC PROPERTIES
Optical properties: introduction - light interaction with solids - atomic and electronic interactions - optical properties of metals, semiconductors and insulators - reflection - refraction - absorption - transmission -

luminescence and photoconductivity. Magnetic properties: introduction - origin of magnetic moment - properties of dia, para and ferro magnetic materials - domain theory and hysteresis effect - hard and soft magnetic materials - problems.

UNIT IV **8 Hours**

SPECTROSCOPY AND MICROSCOPY TECHNIQUES

Introduction: different types of spectroscopy techniques - basic principle of FTIR spectroscopy and X-ray Photoelectron Spectroscopy (XPS). Basic principle and working mechanisms of Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) - Atomic Force Microscope (AFM).

UNIT V **8 Hours**

BIO AND NANO MATERIALS

Biomaterials: classification of biomaterials - development of biomaterials - applications. Nanomaterials: properties - synthesis of nanomaterials - top-down approach: ball milling technique - bottom-up approach: Chemical Vapour Deposition (CVD) - uses of nanomaterials. Carbon nanotubes: properties and applications.

FOR FURTHER READING

Health and environmental impacts

1 **2 Hours**

INTRODUCTION

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 1

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

3 **4 Hours**

EXPERIMENT 2

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the given semiconductor.

4 **4 Hours**

EXPERIMENT 3

With the aid of traveling microscope, find the refractive index of a transparent solid and liquid material.

5 **4 Hours**

EXPERIMENT 4

Determine the wavelength of polychromatic source in the visible region using spectrometer.

6 **4 Hours**

EXPERIMENT 5

Based on Hall effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

7 **4 Hours**

EXPERIMENT 6

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

8 **4 Hours**

EXPERIMENT 7

Determine the V-I characteristics of a solar cell.

Total : 75 Hours

Reference(s)

1. William D. Callister, Materials Science and Engineering An Introduction, John Wiley and Sons, Inc,2010.
2. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc,2011.
3. Jacob Milliman, Christos Halkias, Satyabrata JIT, Electronic Devices and Circuits, McGraw Hill Education (India) Private Limited, New Delhi,2014.
4. S. O. Pillai, Solid State Physics, New Age International Publications, New Delhi,2010.
5. Subbiah Pillai, Nanobiotechnology, MJP Publishers,2010.
6. Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, Wiley-VCH,2013.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	1	4	2		2	5	2		2	2			1	1											22
2	2		2		2		2		5	3			4												20
3	2		2		3	3	2		3	3			2	2											22
4	1	2	1		3	3			3	3			2												18
5	2	2			3	2	3		2				2	2											18
																								Total	100

Assessment Questions

Remember

1. Recall the merits of quantum free electron theory over classical free electrontheory
2. Define carrierconcentration
3. Recall Fermi energy
4. List the four types of polarizationmechanisms.
5. Recognize polar and non-polarmolecules
6. Define Bohrmagneton
7. Recall coercivity andretentivity
8. Point out the four salient features ofbiomaterials
9. Define bioactivematerials
10. State the working principle of FTIRspectroscopy

Understand

1. Classify three types of materials based on bandgapenergy
2. Explain fermi-distribution function and effect of temperature on Fermifunction

3. Represent the variation of Fermi level withtemperature
4. Explain intrinsic and thermal breakdownmechanisms
5. Infer the importance of Fermi level in a semiconductor
6. Illustrate the phenomenon of B-H hysteresis on the basis of domaintheory
7. Classify four types ofbiomaterials
8. Represent the scanning electron microscope to determine the grain size of thenanomaterials
9. Explain the principle, construction and working of Scanning electron microscope
10. Explain the principle and working mechanism of X – ray photoelectron spectroscopy(XPS)

Apply

1. Find the variation of Fermi level with temperature and impurity concentration in n-type semiconductors
2. Show that electronic and ionic polarizabilities are independent oftemperature
3. Show that the position of Fermi level is exactly at the midpoint of forbidden energy gap in intrinsicsemiconductor
4. Compute the relationship between polarizability and electric fluxdensity.
5. Assess the properties of dia, para and ferromagneticmaterials
6. Show that top down method is inferior to bottom up method
7. Construct B-H Hysteresis curve on the basis of domaintheory
8. Design the principle, construction and working of chemical vapourdeposition.
9. Show that the electronic polarizability is directly propotional to the volume of anatom
10. Compute the expression for carrier concentration in intrinsicsemiconductors

Analyse

1. Extrinsic semiconductors possess high electrical conductivity than intrinsic semiconductors. Justify
2. Silver is the best conductor of electricity. But gold is used in high-end electronic connectors. Justify.
3. Identify the role of impurity concentration in the variation of Fermi level in the case of p-type semiconductors.
4. Compare polar dielectrics with non-polardielectrics.
5. Analyse the features of hard and soft magneticmaterials.
6. Compare the six properties of dia, para and ferro magneticmaterials
7. Differentiate top down approach from bottom upapproach.
8. Select the four important features ofTEM
9. Justify the electronic polarizability of Argon is much greater than that ofHelium.
10. Intrinsic semiconductors are insulators at 0K.Justify.

15PH205 SOLID STATE PHYSICS 3 0 2 4

Course Objectives

- To explain the properties of conducting, semiconducting and dielectricmaterials
- To understand the working mechanism of junctiondiodes
- To impart knowledge in optical and magneticmaterials

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. identify different types of emission of electrons and significance of Fermifunction
2. explore the carrier concentration and its variation with temperature of different semiconducting materials
3. analyze the I-V characteristics of a junctiondiode
4. investigate the various polarization mechanisms indielectrics
5. select appropriate optical and magnetic materials for data storage devices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3											
2	2											
3	1											
4	2											
5	1											

UNIT I **10 Hours**

EMISSION PROPERTIES AND QUANTUM THEORY OF SOLIDS

Emission of electrons: types thermionic emission-principle- Richardson equation- secondary emission-principle- work function- Fermi-Dirac distribution function and its temperature dependence significance of Fermi energy- density of energy states- calculation of density of electrons and Fermi energy at 0K-average energy of electrons at 0Kproblems.

UNIT II **9 Hours**

SEMICONDUCTOR PHYSICS

Intrinsic semiconductors: the law of mass action - expressions for density of electrons and holes - determination of carrier concentration - band gap energy. Extrinsic semiconductors: carrier concentration in p-type and n-type semiconductors. Hall effect: theory - experimental determination of Hall voltage - applications - problems.

UNIT III **9 Hours**

JUNCTION DIODE CHARACTERISTICS

Introduction - pn junction diode - volt-ampere characteristics - diode current equation - static and dynamic resistances - space charge - diffusion capacitance - junction diode switching times. Diode circuit with DC voltage source. Applications: full wave rectifier - capacitor filters - clamper circuits.

UNIT IV **9 Hours**

DIELECTRICS

Introduction: fundamental definitions in dielectrics - expressions for electronic and ionic polarizations - orientation polarization (qualitative) - space charge polarization - Langevin Debye equation - frequency and temperature effects on polarization - expression for internal field (cubic structure) - Clausius-Mosotti equation - dielectric loss - applications of dielectrics - problems.

UNIT V **8 Hours**

OPTOELECTRONICS AND MAGNETIC MATERIALS

Principle, working and characteristics of LED and LCD - blue ray disc. Magnetic materials: basic definitions - properties of dia, para and ferro magnetic materials - explanation of hysteresis curve based on domain theory - hard and soft magnetic materials. Magnetic storage device: principle - working - giant magnetoresistance.

FOR FURTHER READING

Motion of an electron in uniform and non-uniform magnetic fields - electric and magnetic fields in a crossedconfiguration.

1 **2 Hours**

INTRODUCTION

Exposure to Engineering Physics Laboratory and precautionary measures

2 **4 Hours**

EXPERIMENT 1

Using Lees disc apparatus, determine the coefficient of thermal conductivity of a bad conductor.

3 **4 Hours**

EXPERIMENT 2

Find the band gap value of the given semiconductor diode. Based on the band gap value, identify the givensemiconductor.

4 **4 Hours**

EXPERIMENT 3

With the aid of traveling microscope, find the refractive index of a transparent solid and liquid material.

5 **4 Hours**

EXPERIMENT 4

Determine the wavelength of polychromatic source in the visible region using spectrometer.

6 **4 Hours**

EXPERIMENT 5

Based on Hall effect, calculate the charge carrier density of a given semiconductor and identify the nature of the semiconductor.

7 **4 Hours**

EXPERIMENT 6

Draw the B-H curve of a ferromagnetic material subjected to external magnetic field and hence identify the nature of the material.

8 **4 Hours**

EXPERIMENT 7

Determine the V-I characteristics of a solar cell.

Total: 75 Hours

Reference(s)

1. Jacob Millman, Christos Halkias and Satyabrata JIT, Electronic Devices and Circuits, McGraw Hill Education (India) Private Limited, New Delhi,2014.
2. William D. Callister, Materials Science and Engineering an Introduction, John Wiley and sons, Inc,2010.
3. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc,2011.
4. R. S. Sedha, A textbook of Applied Electronics, S. Chand & Company Ltd., New Delhi,2010.
5. S. O. Pillai, Solid State Physics, New Age International Publications, New Delhi,2010
6. M. N. Avadhanulu and P.G. Kshirsagar, A Text Book of Engineering Physics, S. Chand & Company Ltd., New Delhi, 2011.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	1	2	2		2	4	2		2	5			2												22
2	2	2			2		3		2	3					6										20
3	2		1		3		2		5				2	2				3							20
4	2	2	2		2	3			2	5			2												20
5	2	2			3	2	2		2				5												18
																								Total	100

Assessment Questions

Remember

1. Recall the Richardsonequation.
2. Define dynamicresistance.
3. State the law of massaction.
4. Define HallEffect.
5. List the three practical applications of p-n junctiondiode.
6. List the four types of polarizations indielectrics
7. Reproduce the expressions for electronic and ionicpolarization.
8. State the working principle ofLED.
9. Define retentivity andcoercivity.

Understand

1. Explain the variation of Fermi-Dirac distribution function withtemperature.
2. Indicate the importance of Fermilevel.
3. Indicate the reason for preferring extrinsic semiconductors over intrinsicsemiconductors.
4. Represent four applications of HallEffect.
5. Represent the switching action of adiode.
6. Interpret the relation between polarization and polarisability indielectrics.
7. All the dielectrics are insulators but all the insulators are not dielectrics. Illustrate withexamples.
8. Interpret the relation between the dielectric constant and electricsusceptibility.
9. Explain the phenomenon of electroluminescence inLED.
10. Summarize the working principle of giantmagnetoresistance.

Apply

1. Find the expression for density of electrons and Fermi energy at 0K.
2. Using the Fermi function, compute the temperature at which there is 1% probability that an electron in a solid will have energy 0.5 eV above EF of 5 eV.

3. Explain how phosphorous atoms donate electrons to the conductionband.
4. Apply the law of mass action to determine the carrier concentration of intrinsicsemiconductors.
5. Construct a circuit using p-n junction diode and execute its V-Icharacteristics.
6. Construct a diode circuit with DC voltage source and demonstrate its workingconditions.
7. Show that electronic polarizability is independent oftemperature.
8. Explain frequency dependence of dielectrics with a neatsketch.
9. Apply the domain theory to the hysteresis effect observed in ferromagneticmaterials.
10. Compute the wavelength of light emitted by an LED with band gap energy of 1.8eV.

Analyse

1. The average energy of electrons at 0 K depends on Fermi level.Justify.
2. Differentiate p-type and n-typesemiconductors.
3. Outline the working principle of full wave bridgerectifier.
4. At optical frequencies the total polarization is less.Justify.
5. Outline the causes for dielectric loss in dielectricmaterials.
6. Analyze the magnetic behavior of dia, para and ferromagneticmaterials.
7. Compare the properties of LED andLCD.
8. Outline the difference between hard and soft magneticmaterials.

Evaluate

1. Evaluate the resistance value using V-I characteristics of a p-n junctiondiode.
2. Evaluate the value of Fermi distribution function for an energy kT above the Fermi energy at that temperature and comment on theanswer.

15CH201 ENGINEERING CHEMISTRY 3 0 2 4

Course Objectives

- Recall the terminologies of electrochemistry and explain the function of batteries and fuel cells with its electrochemicalreactions
- understand the fundamentals of corrosion, its types and polymers with itsapplications
- choose appropriate instrumentation technique for interpreting analyticaldata

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. construct an electrochemical cell and measure its potential using selected referenceelectrode
2. identify the electrodes, electrolyte and cell reactions in batteries, fuel cells and infer the selection criteria for commercial battery systems with respect to commercialapplications
3. Analyze the type of corrosion, factors influencing rate of corrosion on metals and identify suitable corrosion controlmethod
4. differentiate polymers based on its source, properties andapplications
5. Select suitable analytical method for the estimation of alkali and alkaline earth metals in aqueous

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3										
2	2											
3	3	2		1								
4	2	2										
5	3	3		1								

UNIT I **10 Hours**

INTRODUCTION TO ELECTROCHEMISTRY

Types of electrodes - electrode potential - salt bridge - cell reaction - cell representation - silver-silver chloride electrode - calomel electrode - determination of single electrode potential - electrochemical series and its importance. Ion-selective electrode: glass electrode - measurement of pH using glass electrode. Concentration cells (electrode and electrolyte). Potentiometry - potentiometric titrations (redox titration). difference between electrochemical and electrolyticcells

UNIT II **9 Hours**

ENERGY STORAGE DEVICES

Batteries - characteristics of battery - types of batteries.construction, working and applications: Primary (alkaline) and secondary (lead-acid and nickel-cadmium) - Modern batteries (zinc air battery and lithium batteries) - precautions for battery maintenance. Comparison with conventional galvanic cells. Fuel cells - Types of fuel cells: solid polymer electrolyte fuel cell - solid oxide fuel cells - microbial fuel cell. Hydrogen-oxygen fuel cell - construction, working, advantages and limitations

UNIT III **8 Hours**

CORROSION SCIENCE

Corrosion: definition - types of corrosion: chemical and electrochemical corrosion - Pilling-Bedworth ratio - types of oxide layer (stable, unstable, volatile and porous) - hydrogen evolution and oxygen absorption mechanism for electrochemical corrosion - mechanism for rusting of iron. Types of electrochemical corrosion: Galvanic corrosion - differential aeration corrosion (pitting, waterline and pipeline). Galvanic series - applications. Factors influencing corrosion: nature of metal and environment. Corrosion control methods: sacrificial anode method - impressed current cathodic protection method - electroplating - electrolessplating

UNIT IV **10 Hours**

POLYMERS AND ITSPROCESSING

Advantages of polymers over metals. Monomers - polymers - polymerization - functionality - degree of polymerization - classification of polymers based on source and applications - Molecular weight determination. Types of polymerization: addition, condensation and copolymerization - mechanism of free radical polymerization. Preparation, properties and applications of thermosetting (epoxy resin and bakelite) and thermoplastics (polyvinyl chloride and polytetrafluoroethylene). Compounding of plastics - injection and extrusion mouldingmethods

UNIT V **8 Hours**

INSTRUMENTATION TECHNIQUES FOR CHEMICAL ANALYSIS

Beer - Lamberts law. Principle, instrumentation (block diagram only) and applications: UV-visible spectroscopy - Atomic absorption spectroscopy - Colorimetry (estimation of a transition metal) - Flame photometry (estimation of an alkali metal)

FOR FURTHER READING

Nobel prize winners in chemistry over past 5 years

1 **2 Hours**

EXPERIMENT 1

Preparation of N/10 oxalic acid and M/10 sodium carbonate solution.

2 **4 Hours**

EXPERIMENT 2

Determination of strength of hydrochloric acid present in the given solution by pH measurement.

3 **4 Hours**

EXPERIMENT 3

Determination of strength of HCl by conductometric titration.

4 **4 Hours**

EXPERIMENT 4

Conductometric titration of mixture of acids (Hydrochloric acid and acetic acid).

5 **4 Hours**

EXPERIMENT 5

Estimation of iron in the given sample by potentiometric method using saturated calomel electrode.

6 **4 Hours**

EXPERIMENT 6

Measurement of rate of corrosion on zinc/mild steel in aerated neutral/acidic/alkaline solution by weight loss method.

7 **4 Hours**

EXPERIMENT 7

Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.

8 **4 Hours**

EXPERIMENT 8

Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method.

Total: 75 Hours

Reference(s)

1. M. Munjal and S.M. Gupta, Wiley Engineering Chemistry, Second edition, Wiley India Pvt. Ltd, New Delhi,2013.
2. A. Pahari and B.Chauhan, Engineering Chemistry, Infinity Science press LLC, New Delhi,2010.

3. P.H. Rieger, Electrochemistry, Springer, Netherland, Second Edition (Reprint)2012.
4. Fred W. Billmeyer JR, Textbook of polymer science, John Wiley & sons, Third edition,2008.
5. Willard Merritt and Dean Settle, Instrumental methods of analysis, CBS publishers, Seventh edition,2012.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	1	1	1		3	4	2			4	4				1			2							23
2	1	1	1		4	4	3		1	2				1	2										20
3	1	1	1		2	2	1			2	2			2	1			1				1			17
4	5	3	2		3	1	1		1				1	2	2		1	1							23
5	1					3					3				7			2				1			17
																								Total	100

Assessment Questions
Remember
1. List the major four significances of EMFseries.
2. Define the term single electrodepotential.
3. Recall the four advantages of H2-O2 fuelcell.
4. Define the term functionality of amonomer.
5. State Pilling-Bedworthrule.
6. Name two monomers used for the preparation of epoxyresin.
7. Label the parts and charge carried by electrodes in electrochemical and electrolyticcells.
8. List any two significances of monomerfunctionality.
9. State Beer - Lambertslaw.
10. Define concentrationcell.

Understand
1. Classify two types of polymers based onsource.
2. Compare electrochemical cell and electrolytic cell with suitablediagrams.
3. Illustrate the mechanism involved in electrochemicalcorrosion.
4. Explain the principle and five components of UV-visiblespectrophotometer.
5. Outline the mechanism for the synthesis of –(CF2-CF2)n–polymer.
6. Identify any two analytical methods to estimate sodium present in aqueousmedia.
7. Illustrate the injection molding process with a necessary explanation and twoadvantages.
8. Indicate any two importance of salt bridge in an electrochemicalcell.
9. Ilustrate the route to synthesis epoxy resin from its twomonomers.
10. Summarize any four advantages of polymers over metals in everydaylife.

Apply
1. Calculate the single electrode potential value zinc half-cell dipped in a 0.01M $ZnSO_4$ solution at 25°C? E° Zn/Zn 2+ = 0.763 V, R=8.314 JK -1 Mol -1, F= 96500Coulombs.
2. Identify two advantages of degree ofpolymerization.
3. Find the concentration of given solution using spectrophotometer, if %T, bath length and molar adsorption coefficient are 18, 1 cm and 6000 L/mol.cm.
4. Derive an equation for determination pH of unknown solution using glasselectrode.
5. Elaborate the six applications of electrochemicalseries.
6. Select and explain suitable potentiometric titration to estimate the amount of ferrous ion inthe

givensolution.
7. Discuss the construction and working of electrolyte concentration cell with suitableexample.
8. Assess the significances of monomer functionality in the properties and structure of polymer.

Analyse
1. Outline any two methods for preventing chemical and electrochemicalcorrosion.
2. Compare the advantages and limitations of electro and electroless plating ofnickel.
3. The statement "prevention is better than cure" is not suitable for corrosion science and engineering-Justify the answer in your ownwords.
4. Differentiate addition and condensation polymers based on itssynthesis.
5. Arrange the following polymer based on the increasing order of resistance towardschemical
    1. poly(ethylene) 2. Starch 3.Baklite4.Teflon

Evaluate
1. Calculate the electrode potential of zinc metal if EMF of the cell is 1.10 V (Sat. Calomel electrode was used for complete cellformation.
2. Electrode potentials of A and B are E 0 A/A+ = +0.76 V and E 0 B/B+ = -0.34 V respectively. Choose the appropriate anode half-cell and cathode half-cell by giving the cellrepresentation
3. Find out the degree of polymerization for a low density polytetrafluoroethylene with a molecular weight of 10002 amu. (Atomic weights of F=18.9;C=12)
4. The standard reduction potentials of metals Ag, Fe, Cu and Zn are +0.80v,-0.44v, +0.34v and -0.76v respectively. Arrange the metals in the increasing order of their ability to undergo Corrosion.

Create
1. A ship hull in ocean is safe against corrosion under any circumstance -Argue.
2. Derive the probable reason and possible solution for thefollowing:
   i. Stainless steel should not be used to build shiphull.
   ii. Small anodic area results in intensecorrosion.
   iii. Metal under water drop undergoes acceleratedcorrosion.

15CH202 APPLIED CHEMISTRY 3 0 2 4

Course Objectives
- understand the necessity of water softeningprocesses
- aware the causes and consequences ofcorrosion
- acquaint the applications of alloying and phase rule inmetallurgy
- recognise the fundamentals and applications offuels
- characterize the chemical compounds using analyticaltechniques.

Programme Outcomes (POs)
a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. attribute the internal and external treatment methods for the removal of hardness in water for domestic and industrialapplications.
2. Analyze the type of corrosion, factors influencing rate of corrosion on metals and corrosion controlmethods
3. Differentiate ferrous and non ferrous alloys based on its properties, applications and illustrate the importance of phase rule in the field ofmettallurgy
4. Distinguish the three types of fuels based on calorific value for selectedapplications
5. Apply suitable analytical methods for the estimation of elements in aqueousmedia

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2		1								
2	2	3										
3	1	2										
4	2	1										
5	2	3		1								

UNIT I **10 Hours**

WATER PURIFICATION

Hardness of water - classification of hardness (temporary and permanent) - units of hardness (ppm, mg/l, degree Clark, degree French) - expression of hardness in terms of calcium carbonate equivalence - estimation of hardness by EDTA Method - Uses of water for industrial purpose - requirements of boiler feed water - disadvantages of using hard water in industrial boilers: scale, sludge, priming, foaming and caustic embrittlement. Removal of dissolved salts from hard water: internal conditioning (phosphate, carbonate, calgon and colloidal methods), external conditioning (ion exchange process, reverse osmosis, electrodialysis). Uses of water for domestic purpose - municipal water treatment (screening, aeration, coagulation, sedimentation, filtration and disinfection of water - break point chlorination).

UNIT II **8 Hours**

CORROSION SCIENCE

Corrosion - chemical and electrochemical corrosion - Pilling-Bedworth rule - mechanism (types of oxide layer, oxygen absorption - hydrogen evolution) - Galvanic series -types of electrochemical corrosion: Galvanic corrosion - differential aeration corrosion (pitting, pipeline and waterline)-Factors influencing corrosion (nature of metal and environment). Corrosion control: sacrificial anode - impressed current method.Protective coatings - paint -constituents and functions.

UNIT III **9 Hours**

ALLOYS AND PHASE RULE

Alloys: purpose of alloying - function and effects of alloying elements - properties of alloys - classification of alloys. Ferrous alloys: nichrome and stainless steel. Non-ferrous alloys: brass and bronze. Heattreatmentofalloys(annealing,hardening,tempering,normalising,carburizingandnitriding).

Phase rule: phase - component - degree of freedom - phase rule - phase diagram - applications- one component system (water system). Reduced phase rule - two component system (lead and silver system).

UNIT IV **10 Hours**

FUELS

Classification - characteristics - calorific value - solid fuel - coal - types - analysis of coal (proximate and ultimate analysis) - processing of coal to coke - carbonization - types (low temperature and high temperature carbonization) - manufacture of metallurgical coke (Otto Hoffmann method). Liquid fuels - petroleum - refining of crude oil - knocking - octane number - cetane number. Liquid fuel from coal (Bergius process). Gaseous fuels - natural gas (CNG) - coal gas - producer gas - syn gas - shale gas.

UNIT V **8 Hours**

INSTRUMENTAL METHODS

Beer - Lamberts law. Principle, instrumentation (block diagram only) and applications: Ultra violet spectroscopy - Infrared spectroscopy - Atomic absorption spectroscopy - Colorimetry (estimation of transition metal) - Flame photometry (estimation of alkali metal).

FOR FURTHER READING

Synthesis and applications of bio-fuels.

1 **2 Hours**

EXPERIMENT 1

Preparation of N/10 oxalic acid and N/10 sodium carbonate solution.

2 **4 Hours**

EXPERIMENT 2

Water quality of BIT campus - River - Bore well water with respect to hardness, TDS and pH.

3 **4 Hours**

EXPERIMENT 3

Conductometric titration of mixture of acids (HCl CH3COOH).

4 **4 Hours**

EXPERIMENT 4

Determination of strength of hydrochloric acid in a given solution using pH meter.

5 **4 Hours**

EXPERIMENT 5

Determination of the strength of Fe(II) in the given sample by potentiometric method.

6 **4 Hours**

EXPERIMENT 6

Measurement of rate of corrosion on mild steel in aerated / neutral / acidic / alkaline medium by weight loss method.

7 **4 Hours**

EXPERIMENT 7

Estimation of copper content in brass by EDTA method.

8 **4 Hours**

EXPERIMENT 8

Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method.

Total: 75 Hours

Reference(s)

1. A. Pahari and B.Chauhan, Engineering Chemistry, Infinity Science press LLC, New Delhi,2010.
2. M. Munjal and S.M. Gupta, Wiley Engineering Chemistry, Second edition, Wiley India Pvt. Ltd, New Delhi,2013.
3. Willard Merritt and Dean Settle, Instrumental methods of analysis, CBS publishers, Seventh edition,2012.
4. Jain and Jain, Engineering Chemistry, Dhanpat Rai Publishers New Delhi, 16th Edition,2013.
5. R. Mukhopadhy and S. Datta, Engineering Chemistry, New age international Pvt. Ltd, New Delhi,2010.
6. Shashi Chawla, Engineering Chemistry, Dhanpat Rai Publishers New Delhi, 2nd Edition,2003.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	1	1	1		3	4	2			4	4				1			1				1			23
2	1	1	1		2	2	1			2	2			2	1			1				1			17
3	1	1	1		4	4	3		1	2					2							1			20
4	5	3	2		3	1	1		1				1	2	1		1	1				1			23
5	1					3					3				7			2				1			17
																								Total	100

Assessment Questions

Remember

1. Define the term hardness ofwater.
2. List any two internal conditioning methods to convert hard water to soft water.
3. List the two types of electrochemicalcorrosion.
4. Recall any two reasons for galvaniccorrosion.
5. List the four major objectives of alloyingsteel.
6. State Gibbs phaserule.
7. Define octanenumber.
8. State Beer-Lambert'slaw.
9. Recall any four applications ofcolorimetry.

Understand

1. Compare temporary and permanent hardness in water.
2. Illustrate the estimation of carbonate, non-carbonate and total hardness by EDTAmethod.
3. Identify the needs of corrosion control methods with suitableexamples.
4. Indicate the two suitable conditions for electrochemical corrosion tooccur.
5. Classify the three types of alloys based on metalcomposition.
6. For one component water system, the triple point is an invariant point. Reasonout.
7. Distinguish between syn gas and coalgas.
8. With a neat diagram, explain the processes involved in Bergius process to get syntheticpetrol.
9. Diiferentiate chromophore and auxochrome with anexample.

10. Infer the role of ammonium thiocyanate in the colorimetric estimation ofiron.

Apply

1. Illustrate the necessary steps involved in municipal watertreatment..
2. Suggest a suitable laboratory method to estimate carbonate, non-carbonate and total hardness of water.
3. Sketch a suitable protection method to prevent ship's hull made of iron fromcorrosion.
4. Assess the effects of alloyingelements.
5. Apply Gibbs phase rule for one component water system with a neat diagram.
6. Find the combusted products of the followingcomponents.
   (i) 2H2 (ii)CH4
7. Find the application of colorimetry for the estimation ofiron.
8. Calculate the number of the modes of vibrations for the followingmolecules.
   (i) C6H6 (ii)CO2

Analyse

1. How can the effect of caustic embrittlement in boiler beresolved?
2. Identify the problems created in boilers if priming and foaming takesplace.
3. Increase in temperature increases corrosion rate.Justify.
4. Zinc is more corroded when coupled with copper than lead – Reason out.
5. Distinguish ferrous and non-ferrous alloys withexamples.
6. Arrange the following materials based on their increasing calorific value, peat, lignite, bituminous, wood, anthracite and sub-bituminous.

Evaluate

1. Bolt and nut made of the same metal is preferred in practice. Givereason.
2. Support the statement "Coke is a better fuel thancoal".
3. Calculate the absorbance if 10% of light istransmitted.
4. Determine the effect of pH of the conducting medium on corrosion.
5. Determine the number of phases present in the followingsystems.
   (i) Two miscible liquids (alcohol &water)
   (ii) Two immiscible liquids (benzene &water)

Create

1. Derive the probable reason and possible solution for thefollowing:
   i) Stainless steel should not be used to build shiphull.
   ii) Small anodic area results in intensecorrosion.
   iii) Metal under water drop undergoes acceleratedcorrosion.
   iv)AAS is a better method for environmental analysis than calorimetric analysis.Justify.

15CH203 APPLIED ELECTROCHEMISTRY 3 0 2 4

Course Objectives

- Understanding the basic concepts of electrochemistry and theirapplication
- Expanding knowledge about corrosion and methods ofcontrol
- Gaining information regarding principle, working and application of batteries and fuelcells

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and

an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Construct an electrochemical cell and calculate its cellpotential.
2. Measure the emf of a cell using differentelectrodes.
3. Identify the components and processes in batteries and infer the selection criteria for commercial battery systems with respect to differentapplications.
4. Differentiate types of corrosion and its prevention by suitabletechniques.
5. Recognize the importance of fuel cells and solarbattery.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2										
2	2	3										
3	2	1										
4	2	2										
5	3	1										

UNIT I **9 Hours**

FUNDAMENTALS OF ELECTROCHEMISTRY

Introduction - electrical conductance in solution - electrical double layer - electrode potential - importance of electrode potential. Electrochemical cell - standard cell: Weston cadmium cell - Concentration cell: electrode and electrolyte - applications. Applications of electrolytic cells: electrolysis of water, electrolysis of brine and electroplating of copper andgold

UNIT II **9 Hours**

REFERENCE ELECTRODES

Primary and secondary reference electrodes - metal-metal ion electrode, metal-metal insoluble salt electrodes: silver-silver chloride electrode, calomel electrode - ion-selective electrode: glass electrode - measurement of pH of a solution using glass electrode. Quinhydrone electrode: construction - advantages - limitations. Applications of EMF measurements: Potentiometric titrations: acid-base titration - oxidation-reduction titration - precipitationtitration

UNIT III **10 Hours**

ENERGY STORING DEVICES

Types of batteries - alkaline, lead-acid, nickel-cadmium and lithium batteries - construction, working and commercial applications.Electrochemical sensors. Decomposition potential: variation of decomposition potential for different metals - importance of decomposition potential. Over voltage: factors affecting over voltage value. Maintenance and precautions in battery handling

UNIT IV **10 Hours**

CORROSION SCIENCE

Corrosion - causes - dry and wet corrosion - Pilling-Bedworth rule - mechanism (hydrogen evolution and oxygen absorption) - rusting of iron. Galvanic series - applications. Galvanic corrosion - differential aeration corrosion (pitting, waterline and stress) - factors influencing corrosion. Corrosion control -

sacrificial anode and impressed current cathodic protection methods - Metallic coatings: chromium plating - nickel plating - galvanizing andtinning

UNIT V **7 Hours**

FUEL CELL AND SOLAR BATTERY

Introduction - types of fuel cell: low, medium and high temperature fuel cell. Hydrogen-Oxygen fuel cell - advantages. Solid polymer electrolyte fuel cell, solid oxide fuel cells, biochemical fuel cell. Solarbattery - domestic, industrial and commercial applications. Environmental and safetyissues

FOR FURTHER READING

Document the various batteries with its characteristics used in mobile phones and laptops Maintenance free batteries, Batteryrecycling

1 **2 Hours**

EXPERIMENT 1

General instructions to students - Handling reagents and safety precautions.

2 **4 Hours**

EXPERIMENT 2

Determination of strength of a commercial mineral acid by conductometric titration.

3 **4 Hours**

EXPERIMENT 3

Electroplating of copper onto a stainless steel object.

4 **4 Hours**

EXPERIMENT 4

Determination of strength of iron in a given solution by potentiometric method.

5 **4 Hours**

EXPERIMENT 5

Determination of amount of hydrochloric acid present in the given sample using pH meter.

6 **4 Hours**

EXPERIMENT 6

Conductometric titration of mixture of acids.

7 **4 Hours**

EXPERIMENT 7

Determination of corrosion inhibition on mild steel using natural inhibitors.

8 **4 Hours**

EXPERIMENT 8

Estimation of barium by precipitation titration. **Total: 75 Hours**

Reference(s)

1. J. C. Kuriacose and J. Rajaram, Chemistry in Engineering & Technology, Vol. 1&2, Tata McGraw-Hill, New Delhi,2010.
2. B. S. Chauhan, Engineering Chemistry, 3rd Edition, Laxmi Publication Ltd, New Delhi,2010.
3. B. R. Puri, L. R. Sharma and Madan S Pathania, Principles of physical chemistry, 46th Edition, Vishal publishing Ltd, New Delhi,2013.
4. B. S. Bahl, G. D. Tuli and Arun Bahl, Essentials of Physical Chemistry, 5th Edition, S. Chand & Company, New Delhi,2012.
5. S. Vairam, Engineering Chemistry, 1st Edition, John -Willy, India private limited, New Delhi, 2014.
6. Sashi Chawla, Text Book of Engineering Chemistry, Dhanpat Rai Publications, New Delhi,2010.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	2			2	1	1			2	1		1	1	2			2	1			1	1		20
2	1	4			2	4	1			2			1	2				1	2						20
3		1	1		4	5			2	4			2	1			1	2							23
4	2	1			2	5	1			3				2			2	2				2			22
5	2	2			1	4			2	1			1	1				1							15
																								Total	100

Assessment Questions Remember

1. List any two advantages of hydrogen oxygen fuelcells.
2. Name any two secondary batteries used in electronicappliances.
3. State pilling bedworthrule.
4. List any two applications of lithiumbattery.
5. Defineovervoltage.
6. Recall the two limitations of quinhydroneelectrode.
7. List the three major applications of galvanicseries.
8. Recall the term redoxreaction.
9. Define standard electrodepotential.

Understand

1. Identify any two factors affecting the rate of corrosion based on the nature ofmetal.
2. Compare solar battery with lead acid-battery with respect to cell reactions, advantages and limitations.
3. Explain the working of hydrogen-oxygen fuel cell with necessary diagram and cell reactions. Mention its two advantages andlimitations.
4. Explain the difference between galvanic and differential aeration corrosion with an exampleeach.
5. Summarize any five factors that affect overvoltage value of acell.
6. Differentiate cell frombattery.
7. Sketch and explain the construction and working of saturated calomel electrode with necessary cellreactions.
8. With a neat sketch explain the working of a silver – silver chlorideelectrode.
9. Elucidate the working principle of Weston cadmium cell with suitable cellreactions.
10. Distinguish galvanic and electrolytic cells based on cell reactions.

Apply

1. Assess the six advantages of solid polymer electrolyte fuelcell.
2. Many metals form oxide layer when exposed to atmospheric conditions due to corrosion. Predict the four types of metal oxide layers formed with two exampleseach.
3. An iron pipe line buried under soil is used to carry natural gas, suggest any two corrosion control techniques that can be employed to minimize/controlcorrosion.
4. Predict the type of corrosion taking place when a piece of iron rod is exposed to moisture and explain the mechanism of rustformation.
5. Illustrate the construction of 6V lead-acid battery and explain its functioning during discharging and chargingprocess.
6. Select a suitable secondary storage battery used in mobile phones. Explain its reactions during charging and dischargingprocess.
7. Find the electrode potential of zinc rod using saturated calomel electrode as reference electrode (E cell value is 1.10V).
8. Apply the principle of ion selective electrode to find the pH of HCl solution using glass electrode with necessaryequations.
9. Can we use KCl salt bridge to construct a cell using Ag and Pb half-cell. Givereason.
10. Identify a suitable technique to achieve copper coating on stainless steel object with a neat diagram.

Analyse

1. Can you store zinc sulphate solution in a copper container? Give reason if your answer isyes/no.
2. Predict why copper cannot displace hydrogen from mineral acidsolution.
3. Compare a deep cycle battery and a starting battery based on itsapplication.
4. Zinc corrodes at a faster rate when coupled with copper than lead. Givereason.
5. Does the water exhaust from hydrogen - oxygen fuel cell is drinkable? Give reasons ifYes/No.

Evaluate

1. Electrode potentials of A and B are $E0A/A+ = +0.76$ V and $E0B/B+ = -0.34$ V respectively. Choose the appropriate anode half-cell and cathode half-cell by giving the cellrepresentation.
2. Glass electrode cannot be used in solutions having pH greater than 9.0. Givereason.
3. Represent diagrammatically an electrochemical cell that produces 1.1 volt as an output. Write the half-cell reactions responsible forthat.
4. The standard reduction potentials of metals Ag, Fe, Cu and Zn are +0.80v,-0.44v, +0.34v and -0.76v respectively. Arrange the metals in the increasing order of their ability to undergo corrosion.
5. Identify any two advantages of microbial fuel cell over lead acidbattery.

Create

1. Derive the probable reason and possible solution for thefollowing:
   i) Stainless steel should not be used to build shiphull.
   ii) Small anodic area results in intensecorrosion.
   iii) Metal under water drop undergoes acceleratedcorrosion.
2. As an engineer, which type of metal oxide forming metal you will choose for your design? Reasonout.

15CH204 INDUSTRIAL CHEMISTRY 3 0 2 4

Course Objectives

- impart knowledge on the principles of water characterization, treatment methods and industrial applications
- understand the principles and application of electrochemistry, fuel andcombustion
- recognize the fundamentals of polymers, nano chemistry and analyticaltechniques

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. identify the internal and external treatment methods for the removal of hardness in water for domestic and industrialapplications.
2. utilize the concepts of electrochemistry in real timeapplications.
3. realise the importance of fuel chemistry in day to daylife.
4. differentiate the polymers used in day to day life based on its source, properties andapplications
5. familiarize with the synthesis and characterization techniques ofnanomaterials.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	2										
2	1	2										
3	3	1										
4	2	1										
5	2	2										

UNIT I **10 Hours**

WATER PURIFICATION TECHNOLOGY: SOFTENING AND DESALINATION

Hardness of water: Equivalents of calcium carbonate - Units of hardness - Degree of hardness and estimation (EDTA method). Use of water for industrial purposes: Boiler feed water-scale-sludge -priming and foaming -caustic embrittlement. Softening of hard water: External conditioning - ion exchange methods - Internal conditioning - trisodium, dihydrogen, trihydrogen phosphate and sodium hexameta phosphate- carbonate- colloidal methods. Desalination: Reverse osmosis - electrodialysis. Domestic water treatment - Disinfection of water - break point chlorination

UNIT II **10 Hours**

ELECTROCHEMISTRY

Introduction - EMF - Single electrode potential -Calomel electrode - Glass electrode -pH measurement using glass electrode - Electrochemical series. Cells: Electrochemical cells - Cell reactions- Reversible cells and irreversible cells. Batteries - characteristics of battery - types of batteries, construction, working and applications: Primary (alkaline) and secondary (lead-acid and nickel-cadmium) - Modern batteries (zinc air battery and lithium batteries) - precautions for battery maintenance. Fuel cell: Hydrogen - Oxygen fuel cell.Electroplating of copper and electroless plating ofnickel

UNIT III **8 Hours**

FUELS AND COMBUSTION
Fuel: Introduction - classification of fuels - calorific value - higher and lower calorific values - analysis of coal (proximate and ultimate) - carbonization - manufacture of synthetic petrol (Bergius process) - knocking - octane number - cetane number - natural gas - Compressed Natural Gas (CNG)- Liquefied Petroleum Gases (LPG) - producer gas - water gas. Combustion of fuels: introduction- theoretical calculation of calorific value - calculation of stoichiometry of fuel and air ratio - ignition temperature

UNIT IV **9 Hours**

POLYMER AND COMPOSITES
Monomers - functionality - degree of polymerizations - classification of polymers based on source and applications; porosity - tortuosity - molecular weight determination by Ostwald method - polymerization methods: addition, condensation and copolymerization - mechanism of free radical polymerization - thermosetting and thermoplastics. Polymer blends - composites, significance, blending-miscible and immiscible blends, phase morphology, fibre reinforced plastics, long and short fibre reinforced composites

UNIT V **8 Hours**

NANOMATERIALS
Types of Nanomaterials - Nano particles - nanoclusters - nano rod - nanowire -nano tube. Synthesis: Top down process: laser ablation - electrodeposition - chemical vapor deposition. Bottom up process: Precipitation - thermolysis - hydrothermal - solvothermal process. Carbon nanotubes: Types - production - properties - applications. Working principle and applications - Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) - UV-Visiblespectrophotometer

FOR FURTHER READING
Application of nanomaterials in medicine, environment, energy, information and communication sectors

1 **2 Hours**

EXPERIMENT 1
General instructions to students - Handling reagents and safety precautions

2 **4 Hours**

EXPERIMENT 2
Water quality of BIT campus - River - Bore well water with respect to hardness, TDS and pH

3 **4 Hours**

EXPERIMENT 3
Determination of strength of hydrochloric acid in a given solution using pH meter

4 **4 Hours**

EXPERIMENT 4
Determination of strength of a commercial mineral acid by conductometric titration

5 **4 Hours**

EXPERIMENT 5

Conductometric titration of mixture of acids

6 **4 Hours**

EXPERIMENT 6

Determination of the strength of iron in the given sample by potentiometric method

7 **4 Hours**

EXPERIMENT 7

Determination of molecular weight of polyvinyl alcohol by Ostwald viscometry method

8 **4 Hours**

EXPERIMENT 8

Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method

Total: 75 Hours

Reference(s)

1. M. Munjal and S.M. Gupta, Wiley Engineering Chemistry, Second edition, Wiley India Pvt. Ltd, New Delhi, 2013
2. A. Pahari and B.Chauhan, Engineering Chemistry, Infinity Science press LLC, New Delhi,2010
3. P.H. Rieger, Electrochemistry, Springer, Netherland, Second Edition (Reprint)2012
4. Fred W. Billmeyer JR, Textbook of polymer science, John Wiley & sons, Third edition,2008
5. G. Cao, Ying Wang, Nanostructures and Nanomaterials: Synthesis, Properties, and Applications, World Scientific, New Jersey, 2011
6. S. Sarkar, Fuels and combustion, 3rd edition, Orient Longman Ltd. New Delhi,2010

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	1	1	1		2	4	3			1	3		1		3				1						21
2	2	1	2		2	5	2		1	1	3				1				1						21
3	1	2	2		1	3	3			2	2			1	1				1						19
4	1	1	1		3	4	1		1	1	3			1	2				1						20
5	1	1	1		1	2	2			2	3			2	2				2						19
																								Total	100

Assessment Questions

Remember

1. Define the term break pointchlorination.
2. Name a method to prevent the scale formation in the industrialboilers.
3. Define single electrode potential of anelectrode.
4. List any two advantages of H2-O2 fuelcell.
5. Define functionality of amonomer.
6. Name any two thermoplastic and thermosettingpolymers.
7. List any four advantages ofCNG.

8. Recall any two application of X-Raydiffractometer.
9. List three factors which affects the standard electrode potential ofcell.

Understand

1. Illustrate any three applications of electrochemicalseries.
2. Summarize the four applications ofcalorimeter.
3. Explain the components of TEM with a neatsketch.
4. Compare bottom up approach with top down approach of nanoparticlesynthesis.
5. Distinguish between alkaline and non alkalinehardness.
6. Differentiate between thermoplastic and thermosettingplastics
7. Why copper cannot displace hydrogen from mineral acidsolution?
8. Identify two significances of RO method in watertreatment.
9. Indicate any two advantages of water gas over producergas.
10. Compare nanocluster withnanocrystal.
11. Identify the reasons for change of properties of materials atnanoscale.

Apply

1. A water sample contains 204 mgs of $CaSO_4$ and 73 mgs of $Mg(HCO_3)_2$ per litre. Calculate the total hardness in terms of $CaCO_3$equivalence.
2. 100 ml of sample water has hardness equivalent to 12.5ml of 0.08N $MgSO_4$. Calculate hardness inppm.
3. Find out the single electrode potential of a half cell of zinc electrode dipped in a 0.01M $ZnSO_4$ solution at 25°C? E° Zn/Zn^{2+} = 0.763 V, R=8.314 $JK^{-1}Mol^{-1}$, F= 96500Coulombs.
4. Calculate the reduction potential of Cu^{2+}/Cu=0.5M at 25°C. E° Cu^{2+}/Cu=+0.337V.
5. Find out the weight and volume of air required for the complete combustion of 1 kg ofcoke.
6. A sample of coal containing 60% C, 6% H, 33% O, 0.5 % S, 0.2% N and 0.3% of ash. Find the gross and net calorific value ofcoal.
7. Calculate the degree of polymerization of polypropylene having molecular weight of25200.
8. Apply the principle of ion selective electrode to determine the pH of HCl solution using glass electrode withequations.

Analyse

1. Calgon conditioning is advantageous over phosphate conditioning- reasonout.
2. Soft water is not demineralized water whereas demineralized water is a soft water-Jusify.
3. Hydrogen electrode is not generally used for pH measurements –Why?
4. Zinc reacts with dil.H_2SO_4 to give hydrogen but silver doesn’t liberate hydrogen. Givereasons.
5. Good fuel should have low ash content- Givereasons.
6. Sugar is an example of non-electrolyte - Reasonout.

15CH205 WATER TECHNOLOGY AND GREEN CHEMISTRY

3 0 2 4

Course Objectives

- Imparting the knowledge on the principles of water technology and greenchemistry
- Understanding the principles and applications of green technology in watertreatments
- Infer the engineering applications of green chemistry in dyes, corrosion engineering and nanotechnology

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Explain the importance of green chemistry with its emergence anddevelopment.
2. Realize the designing of safer methodologies for green technology to meet the objectives of green engineering.
3. Identify the type of corrosion and its mechanism which will help to develop the corrosion control methods.
4. Apply suitable technique to extract natural dye from itssource.
5. Familiarize with the synthesis and characterization techniques ofnanomaterials.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1												
2												
3	2	2										
4												
5												

UNIT I **9 Hours**

WATER TREATMENT

Water quality parameters - Hardness of water - Disadvantages of hard water - Degree of hardness and its estimation (EDTA method) - Boiler feed water - Boiler troubles: Priming, foaming and caustic embrittlement - Softening of hard water: Internal conditioning: Sodium hexameta phosphate - Phosphate methods; External conditioning: Ion exchange method - Desalination: Reverse osmosis - Electrodialysis. Domestic water treatment - Disinfection of water - Break point chlorination.

UNIT II **8 Hours**

WASTE WATER ANALYSIS

Basic principles and concept of green chemistry - Need of green chemistry in day-to-day life - Scientific areas for practical applications of green chemistry - Industrial effluents - Waste water analysis: Concept ofchemical oxygen demand (COD) and biological oxygen demand (BOD) - Removal of trace pollutants in waste water: Membrane Bioreactor (MBR) technology - Wet oxidationmethod.

UNIT III **10 Hours**

CHEMISTRY OF CORROSION

Corrosion: Mechanism of corrosion - chemical and electrochemical - Pilling-Bedworth rule - oxygen absorption - hydrogen evolution - galvanic series. Types of corrosion: Galvanic corrosion - differential aeration corrosion (pitting, pipeline, water line and wire fence corrosion) - factors influencing corrosion. Methods of corrosion control: choice of metals and alloys - proper designing - cathodic protection (Sacrificial anode method, impressed current method)-modifying the environment. Protective coatings: Concept of electroplating: electroplating (gold and copper) - electroless plating (nickel and copper).

UNIT IV **9 Hours**

NATURAL DYES

Introduction - definition - classification of natural dyes - concept of chromophores and auxochromes - Extraction process of colour component from natural dyes: Aqueous extraction, non-aqueous extraction - Purification of natural dyes: Chromatography techniques - Types - Column chromatography - thin layer chromatography - Qualitative analysis: UV-Visible spectroscopic study - Mordant: Metallic and non-metallic mordant - advantages and disadvantages of natural dyes.

UNIT V **9 Hours**

NANOMATERIALS

Types of Nanomaterials - Nano particles - nanoclusters - nano rod - nanowire - nano tube. Synthesis: Top down process: laser ablation - electrodeposition - chemical vapor deposition. Bottom up process: Precipitation - thermolysis - hydrothermal - solvothermal process. Carbon nanotubes: Types - production - properties - applications. Working principle and applications: Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) - UV- Visible spectrophotometer. Synthesis of Au and Ag nanoparticles using plant extract -Advantages.

FOR FURTHER READING

Protection of metals in concrete against corrosion - Microwave technology on greenchemistry

1 **2 Hours**

EXPERIMENT 1

General instructions to students - Handling reagents and safety precautions

2 **4 Hours**

EXPERIMENT 2

Water quality- river/bore well water with respect to hardness and TDS

3 **4 Hours**

EXPERIMENT 3

Determination of strength of hydrochloric acid in a given solution using pH meter

4 **4 Hours**

EXPERIMENT 4

Estimation of strength of iron by potentiometric method using calomel electrode

5 **4 Hours**

EXPERIMENT 5

Extraction of a natural dye by aqueous extraction method

6 **4 Hours**

EXPERIMENT 6

Measurement of rate of corrosion of mild steel in aerated neutral/acidic/alkaline solution by weight loss measurements/Tafel polarization method

7 **4 Hours**

EXPERIMENT 7

Determination of dye concentration in a given sample by using UV-Visible spectroscopic method

8 **4 Hours**

EXPERIMENT 8

Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method

Total: 75 Hours

Reference(s)

1. M. Munjal and S.M. Gupta, Wiley Engineering Chemistry, Second edition, Wiley India Pvt. Ltd, New Delhi,2013
2. V K Ahluwalia, Green Chemistry - Environmentally Benign Reactions, Ane Books Pvt. Ltd., New Delhi, 2nd Edition, 2012
3. Giusy Lofrano, Green Technologies for Wastewater Treatment - Energy Recovery and Emerging Compounds Removal, Springer Dordrecht Heidelberg, New York, London,2012
4. Ashis Kumar Samanta and Adwaita Konar, Natural Dyes - Dyeing of Textiles with Natural Dyes, Dr.Emriye Akcakoca Kumbasar (Ed.), InTech Publisher, New Delhi,2011
5. J. C. Kuriacose and J. Rajaram, Chemistry in Engineering & Technology, Vol. 1&2, Tata McGraw-Hill, New Delhi,2010
6. David Pozo perez, Nanotechnology and Nanomaterials, InTech Publishers, NewDelhi,2010

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	2			3	3				3	3			2	1							1			20
2	2				3	4				2	2			2	1			1							17
3	1	2	1		4	3	3			1	3			1	2			2							23
4	1	2			6	6				3												2			20
5	3	2	2		3	6	2		2																20
																								Total	100

Assessment Questions

Remember

1. List out any four water qualityparameters.
2. Name the salts responsible for temporary hardness ofwater.

3. Recall any two practical applications of greenchemistry.
4. Define wet oxidation in waste watertreatment.
5. State Pilling Bed-worth′srule.
6. Recall any two examples for differential aerationcorrosion.
7. Name any two naturaldyes.
8. Recall the role of auxochromes indyes.
9. Name the four methods of nanomaterialsynthesis.
10. Name any two plant extracts used in silver nanoparticlessynthesis.

Understand

1. Hardness of water is always expressed in terms of $CaCO_3$ equivalent. Reasonout.
2. Soft water is not demineralized water whereas demineralized water is soft water -Justify.
3. Represent the need of green chemistry in waste watertreatment.
4. Indicate the importance of MBR technology in waste watertreatment.
5. Express the mechanism of wetcorrosion.
6. Bolt and nut made from same metal is preferred in practice. Reasonout.
7. Classify the types of natural dyes based on their chemicalstructure.
8. Compare the properties of metallic and non-metallicmordents.
9. Infer any two important needs of green chemistry in nanotechnologysector.
10. Identify the physicochemical and engineering properties ofnanomaterials.

Apply

1. A sample of water contains 180 mgs of MgSO4 per litre. Calculate the hardness in terms of CaCO3 equivalents. (Molecular weight of MgSO4 is120).
2. Calculate the non-carbonate hardness of a sample of water containing the dissolved salts as given below in mg/l Mg(HCO3)2 = 7.3; Ca(HCO3)2 = 40.5 and NaCl=50.
3. Select the scientific areas for the practical applications of greenchemistry.
4. Predict the significance of sacrificial anode in the prevention ofcorrosion.
5. Outline the principle of electro-deposition to achieve copper coating on stainless steel object with a neatdiagram.
6. Select a suitable technique used for the purification of naturaldye.
7. Assess the role of Scanning Electron Microscope (SEM) in nano-materialscharacterization.

Analyse

1. Distinguish between scale andsludge.
2. Identify the four reasons for boilertroubles.
3. Differentiate between BOD andCOD.
4. The rate of corrosion increases with increase in temperature. Givereason.
5. Outline the effect of pH of the conducting medium oncorrosion.
6. Differentiate chromophores & auxochromes indyes.

Evaluate

1. Substantiate the statement that nature of the environment affectscorrosion..
2. Choose and explain any two best methods to synthesisnanoparticles.

Create

1. Plan and execute a method to get pure water from waste water using available low coast material in yourarea.
2. Relate the characteristic properties of natural with syntheticdyes.

DISCIPLINE ELECTIVES

15CE001 HYDROLOGY 3 0 0 3

Course Objectives

- To enhance the knowledge on the various components of hydrologiccycle
- To impart knowledge on spatial and temporal distribution of water available in anyregion
- At the end of the course the students will be able to estimate the rainfall and ground waterflow

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Evaluate the rainfall intensity by variousmethods
2. Compute the losses fromPrecipitation
3. Estimate the discharge from a riverbasin
4. Identify the types of flood, flood zoneareas
5. Estimate the Aquiferparameters.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	3										
2	1	3										
3	2											
4	3											
5	2	3										

UNIT I **9 Hours**

PRECIPITATION

Introduction-Climate and Weather -Air mass- Air front -Hydrologic cycle - Types of precipitation - Measurement of Rainfall -Spatial measurement methods -Temporal measurement methods - Rainfall Hyetograph- Frequency analysis of point rainfall - Intensity, duration, frequency relationship - Probable maximum precipitation.

UNIT II **10 Hours**

ABSTRACTION FROM PRECIPITATION

Losses from precipitation -Interception and depression storage - Evaporation-Transpiration-Evapotranspiration-Infiltration-Effective rainfall- Runoff - Measurement of infiltration -Infiltration indices

UNIT III **9 Hours**

HYDROGRAPHS

Baseflow separation - Unit hydrograph- Derivation of unit hydrograph - S curve hydrograph - Unit hydrograph of different deviations - Synthetic Unit Hydrograph .

UNIT IV **9 Hours**

FLOODS AND FLOOD ROUTING

Hydrologic extremes - Flood -Types of Flood -Recurrence interval - Gumbels method -Flood routing - Reservoir flood routing- Muskingum Channel Routing - Flood control - Run-off and Estimation of Run-off

UNIT V **8 Hours**

GROUND WATER HYDROLOGY

Darcy's law- Dupuit assumptions- Confined Aquifer- Unconfined Aquifer -Recuperation test-Transmissibility- Specific capacity- Yield of a well-Pumping test- Steady flow analysis

FOR FURTHER READING

Rain gauge network - Factors affecting Run-off- Factors affecting Hydrograph- Flood frequency studies-Artesian Wells -Water conservation measures-Rain water and Runoff Harvesting in Rural and Urban Areas-Methods of artificial groundwater recharge

Total: 45 Hours

Reference(s)

1. K Subramanya, Engineering Hydrology, Tata McGraw Hill, New Delhi,2008
2. VenTe.Chow, D.R. Maidment and L.W. Mays, Applied Hydrology, McGraw Hill, New York, 2008
3. P. Jayarami Reddy, Hydrology, Tata McGraw Hill, New Delhi ,2008
4. H. Ragunath, Hydrology, Wiley Eastern Limited, NewDelhi,2003

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	3				5				3			2	5											20
2	2	3			2	3							5		5										20
3	2		3		2	3				3			2	5											20
4	3	2			3	2								5	5										20
5	2	3				5							2	8											20
																								Total	100

Assessment Questions

Remember

1. List the 6 forms ofprecipitation.
2. Define unithydrograph.
3. State Darcy'slaw.
4. State unit hydrograph. List the 4 with assumptions of unit hydrograph theory. Also list the 2 limitations of the unit hydrographtheory.
5. Write short noteon
   a) Aquifer b)Aquifugec)Aquiclude

6. Define baseflow.
7. What are the types ofPrecipitation?
8. Define the term recurrenceinterval.
9. Define S CurveHydrograph.
10. Define effectiverainfall.

Understand

1. Define drainagedensity.
2. Explain the Muskinghum method of Channel routing with neatsketch.
3. Explain with neat sketch the method of estimating the infiltration capacity of soil by double ring infiltrometer.
4. Explain with neat sketch about floating type raingauge.
5. Discuss briefly aboutEvaporimeters.
6. Briefly explain with neat sketch of weighing bucket type raingauge.
7. Differentiate Hyetograph andHydrograph.
8. Draw a neat sketch of hydrologiccycle.
9. What are the disadvantages of weighing buckettype?
10. Explain intensity durationgraph.

Apply

1. Describe the purpose of different types of instruments are commonly installed in an hydro metrologicalstation
2. How precipitation is measured and lists the errors that occur in the instruments ofprecipitation?
3. Compute the average precipitation by the arithmetic average mean method and thiessen polygon method from the followingdata.

Station no	Precipitation (mm)	Area (sq.km)
1	30.8	45
2	34.6	40
3	32.0	30
4	24.6	38

4. The rainfall data for Mumbai observed for 100 years is only once. Find theprobability
   (i) only once in 35 successiveyears
   (ii) twice in 20 successiveyears
   (iii) at least once in 50 successiveyears
5. In a drainage basin there exist 6 raingauges and average rainfall at these stations is 108,93,70,53,61,50cm. Determine whether the number of raingauge stations is enough to yieldÂ a representative and reliable picture of intensity and duration of rainfall on the basin with 10%error.
6. Describe the S curve method of developing 6 h UH by using 12 h UH of thecatchment
7. Derive a 3 hr synthetic unit hydrograph of a basin with the followingdata
   Basin area=3000Km^2, Length=120km, Distance from centroid of the basin to the outlet=63Km.The synder’s coefficients Ct and Cp may be assumed to be 1.60 and 0.64 respectively. Construct the hydrograph
8. Derive a 3 hr synthetic unit hydrograph of a basin with the followingdata
   Basin area=3000Km^2, Length=120km, Distance from centroid of the basin to the outlet=63Km.The synder’s coefficients Ct and Cp may be assumed to be 1.60 and 0.64 respectively. Construct the hydrograph
9. calculate the average precipitation by isohyetalmethod

Isohyets (cm)	Area(km^2)
Station -12.0	30
12.0-10.0	140
10.0-8.0	80
8.0-6.0	180
6.0-4.0	20

Analyse

1. List the factors affecting a flood hydrograph. Discuss the role of thesefactors.
2. Describe the analysis of the recession limb of a floodhydrograph
3. . Describe the procedure for deriving a D h unit hydrograph from the UH of thecatchment
4. What are the reasons for error in measurement ofprecipitation?
5. Describe the methods to reduce the evaporation rate from a watersurfaces.
6. Describe about the Factors affectinginfiltration.
7. Differentiate between infiltration andpercolation.
8. Describe the frequency analysis of a rainfalldata
9. How can you differentiate between a lake and areservoir
10. Give four major concerns in designing hydrological stationnetwork.

15CE002 TRANSPORTATION PLANNING AND SYSTEMS

3 0 0 3

Course Objectives

- To enhance the knowledge of students on transportation planningtechniques
- To distinguish the successful features of innovative transportation planningschemes
- To impart knowledge on transportationeconomics

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Characterize transportation planning based on the concepts involved in itsdevelopment
2. Identify and analyze the suitable zones and techniques involved in making trips to variousplaces.
3. Analyze the trip distribution and identify the mode bymodeling.
4. Identify and apply different techniques for different routeassignments
5. Estimate the demand and cost for Transportationplanning

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1										
2	3	2	1									
3	1	3	1									
4	1	3										
5	2	1										

UNIT I **9 Hours**

INTRODUCTION

Transportation planning process and concepts - Transportation problems - Urban travel characteristics - Concept of travel demand - Demand function - Demand estimation - Sequential, recursive and simultaneous processes- Land use transport interaction.

UNIT II **9 Hours**

TRIP GENERATION

Trip generation analysis - Zoning - Types and sources of data - Expansion factors - Accuracy checks - Trip generation models - Zonal models - Household models - Category analysis - Trip attractions of work centers

UNIT III **9 Hours**

TRIP DISTRIBUTION AND MODE CHOICE MODELING

Trip distribution analysis - Trip distribution models - Growth factor models - Gravity models - Opportunity models- problems in distribution models - Mode split analysis - Mode split Models - Mode choice behaviour, competing modes, mode split curves, probabilistic models

UNIT IV **9 Hours**

ROUTE SPLIT ANALYSIS

Traffic assignment - Route split analysis: Elements of transportation networks, nodes and links - Minimum path trees - All-or-nothing assignment - Multipath assignment - Capacityrestraint.

UNIT V **9 Hours**

TRANSPORT ECONOMICS

Scope of transportation economics - Transportation demand - Demand- Supply and equilibrium- Sensitivity of travel demand - factors affectingelasticites.

FOR FURTHER READING

Historical development of urban transportation - Various surveys for data collection - Factors influencing mode choices - Introduction to BPR - Elements of engineering economics

Total: 45 Hours

Reference(s)

1. C. JotinKhisty and B. Kent Lall, Transportation Engineering, Prentice Hall of India, New Delhi, 2003
2. L. R. Kadiyali, Traffic and TransportationPlanningg, Khanna Publishers Ltd., New Delhi, 2016
3. M. J. Bruton, Introduction to Transportation Planning, Hutchinson, London,1992

4. C. S. Papacostas and Prevedouros, Transportation Engineering and Planning, Prentice Hall of India, New Delhi,2002
5. B. G. Hutchinson, Principles of Urban Transportation System Planning, Tata McGraw Hill,2007

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2					2					6				4				6						20
2	4					4				2				6					4						20
3	2				5					4					4						5				20
4	4					4				4					4							4			20
5	4					4				12															20
																								Total	100

Assessment Questions

Remember

1. List out the various TransportationProblems
2. Mention the assumptions of categoryanalysis.
3. What effective method will improve Mass TransportationSystem?
4. What iszoning?
5. List out the different types of trip distributingmodel.
6. Recall the purpose of doing Transportation DemandAnalysis.
7. What is Trip GenerationModel?
8. Find out in which model vehicular trips are estimated rather than persontrips.
9. Does the transportation have any applications relating to QueuingTheory?
10. Recall the purpose of doing Transportation DemandAnalysis
11. What is Capacityrestraint?
12. What is Sensitivity oftravel?

Understand

1. Explain the systems approach to transportation planning with a neatsketch.
2. List out the various steps in transportationplanning.
3. Summarize the Technique of TripAssignment.
4. When do you prefer single plane method and Double planemethod
5. List out the various factors governing the trip generation andattraction.
6. Compare the merits and demerits of different types of surveys employed for collecting the data in the transportation planningprocess.

Analyse

1. A self contained town consists of four residential areas A,B, C and two industrial estates X and Y. Generation equation shows that, for the design year in question, the trips from home to work generated by each residential area per 24 hour day are asfollows:
   There are 3,700 jobs in industrial estate X and 4,500 in industrial estate Y. It is known that the attractin between zones is inversely proportional to the square to the journey times between zones. The journey times in minutes from home to work are: Calculate and tabulate the inter-zonal trips for journeys from home towork.
2. In order to relieve congestion on an urban street network a motorway is proposed to be constructed. The travel time from one zone centroid to another via the proposed motorway is

estimatedtobe10minuteswhereasthetimeforthesametravelviatheexistingstreetsis18

minutes. The flow between the two zones centroids is 1000 vehicles per hour. Assign the flow between the new motorway and existing streets.

Evaluate

1. Which isTrue
   Trip involves movement from a single origin to a single destination.
   Trip Involves movement from single origin and reach multiple destinations.
2. Compare and contrast the multiple linear regression analysis and categoryanalysis

Create

1. Does Forecasting Urban Activity help in predicting Trip Assignment?

15CE003 PREFABRICATED STRUCTURES 3 0 0 3

Course Objectives

- To impart knowledge on prefabricated elements and the technologies used for fabrication and erection
- To impart knowledge on the applications of prefabricated elements inconstruction

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Understand the general principles offabrication
2. Design of simple rectangular beams and Ibeams
3. Demonstrate the suitable techniques for erection of different types of members like beams, slabs, wall panels andcolumns
4. Hoist equipments for different types ofmembers
5. Designing and detail the precastunit

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1		2	3							
2		3	2	2								
3		1		2	2							
4				1	2							
5		2	2	3								

UNIT I **9 Hours**

GENERAL PRINCIPLES OF FABRICATION

Comparison with monolithic construction - Types of prefabrication - site and plant prefabrication - Economy of prefabrication - Modular coordination - Standardization - Planning for Components of prefabricated structures - Disuniting of structures - Design of simple rectangular beams and I beams - Handling and erection stresses - Elimination of erection stresses - Beams, columns - Symmetrical frames

UNIT II **9 Hours**

PREFABRICATED ELEMENTS

Roof and floor panels, ribbed floor panels - wall panels - footings - Joints for different structural connections - Effective sealing of joints for water proofing - Provisions for non-structural fastenings.

UNIT III **9 Hours**

PRODUCTION TECHNOLOGY

Choice of production setup - Manufacturing methods - Stationary and mobile production - Planning of production setup - Storage of precast elements - Dimensional tolerances.

UNIT IV **9 Hours**

HOISTING TECHNOLOGY

Equipments for hoisting and erection - Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns.

UNIT V **9 Hours**

APPLICATIONS

Designing and detailing of precast unit for factory structures - Purlins, Principal rafters, roof trusses, lattice girders, gable frames - Single span single storeyed frames - Single storeyed buildings - slabs, beams andcolumns.

FOR FURTHER READING

Acceleration of concrete hardening - Vacuum lifting pads - Expansion joints in pre-cast construction.

Total: 45 Hours

Reference(s)

1. L. Mokk, Prefabricated Concrete for Industrial and Public Structures, Publishing House of the Hungarian Academy of Sciences, Budapest,2007.
2. T. Koncz, Manual of Precast Concrete Construction, Vol. I, II, III &IV, Berlin,1988
3. B. Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam, London, New York,1998
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland Betor Verlag,2009

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	3					3				3			3				3			3					18
2			4					4				3			4			4							19
3	5					4					4			3			5								21
4	5					5			3	3			5					5							26
5	5						3					3			3			2							16
																								Total	100

Assessment Questions

Remember

1. Define module and classify the types ofmodule.
2. List out the precautions taken while erecting precastelements.
3. How the prefabricates are classified based on the number of different materialsused?
4. Define hollow coreslab.
5. Define ribbed roofslab.
6. Explain RCCpanel.
7. How beam to beam connection is made by using vertical steelplate?
8. What are the characteristics for selecting the materials forprefabrication
9. Predict the various types of joints for different structuralconnections.

Understand

1. Describe and illustrate the erection of prefabricated beams and columns with neatsketches.
2. Classify the types of floor slab with sketches.
3. Classify the types of sealants available and give examples for eachtype.
4. Explain why vacuum lifting pads are used in productionsetup.
5. Define cellularconcrete.
6. Define solidpurlin.

Apply

1. Explain the various types of disuniting of structures with neatsketch.
2. Explain the design concept of simple rectangular beams with step by stepprocedure.

Analyse

1. Compare prefabrication with monolithicconstruction
2. Distinguish between site prefabrication and plantprefabrication
3. Discuss the various sealants used for waterproofing.

Evaluate

1. Discuss about Column to column dowelledconnection.
2. Explain the conveyor belt or production line system Productiontechnique?
3. Explain in detail with sketches the prefabrication system and their relative merits and field of application

15CE004 MASS TRANSPORTATION SYSTEM 3 0 0 3

Course Objectives

- To enhance the knowledge on function of public transit and the role of governmentunits
- To impart knowledge on mass transportationsystem

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Analyze the modes of masstransportation
2. Acquisition of skills on mass transportationsystems
3. Design and evaluation oftransport.
4. Better knowledge on planning of transitsystems.
5. Knowledge on developments in publictransportation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1					1							
2					1							
3	1		2									
4				2								
5				1								

UNIT I **9 Hours**

INTRODUCTION

Urban transportation systems - Mass rapid transit system - Light rail transit - Personal rapid transit, guided way systems, cabin taxi, dual mode bus - Para transit systems - Demand responsive system - Intermediate publictransport.

UNIT II **9 Hours**

MASS TRANSPORTATION SYSTEM

History and role of Transit - Recent Trends Mass Transportation Characteristics - Demand Characteristics - Spatial - Temporal and Behavioral - Characteristics of Transportation Demand. - Urban Mass Transportation Planning - Demand Surveys - Transit oriented land usedevelopment.

UNIT III **9 Hours**

DESIGN AND EVALUATION OF MASS TRANSPORT

Four Stages of Planning - Performance Evaluation of Mass Transport System - Structure of Decision Making, - Evaluation and Selection Methods - Selection Procedures - Economic Evaluation Methods.Terminals and their functions - Design, Typical Characteristics. - Scheduling, Service Analysis, Vehicle Dispatch Policy, Vehicle Requirements, Spacing of Bus Tropos, - Route Spacing and Performance - Operational and
Management Issues - Reserved Bus Lanes - Signal Preemption, - Dial-a-Bus

UNIT IV **9 Hours**

TRANSIT PLANNING

Introduction - Definition - Shuttle systems - Corridors - Two dimensional system - Realistic cases only - Flexible transit - Individual public transportation system -Collective transportation

UNIT V **9 Hours**

PUBLIC TRANSIT

Introduction to public transit - History - Personal public transit experiences -Public transportation system characteristics - Mass transit definitions and classifications - Route development - stop location and stopping policy - Schedule development.

FOR FURTHER READING

Historical development of urban transportation - Estimation and Demand Projection -advance developments - Special Studies on Vehicle Monitoring and Control System - Systems in reliable transit operations- Features of public transportation

Total: 45 Hours

Reference(s)

1. C. Jotin Khisty and B. Kent Lall, Transportation Engineering, Prentice Hall of India, New Delhi, 2003
2. Hutchinson, B.G., Principles of Urban Transport Systems Planning Mc Graw Hill,New York, 1974
3. M. J. Bruton, Introduction to Transportation Planning, Hutchinson, London,1992
4. Vuchic V.R., Urban Public Transportation System and Technology, Prentice Hall, Inc. Englewood Cliffs, New Jersey,1981.
5. Agarwal M.K., Urban Transportation in India, INAE, Allied Publishers Ltd.,1996
6. Grey G.E. &Hoel, LA, Public Transportation? Prentice Hall, Englewood Cliffs,N.J.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5	5				10																			20
2		5				5				10															20
3		10				10																			20
4	10	10																							20
5		10				5				5															20
																								Total	100

Assessment Questions

Remember

1. What is urban transportationsystem?
2. List out the various TransportationProblems.
3. What is Trip GenerationModel?
4. Does the transportation have any applications relating to QueuingTheory?
5. Find out in which model vehicular trips are estimated rather than persontrips.

Understand

1. Define Mass rapidtransit
2. List out the characteristics of urban transportationsystem
3. How demand surveys are done fortransportation?
4. What is personal rapidsystem?
5. Explain the systems approach to transportation planning with a neatsketch.
6. List out the various steps in transportationplanning.
7. Summarize the Technique of TripAssignment.
8. When do you prefer single plane method and Double planemethod

Apply

1. Differentiate between mass transit and urbantransport
2. List out the various factors governing the trip generation andattraction.
3. Compare the merits and demerits of different types of surveys employed for collecting the data in the transportation planningprocess.

Analyse

1. A self contained town consists of four residential areas A,B, C and two industrial estates X and Y. Generation equation shows that, for the design year in question, the trips from home to work generated by each residential area per 24 hour day are as follows:There are 3,700 jobs in industrial estate X and 4,500 in industrial estate Y. It is known that the attractin between zones is inversely proportional to the square to the journey times between zones. The journey times in minutes from home to work are: Calculate and tabulate the inter- zonal trips for journeys from home towork.
2. In order to relieve congestion on an urban street network a motorway is proposed to be constructed. The travel time from one zone centroid to another via the proposed motorway is estimated to be 10 minutes whereas the time for the same travel via the existing streets is 18 minutes. The flow between the two zones centroids is 1000 vehicles per hour. Assign the flow between the new motorway and existingstreets.

Evaluate

1. Compare and contrast the multiple linear regression analysis and category analysis

Create

1. Does Forecasting Urban Activity help in predicting Trip Assignment?

15CE005 BASICS OF STRUCTURAL DESIGN AND ASEISMIC DESIGN OF STRUCTURES

3 0 0 3

Course Objectives

- To impart knowledge on the theory of vibration and basics of structuraldynamics
- To impart the design philosophy of earthquake resistant design ofstructures
- To create awareness on the use of codal provisions for aseismic design ofstructures

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Analyze a structure by seismic coefficientmethod.
2. Recall the lessons learnt from pastearthquakes
3. Design building with seismicresistance
4. Design masonry building with seismicresistance
5. Retrofit the RC buildings and structuralelements

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	1									
2		2	1									
3		2	2									
4		2	2									
5		1	1	2								

UNIT I **9 Hours**

INTRODUCTION AND PRINCIPLES OF DYNAMICS

Vibration studies and their importance to structural engineering problems - Elements of vibratory systems and simple harmonic motion - Vibration with and without damping - Generalized mass - D' Alembert's principle - Degree of freedom: Equation of motion for S.D.O.F. - Damped and undamped free vibrations - Undamped forced vibration

UNIT II **9 Hours**

INTRODUCTION TO EARTHQUAKE ENGINEERING

Elements of engineering seismology - Causes of earthquakes - Seismic waves - Magnitude - Intensity and Energy release - Indian seismology - Earthquake history - Catastrophies - Failures - Lessons learnt from past earthquakes - Seismic zone map of India - Strong motion characteristics

UNIT III **9 Hours**

ASEISMIC DESIGN OF BUILDINGS

Idealization of building frames - Introduction to methods of seismic analysis - Equivalent static analysis - IS 1893 provisions - Design horizontal seismic coefficient - Design base shear distribution - Seismic resistant design of buildings

UNIT IV **9 Hours**

EARTHQUAKE RESISTANT CONSTRUCTION

Earthquake resistant properties of materials - Lateral force resisting systems - Strong column weak beam - Guidelines for seismic resistant construction - Building configuration requirements - Ductile detailing of reinforcements in RC buildings - Behavior and design of masonry structures-Behaviour of Tall building under seismic and wing conditions.

UNIT V **9 Hours**

REPAIRS AND RETROFITTING

Code of practices for repairs and retrofitting - Retrofitting of RC buildings and structural elements - Techniques of retrofitting - Improving structural integrity of masonry buildings - Retrofitting by seismic isolation - Case studies

FOR FURTHER READING

Application of software packages for structural dynamics problems.(USING STAAD PRO and ETABS)

Total: 45 Hours

Reference(s)

1. Mario Paz, Structural Dynamics - Theory and Computation, CBS Publications,2004
2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of Structures, Prentice Hall of India,2006
3. IS 1893 - 2002, Criteria for Earthquake Resistant Design ofStructures
4. IS 4326 - 1993, Earthquake Resistant Design and Construction of Buildings - Code of Practice
5. IS 13920 - 1993, Ductile Detailing of Reinforced Concrete Structures to Seismic Forces - Code of Practice
6. IS 13935 - 1993, Repair and Seismic Strengthening of Buildings -Guidelines

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5				5				5				5												20
2		4				4				3	3				4				2						20
3		3		3			2		2		3			3	2			2							20
4	3		2			3			2	2		3			2		3								20
5	3	3			4						3			3				4							20
																								Total	100

Assessment Questions

Remember

1. What is the formula for free vibrationresponse?
2. Definedamping.
3. Define staticforce.
4. Write a short note on single degree of freedom (SDOF)systems.
5. Define logarithmic decrement method.Define logarithmic decrementmethod.
6. List out the scales which is used to measure earthquakeintensity.
7. Explain with sketches, details of different types of seismic waves and theirpropagation.
8. With neat sketches explain the different types of body waves and surfacewaves.
9. Explain the principle of working of a seismograph with the help ofsketches
10. Define the term DBE, MCE andMMI.
11. Define lateral load analysis of buildingsystem.

Understand

1. Compare P waves and Swaves.
2. What is the difference between the Richter scale and the moment magnitudescale?

Apply

1. Derive the equation for the idealized one story system subjected to earthquakeexcitation?
2. Draw a schematic diagram of seismograph and explain itsfunctions.

Analyse

1. DefineResonance.
2. A harmonic excitation has a maximum velocity of 6m/sec and it has a frequency of 12cps. Determine its amplitude, its period and its maximum acceleration.A harmonic excitation has a maximum velocity of 6m/sec and it has a frequency of 12cps. Determine its amplitude, its period and its maximum acceleration.A harmonic excitation has a maximum velocity of 6m/sec and it has a frequency of 12cps. Determine its amplitude, its period and its maximumacceleration.
3. Derive the governing differential equation for a undamped free vibration of SDOFsystem.

Evaluate

1. A vibrating system consist of a mass 5kg, spring of stiffness 120N/m and a damper with a damping co-efficient of 5Nsec/mDetermine
   a. Dampingfactor
   b. natural frequency of dampedvibration
   c. logarithmicdecrement
   d. ratioof two successive amplitudes.
   e. number of cycles after which the initial amplitude is reduced to25%
2. Discuss the different types of seismicwaves.

15CE006 RAILWAYS, AIRPORTS AND HARBOR ENGINEERING

3 0 0 3

Course Objectives

- To impart a basic knowledge in railway planning and itscomponents.
- To impart a basic knowledge in planning of harbor and itscomponents.
- To provide a basic knowledge in planning and design ofairports.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Spot the best track alignment
2. Design the railwaytrack
3. Plan the airport considering site andlocation
4. Design airport with controlaids
5. Demonstrate the importance of various harbor elements in harborplanning.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2	1	2								
2		1	2									
3		2	1	3								
4		1	2	2								
5			1			2						

UNIT I **9 Hours**

RAILWAY PLANNING AND DESIGN

Introduction - Engineering survey for track alignment - Conventional and modern methods (Remote Sensing, GIS & GPS) - Permanent Way - Components and functions of each component - Gauges in railway tracks - Coning of wheels - Geometric design of railway tracks - Gradient - Super-Elevation - Widening of gauges in curves - Transition curves

UNIT II **9 Hours**

RAILWAY TRACK CONSTRUCTION, MAINTENANCE AND OPERATION

Track construction and maintenance - Track drainage - Lay outs of railway stations and yards - Points and Crossings - Signals - Types of signals - Principles and mechanism of interlocking - Methods of interlocking - Track circuiting - Electric traction - Introduction to modern trends in Indian Railways in the design of high speed tracks - Modern trends in railway track alignment

UNIT III **9 Hours**

AIRPORT PLANNING AND VISUAL AIDS

Introduction - Airport planning - Standards for planning of airports as per ICAO - Airport site selection - Aircraft characteristics and their impact on planning of an airport - Airport layout - Components of airports - Terminal area - Passenger facilities - Aprons - Hangars - Airport zoning - Air Traffic Control - Airport drainage - Aircraft parking system - Visual aids - Importance of airports in national transportation sector

UNIT IV **9 Hours**

AIRPORT DESIGN AND CONTROL AIDS

Introduction to Airport pavement design - Runway design - Orientation - Geometric design and Correction for gradients - Pattern of Runways - Runway configuration - Taxiway - Factors governing layout of taxiways - Rapid exit taxiways - Separation clearance - Parking and circulation area - Marking and lighting of runway and apron area - Wind and landing directionindicator

UNIT V **9 Hours**

HARBOUR ENGINEERING

Definition of terms - Harbours, ports, docks, tides and waves - Harbours - Site investigation - Planning, requirements and classification - Concept of satellite ports - Docks - Dry and Wet Docks - Dredgers and dredging - Terminal facilities - Shipping terminal facilities - Essentials of passenger terminal - Port Buildings - Warehouse - Transit sheds - Mooring accessories - Navigational aids - Piers - Breakwaters - Wharves - Jetties - Quays - Spring fenders - Littoral drift

FOR FURTHER READING

Role of Indian railways in national development - Monorail, MRTS & Magnetic guided rails (basics only)and suburban railways - BOT and BOLT (basic Concepts) - Case study of any Indian airport layout - Case study of orientation of runway with the aid of wind rose diagram - Layout of harbours - History of port - Case study of selected Indian ports.

Total: 45 Hours

Reference(s)

1. S. C. Saxena and S. P. Arora, Railway Engineering, Dhanapat Rai Publications Pvt. Ltd., New Delhi,2010
2. S. K. Khanna, M. G Arora and S. S. Jain, Airport Planning and Design, Nem Chand and Bros., Roorkee,2001
3. S. P. Bindra, A Course Work in Docks and Harbour Engineering, Dhanapat Rai Publications Pvt. Ltd., New Delhi,2003.
4. S. Chandra and M. M. Agrawal, Railway Engineering, Oxford, New Delhi,2007
5. S. C. Saxena, Airport Engineering - Planning and Design, CBS Publishers,2015
6. H. P. Oza and G. H. Oza, A Course in Docks and Harbour Engineering, Charotar Publishing House,1999

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5				10				5																20
2		10							5					5											20
3			5		5					10															20
4						5					5			10											20
5		5				5			5					5											20
																								Total	100

Assessment Questions

Remember

1. Label the various components of a permanentway
2. State the importance of providinggradients.
3. Relate the advantages of flat footed rails over otherrails
4. Relate the importance of coning of wheels incurves.
5. State the principle of trackcircuiting.
6. Defineyards.
7. Outline the classification of watertransportation
8. List out the factors influencing the site investigation of harbours along with theirsignificance
9. State the functions ofhangar.

Understand

1. State the functions of railway track, sleeper andballast
2. Describe in detail about the surveys that are employed in railway trackalignment
3. Discuss the steps involved in the construction of a railwaytrack.
4. Classify the various types of railwaysignals.
5. Explain the modern survey equipments/techniques used for maintenance of railwaytracks?
6. With neat sketches, describe the two types of wind rose diagram and how the optimum runway orientationoriented
7. With neat sketches, explain the markings on a runway andapron.
8. Give examples for military harbor and refugeharbors.
9. Describe in detail about the hydrographic and topographicsurveys
10. Classify the harbors based on their location and the protectionneeded.
11. Explain the different types of navigationalaids

Apply

1. Relate the relationship between radius and versine of a curve by deriving a mathematicalformula.
2. Compute the extra width required on the gauge for a vehicle moving on a B.G track. The wheel base of the vehicle is 6.0 m. Diameter of the wheel is 1.5 m. Depth of the flanges below top of rail is 3.17 cm. Radius of curvature is 168m.
3. Illustrate with neat sketches the working principle of a right hand or a left handturnout.
4. Write the formula for finding the runway length by incorporating the elevation, temperature and gradientcorrections.
5. Sketch and explain the energy dissipation mechanism in different types ofbreakwater.

Analyse

1. Illustrate with neat sketches how the number of vehicles accommodated changes for different car parking systems in anairport.
2. Name the formula for determining the airport referencetemperature

15CE007 WATER RESOURCES PLANNING AND MANAGEMENT

3 0 0 3

Course Objectives

- To emphasize the need for water resourcesplanning
- To disseminate the knowledge on the reservoir management and economic analysisaspects

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinaryenvironments.

Course Outcomes (COs)

1. To disseminate the knowledge on the reservoir management and economic analysisaspects
2. Analyse the hydrologicdata
3. Estimate the water requirements for irrigation, drinking and navigationpurposes
4. Assess the planning and management ofreservoir.
5. Perform the economic analysis of waterresources

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		2									-	
2		2	1								1	
3		2	1	2							1	
4		2	2	1								
5		2	1	1								

UNIT I **9 Hours**

INTRODUCTION

Water Resources Survey - Water resources of India and Tamilnadu-Description of water resources planning - Economics of water resources, planning, physical and socioeconomic data - National water policy - Collection of meteorological and hydrological data for water resources development-Principles of international and national law in the area of water management

UNIT II **8 Hours**

NETWORK DESIGN

Hydrologic measurements - Analysis of hydrologic data - Hydrologic station network - Station network design - Statistical techniques in network design

UNIT III **9 Hours**

WATER RESOURCE NEEDS

Consumptive and non-consumptive water use - Estimation of water requirements for irrigation, for drinking and navigation - Water characteristics and quality - Water Scarcity and its impacts - Concept of basin as a unit for development -Water budget and development plan- Conjunctive use of surface and ground water

UNIT IV **10 Hours**

RESERVOIR PLANNING AND MANAGEMENT

Reservoir - Single and multipurpose - Multi objective - Fixation of storage capacity -Strategies for reservoir operation - Silting of reservoirs -Desilting operation- Design flood - Channel improvement - Rain water and Runoff Harvesting in Rural and Urban Areas

UNIT V **9 Hours**

ECONOMIC ANALYSIS

Estimation of cost and evaluation of benefits - Discount rate - Discounting factors - Discounting - techniques

FOR FURTHER READING

Regulatory Programs and their Impact on Planning Processes - Rainfall computation, estimation and determination- Water Scarcity Management in Urban, Industrial and Agricultural sectors- Optimization techniques for water resource operations- Software for economic analysis of water resources

Total: 45 Hours

Reference(s)

1. R. K. Linsley and J. B. Franzini, Water Resources Engineering, McGraw Hill Inc., New York, 2000
2. K. N. Duggal and J. P. Soni, Elements of Water Resources Engineering, New Age, International Publishers, New Delhi,2004
3. J. L. Douglas and R. R. Lee, Economics of Water Resources Planning, Tata McGraw Hill Inc., New Delhi,2000
4. M. C. Chaturvedi, Water Resources Systems Planning and Management, Tata McGraw Hill Inc., New Delhi,1997
5. S. Goodman Alvin, Principles of Water Resources Planning, Prentice Hall,1984

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3	4				5							4	4											20
2		3			2	3				3			5		4										20
3	2		3		2	3							5	5											20
4	3	2			3	2					3			2	2			3							20
5	2	4											4	5								5			20
																								Total	100

Assessment Questions
Remember

1. Name four major concerns in designing hydrological stationnetwork
2. State the major classifications of hydrological and meteorologicaldata
3. List the different types of meteorological and hydrologicaldata.
4. List out the central agencies in water resourcessector.
5. List out any four important river basins inIndia.
6. Define hydrologicalcycle.
7. List out the common probability distribution functions for a continuousvariable.
8. List out the types of gauges for measuringprecipitation.
9. Name the different forms ofprecipitation?
10. State the two methods of frequency analysis for hydrologicaldata.

Understand

1. Explain how to measure flow in stream andrainfall.
2. List out the methods for computation of average rainfalldata.
3. Explain how to select the site for raingauge?
4. Find the essential requirements ofdata?
5. Briefly discuss about economics of water resourceplanning.
6. Compare between National Water policy (2002) and National Water policy(2012).
7. Indicate how drought prone area will bedeveloped?
8. Illustrate the methodologies in watershedmanagement.
9. Illustrate notes on stream flow monitoringgauges.
10. Explain the use of rating curves in water resourcesplanning.
11. Identify the thrust areas of attention in the National Water Policy2012

Apply

1. Conceptual frameworks have been developed by various international agencies for the implementation of IWRM. Discuss on any one such framework to bring out the challenges that are being faced duringimplementation
2. Demonstrate how “sustainable development” can be reached by optimizing the uses of water resources
3. Show how multi-objective analysis is the most suited tool for water resources planning and management.
4. A certain catchment area has rain gauges. The mean annual rainfall recorded at these rain gauges are 1150, 1100, 950, 1000, 900, 800, 650, 500 and 600 mm respectively. The permissible error is 5%. Determine the optimum number of rain gauges.
5. Assess the national policies being implemented for the sustainable management of water resources in ourcountry?

Analyse

1. How ecology is affected by a water resource developmentaction?
2. Comment on the statement: “The natural environment is not beautiful and pleasant everywhere. It can be extremely harsh, dangerous, ruthless andfurious”.
3. How can you justify the expenses on managing damagedresources?

Evaluate

1. Comment on the guidelines for integrated water resources planning and management being implemented in ourcountry.
2. Check about the mitigation measures to beundertaken.
3. Determine the principles of acquisition and processing of stream flowdata.
4. Determine why normal average method cannot be advised for fitting the missingdata.
5. Choose the sources of getting data for anyregion?
6. Critize the classification of data regarding data collection. Give examples for the three types of data.
7. Check the major physical and chemical characteristics ofwater.
8. Why do we say environment is in dynamic balance with itselements?
9. Select the role of benefit cost ratio for evaluation of water resourcesprojects?
10. Choose the method of benefit-cost analysis. List out any four discountingtechniques.
11. Conceptual frameworks have been developed by various international agencies for the implementation of IWRM. Discuss on any one such framework to bring out the challenges that are being faced duringimplementation.
12. To what extent the environmental indicators are useful in the impactassessment?

Create

1. Give your suggestions to bridge the gap between planning andimplementation.
2. Discuss about the primary and secondary environmental impacts of water resourcesprojects.
3. Infer how the human intervention is affecting the dynamic balance of theenvironment

15CE008 TRAFFIC ENGINEERING AND MANAGEMENT

3 0 0 3

Course Objectives

- To Provide an insight in traffic and its components, factors affecting road traffic and the design of intersection.
- To enable the students to get familiarize in conducting various traffic surveys, interpretation and analysis.
- To enhance an insight on different traffic regulations methods and managementmethods.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Acquire knowledge of traffic, itscomponents,
2. Able to apply the knowledge of sampling data in conducting various surveys andanalysis
3. Capable of understanding traffic movements and designing islands, intersections and road lightings.
4. Design signals, redesigning the existingsignals.
5. Recall traffic regulations, impact of noise pollution, air pollution and the method of controlling them

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1					2							
2				2								
3	1											
4	1	2	3									
5				2								

UNIT I **9 Hours**

INTRODUCTION

Significance and scope, Characteristics of Vehicles and Road Users, Traffic signs and markings- Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics -" Traffic problems in India " Integrated development of cities and towns.

UNIT II **9 Hours**

TRAFFIC SURVEYS AND ANALYSIS

Surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services- Basic principles of Traffic Flow.

UNIT III **9 Hours**

GEOMETRIC DESIGN OF INTERSECTIONS

Conflicts at Intersections, Classification of 'At Grade Intersections, - Channelized Intersections - Principles of Intersection Design, Elements of Intersection Design, Rotary design, Grade - Separation and interchanges - Design principles

UNIT IV **9 Hours**

TRAFFIC CONTROL

Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems), Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design.

UNIT V **9 Hours**

TRAFFIC MANAGEMENT

Traffic Management- Transportation System Management (TSM) - Travel Demand Management (TDM), IRC guidelines - Traffic Forecasting techniques, Restrictions on turning movements, One- way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes, Introduction to Intelligent Transportation System (ITS).

FOR FURTHER READING

Introduction to Intelligent Transport System- Application of ITS to Traffic Management System- Public Transportation Management System - ITS Case studies.

Total: 45 Hours

Reference(s)

1. Kadiyali, L.R. `Traffic Engineering and Transport Planning', KhannaPublishers,2016
2. Drew, D.R. `Traffic Flow Theory and Control', McGraw Hill BookCo.
3. IRC and ISPublications.
4. Institute of Transportation Engineers, `Manual of Transportation Engineering Studies', Prentice Hall
5. Khanna and Justo, â€˜Text book of Highway Engineeringâ€™, Nemchand Brothers, Roorkee, 2000
6. Papacostas, C.A., Fundamentals of Transportation Engineering', Prentice-Hall of India Private Limited, NewDelhi.2000.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5	5				10																			20
2		5				5				10															20
3		10				10																			20
4	10	10																							20
5		10				5				5															20
																								Total	100

Assessment Questions

Remember

1. Write the four vehiclecharateristics?
2. What is skidresistance?
3. Define volumecount
4. Write about Trafficsigns?
5. What isTSM?
6. What isTDM?
7. Write about Characteristics of Vehicles and RoadUsers?
8. List out the Components of TrafficEngineering
9. Write about Safety Level ofServices
10. What is StreetLighting?
11. Define Exclusive BusLanes

Understand

1. Definespeed
2. What are the conflits atintersection?
3. What is meant Level ofServices?
4. Explain about Traffic control aids and Streetfurniture?
5. Comment on intelligent transportationsystem
6. State the importance of SkidResistance
7. Why Braking Efficiency isnecessary?
8. Classify 'At GradeIntersection’
9. Why Traffic Calming reqiured incities?

Apply

1. Write in detail about Components of TrafficEngineering?
2. Comment on PedestrianStudies
3. Explain about Roadmarkings?
4. Explain about Computer applications in Signal design?

Analyse

1. Explain BrakingEfficiency
2. Describe the Elements of IntersectionDesign?
3. Differeniate between Channelized Intersections and atgradeintersections
4. How do you analyze a rotaryjunction?

15CE009 MUNICIPAL SOLID WASTE MANAGEMENT 3 0 0 3

Course Objectives

- To provide basic knowledge about the sources and composition of municipal solidwaste.
- To emphasize the need for municipal solid wastemanagement.
- To impart knowledge about the safe disposal of municipal solidwaste.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Characterize the solid waste based on source, type and composition and describe the effects of its improperdisposal.
2. Identify the suitable method for collection, segregation and transportation of solidwaste.
3. Analyze the various offsite processing techniques for solidwaste.
4. Choose the suitable disposal methods and waste to energy techniques for solidwaste.
5. Categorize biomedical waste and identify a suitable method to collect, treat and disposeit

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2										
2	1	2										
3	1	3										
4	2	2				1						
5	2	2					1					

UNIT I **10 Hours**

MUNICIPAL SOLID WASTE(MSW)

Solid waste - Definition - Scope and importance - Sources and types of solid wastes - Functional elements of solid waste management - Quantity assessment - Generation rate - factors affecting generation of solid wastes - characteristics -methods of sampling - Effects of improper disposal of solid wastes - on human health; the social and economic impacts; Public awareness; Role of NGOs; Legislatory bodies and legislation.

UNIT II **9 Hours**

COLLECTION, SEGREGATION AND TRANSPORTATION OF MSW

On-site storage methods - materials used for containers -on-site segregation of solid wastes - Colour codes – garbagechutes Methods of public collection - selection of location -requirement of human resources - types of vehicles - collection routes - transfer stations -operation and maintenance - options under Indian conditions - Route optimization.

UNIT III **9 Hours**

OFF-SITE PROCESSING

Processing techniques and Equipments: Sorting - Manual and Mechanical - Magnetic Separators - Ballistic method - Eddy Current Separators - Screens for size separation. Volume Reduction - Compaction and Baling; Size Reduction- Shredding - Automaticshredders.

UNIT IV **10 Hours**

DISPOSAL

Disposal Mechanisms - Open area Dumping - Sanitary Land Filling - site selection, design and operation of sanitary landfills -Methods of sanitary landfills - Leachate collection and treatment.

Waste to Energy Techniques - Composting- Aerobic and anaerobic processes - Bangalore and Indore processes -byproducts - factors affecting composting - Merits and demerits - types of composting; Incineration, Pyrolysis - merits and demerits.

UNIT V **7 Hours**

BIOMEDICAL WASTE MANAGEMENT (BMW)

Introduction - Need for safe treatment and disposal of BMW - Colour coding - Types of containers - Categories of Biomedical Waste; Treatment and disposal methods of Biomedical Waste - Biomedical waste management regulations

FOR FURTHER READING

Case study of solid waste management in any 2 cities in -Tamil Nadu - Andhra Pradesh - Karnataka - Kerala; in any 2 cities in North India.

Total: 45 Hours

Reference(s)

1. George Tchobanoglous et.al., Integrated Solid Waste Management, McGraw-Hill Publishers, 1993.
2. K. Sasikumar and Sanoop Gopi Krishna, "Solid Waste Management" PHI Learning Private Limited, New Delhi,2009.
3. B. Bilitewski, G. HardHe, K. Marek, A. Weissbach, and H. Boeddicker, Waste Management, Springer,1994.
4. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi,2000
5. R.E. Landreth and P.A. Rebers, Municipal Solid Wastes problems and Solutions, Lewis Publishers,1997.
6. Bhide A.D. and Sundaresan, B.B., Solid Waste Management in Developing Countries, INSDOC, 1993.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	4	2				2			6	6															20
2	2	2			2	2					6			6											20
3	2					6					6				6										20
4		2				4	2				6			6											20
5	2	2				2	2				6				6										20
																								Total	100

Assessment Questions

Remember

1. Define solidwaste.
2. State the scope and importance of solid wastemanagement.
3. Whar are the functional elements of solid wastemanagement.
4. List out the effects of improper disposal of solidwastes.
5. Recognise the role of NGO's in Solid WasteManagement
6. Narrate the importance ofsampling.
7. List the types of materials used forcontainers
8. Enumearte the significance of a transferstation.
9. Definecomposting
10. State any two rules related to biomedicalwaste.

Understand

1. Brief on the importance of municipal solid wastemanagement.
2. Classify municipal solidwaste
3. Explain the functional elements of solid wastemanagement
4. Highlight the steps in Indore and Bangalore methods ofcomposting.
5. Explain any one method of sanitary land filling with a neatsketch.
6. Classify the types of sanitary landfilling.
7. Explain routeoptimization.
8. Summarize the rules for biomedicalwaste.
9. Explain any 5 categories of biomedical waste as per WHOstandards.

Apply

1. Summarize the factors affecting incinerationprocess.
2. Select a suitable methodology for on –site storage for yourhome.
3. Assess the merits and demerits of Indore and Bangalore processes ofcomposting.
4. Predict the effects caused to human health due to improper disposal of solid waste.
5. Find out the benefits ofvermin-composting.
6. Select an optimum route for your city with the help of route optimizationtechnique
7. Narrate the circumstances in which ramp and pit method of land filling arepreferred.
8. Predict a suitable method of sanitary land filling technique for low lyingareas.
9. Show the classification and characteristics of municipal solidwaste.
10. Find out the ill effects of improper disposal of biomedicalwaste.
11. Predict the factors to be considered in the selection of collectionequipment.

Analyse

1. Differentiate between incineration andpyrolysis.
2. Compare sanitary land filling with opendisposal.
3. Compare Indore and Bangalore processes forcomposting.
4. Outline the different types ofsampling.
5. Elaborate on the different colour coding system used in biomedical wastemanagement.
6. Enumerate the characteristics and composition of solidwaste.
7. Compare the advantages of Trench area method over ramp and pit method of sanitary landfilling.
8. Summarise the effect on human health, society and economy due to improper disposal of solid waste.
9. Compare biomedical waste with municipal Solid WasteManagement.
10. Suggest suitable measures for Solid Waste Management of a moderntown.

15CE010 DESIGN OF INDUSTRIAL STRUCTURES 3 0 0 3

Course Objectives

- To impart knowledge on classification of industries and their functionalrequirements
- To familiarise the students on the design of silos, bunkers andchimneys
- To impart knowledge on the transmissionstructures

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Draw layout for any industrialbuilding
2. Demonstrate the functional requirements for anyindustry
3. Design of industrial RC and steelstructures
4. Design roofing systems for industry
5. Design Foundation forindustries

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		2										
2		2										
3		1	3	2								
4		1	3									
5		1	3	2								

UNIT I **9 Hours**

GENERAL

Classification of Industries and Industrial Structures -Specific requirements for Industries like Engineering, Textiles, Chemicals, steel and cement. Site layout and external facilities required.

UNIT II **9 Hours**

FUNCTIONAL REQUIREMENTS

Natural and artificial lighting - protection from the sun light - Services - Electrical wiring fixtures - cable and pipe bridge - Electrical installations - substations - Effluent disposal - Fire expanse and chutes - fire alarm, extinguishers and hydrants - Guidelines from factories act. Heating and Ventilation - Air conditioning

9 Hours

UNIT III

DESIGN OF INDUSTRIAL RC STRUCTURES

Design and detailing of corbels, nibs, bunkers, silos, chimneys and RC slab supported by portal frames.

UNIT IV **9 Hours**

DESIGN OF INDUSTRIAL STEEL STRUCTURES

Design of Gantry Girders, chimneys-Design of roofing system supported by steel trusses-Substation Structures

UNIT V **9 Hours**

FOUNDATION FOR INDUSTRIAL STRUCTURES

Types of Machine Foundations and their design-Foundations for RC and steel chimneys

FOR FURTHER READING

Application of prefabrication techniques for industrial structures - case studies on existing industrial structures

Total: 45 Hours

Reference(s)

1. N. Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers and Distributors,2008
2. A. R. Santhakumar and S. S. Murthy, Transmission Line Structures, Tata McGraw Hill,1992
3. P. Dayaratnam, Deign of steel structures, A.H. Wheeler & Co., Ltd., Allahabad,2008
4. IS :4998 (part 1)'Indian Standard Practice for Design of Reinforced Concrete Chimneys IS: 4995 (part 1 and part 2)criteria for design of reinforced concrete bins for storage of granular and powdery materials IS: 3483 code of practice for noise Reduction in industrial buildings. IS: 6060 code of practice for daylighting of factorybuildings.
5. S. N. Manokar, Tall Chimneys â€“ Design and Construction, Tata McGraw Hill,1986
6. Handbook on functional requirements of industrial buildings(Heating andventilation)

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	4					4					6												6		20
2	2	2			6	4					6														20
3	2					4			2					6	6										20
4	2					4			2					6	6										20

5	2	2				6					4				6										20
																								Total	100

Assessment Questions

Remember

1. List out the specific requirements of a textileindustry
2. How the industries areclassified?
3. List out the types of firehazard
4. What issubstation
5. Differentiate between a bunker and asilo.
6. Mention the types of chimneys that are commonlyadopted.
7. Mention the types of transmissiontower
8. What are the soil parameters that are needed to be consider for designing the foundations for tower?
9. What are the components of machinefoundation?
10. What is the minimum grade of concrete and steel to be used for substationstructures?

Understand

1. What are the factors governing site selection for anindustry?
2. Bring out the uses of fire alarms, extinguishers andhydrants.
3. Distinguish between natural lighting and artificiallighting.
4. What do you mean by vibration isolation?
5. What is the function of acorbel?
6. What is mean by nib and where it isused?
7. Explain in detail the various loads to be considered while designing a transmissionlines.
8. Write down the step by step procedure of design of towerfoundation.
9. Outline the types of machinefoundation
10. What is the purpose of gantrygirder?

Apply

1. List out the specific requirements for a TextileIndustry.
2. Explain the application of Prefabricationtechniques.

Analyse

1. Design a Corbel to carry an ultimate load of 800 kNat distance of 250 mm from the face of a column of size 450mm X 450mm. M25 Concrete and Fe415 steel are to be used. Draw the reinforcement details. Take bearing stress of concrete as 0.8fck.
2. A reinforced concrete chimney 50m high above ground has an outside diameter of 4m. The thickness of the shell is 200mm at the top and it is increased to 250mm and 300mm at 18m and 30m from the top. A vertical steel bar is 1% of the cross section area. The total wind force above the section at 18m from top may be taken as 93kN. Find the stresses developed due to wind and dead load at the section 18m from the top of the chimney. Assume modular ratiom=13.

Create

1. Draw a neat layout of a chemicalplant.
2. Draw a neat layout of an Engineering Industry with all its specificrequirements.

15CE011 ENVIRONMENTAL IMPACT ASSESSMENT 3 0 0 3

Course Objectives

- To emphasize the need forEIA.
- To provide basic knowledge on the components, methods and quality control measures ofEIA
- To make the students understand the importance of documentation and monitoring of EIA along with casestudies.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineeringpractice.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions.

Course Outcomes (COs)

1. Analyse the key features of EIA with reference to legislator aspects inIndia.
2. Analyse cost benefits andalternatives
3. Predict the impact of any project on environmental issues related to land, water, air, flora and fauna, noise, energy andsocio-economics.
4. Practice the various documentation and report procedures forEIA.
5. Involve public toparticipate

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1										
2		2				1						
3	2					2	1					
4				2		2		1				
5						3			2	2		

UNIT I **8 Hours**

INTRODUCTION

Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - Environmental Risk Assessment (ERA) - Legal and Regulatory aspects in India - Types and limitations of EIA - - Issues in EIA - National - Cross sectoral - Social and cultural Terms of Reference in EIA

UNIT II **8 Hours**

COMPONENTS AND QUALITY ANALYSIS

Components - Screening - Setting - Analysis - Prediction of impacts - Mitigation - Matrices - Networks - Checklists - Impact Assessment techniques - Cost benefit analysis - Analysis of alternatives;Trends in EIA practice and evaluation criteria - Capacity building for quality assurance - Expert System in EIA - Formats ofregulations

UNIT III **12 Hours**

PREDICTION, ASSESSMENT AND MITIGATION

Methods for Prediction and assessment of impacts on Air - Water - Soil - Noise - Biological - Cultural - Social - Economic environments - Standards and guidelines for evaluation - Options for mitigation of impacts- Policies for decision making

UNIT IV **10 Hours**

DOCUMENTATION AND MONITORING

Document planning - Collection and organization of relevant information - Use of visual display materials - Team writing - Reminder checklists - Environmental monitoring - Guidelines - Policies - Planning of monitoring programmes - Environmental Management Plan -Post projectaudit

UNIT V **7 Hours**

PUBLIC PARTICIPATION

Objectives of public participation - regulatory requirements- merits and de-merits - conducting public participation - conflict management - dispute resolution Questionnaires for decisionmaking

FOR FURTHER READING

Case studies of EIA for developmental projects - Cement plant, Thermal Power Station, Hydro-Electric Power Project, Mining Industry, Oil Explorations.

Total: 45 Hours

Reference(s)

1. L. W. Canter, Environmental Impact Assessment, McGraw Hill, New York,1996.
2. Policy Intervention Analysis: environmental Impact Assessment, Ritu Paliwal, Leena Srivastava, The Energy and Resources Institute (TERI), TERI Press, Durbari Seth Block,IHC Complex, Lodhi Road, New Delhi - 110 003, India,2014
3. Handbook of Environmental Decision Making in India: An EIA Model (Handbooks Series), O.V.Nandimath, Oxford University Press of India,2008
4. J. Petts, Handbook of Environmental Impact Assessment Vol. I and II, Blackwell Science, London,1999.
5. The World Bank Group, Environmental Assessment Sourcebook Vol. I, II and III, The World Bank, Washington,1991.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3	4				5							4	4											20
2		3			2	3				3			5		4										20
3	2		3		2	3							5	5											20
4	3	2			3	2					3			2	2			3							20
5	2	4											4	5								5			20
																								Total	100

Assessment Questions

Remember

1. Elucidate the concept ofEIA.
2. What are the various issues to be considered forEIA?
3. Name some methods for EIA prediction
4. What ismitigation?
5. Elaborate on the checklist for environmental monitoring.
6. Narrate the methods for collecting relevant information forEIA.
7. Narrate the steps for evaluation criteria for a givenproject
8. Define environmentalImpact
9. Identify the limitations ofEIA.
10. Name some of the methods for predictingimpact
11. What are the issues to be considered inEIA?
12. Name some of the methods for predictingimpact.
13. Name some regulatory aspects of EIA inIndia
14. Name some polluting agents affecting the humanhealth.
15. List some impotant industries that are detrimental to humanhealth.

Understand

1. List the general issues ot be considered for conducting EIA
2. Identify the limitations ofEIA.
3. Interpret the use of the visual display materials for environmental monitoring of anyproject.
4. Illustrate some major regulatory aspects of EIA inIndia.
5. Narrate the important environmental impacts to be considered for a developmentalproject.
6. What are the guide lines for public health monitoring forEIA?
7. Enumerate the merits and de-merits of involving public in decision making at any phase ofEIA.
8. What do you mean bymitigation?
9. List out some checklist for environmentalmonitoring.
10. Write an explanatory note on detailed investigaton about the case study on EIA ofharbours.
11. Give anarrationon i)Teamwriting ii) Reminderchecklists
12. What do you mean by riskmanagement?

Apply

1. Applying the guide lines for monitoring of a thermal power plant project, prepare a Management Plan, enumerate the merits and de-merits of involving public in decision making at any phase of EIA.
2. Explain the general methodology for assessing the impacts of any project on powerproduction.

3. Explain the importance of cost benefitanalysis
4. Enumerate the importance of analysis of the alternatives of the impacts inproject

Analyse

1. Outline the trend in EIApractice.
2. Prepare an analytical report on the various factors that affect the society and environment in general for major developmentalproject.
3. Analyse the several legislative aspects which are to be considered for preparing an EIAreport.
4. Narrate the steps for evaluation criteria for a givenproject
5. Diiferentiate between screening andsetting
6. Develop and analyse the feed back questionare for cement maufacturing factoryproject

Evaluate

1. Evaluate the main environmental features of a project by attaching due relative weightage to each.
2. Predict the major impacts to be considered for anyone of the followingprojects:
   1. Thermal Power Plant 2. Mining 3. OilExploration

Create

1. Applying the principles of EIA, create an EIA report on a mining / hydro electric/project
2. Create a questionare for collecting collecting response from the public for a hydro-electric power project.

15CE012 ADVANCED RC DESIGN 3 0 0 3

Course Objectives

- To impart knowledge on the design of many complicated structures such as curved beams, gable frames, silos, bunkers andchimneys.
- To impart knowledge on the design of flat slabs and precastconstruction.

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Design beams, corbel andnibs
2. Analyze and Design slabs using yield linetheory.
3. Design portal and gableframes
4. Draw detailing for joints of variousstructures
5. Design flat slabs and analyse hyperstaticstructures

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1	2	1								
2		2	1	1								
3		1	2	1								
4		2	2	1								
5		1	2	1								

UNIT I **9 Hours**

SPECIAL STRUCTURAL MEMBERS

Design of continuous beams- Beams curved in plan - Canopy beams - Simply supported and continuous deep beams -Corbels - nibs.

UNIT II **9 Hours**

YIELD LINE THEORY

Assumptions made - Yield line patterns for various types of slabs with different boundary conditions - Analysis of square - Rectangular and circular slabs subjected to central concentrated load or uniformly distributed load by virtual work method and equilibrium method - Effect of corner lever - Hillerborg's strip method ofanalysis.

UNIT III **9 Hours**

INDUSTRIAL R.C. STRUCTURES

Design of portal and gable frames - Bunkers - Silos - Chimneys.

UNIT IV **9 Hours**

PREFABRICATION

Principles of precast Construction-Merits and demerits - Dimensioning and detailing of joints for different structural connections - Construction and expansion joints.

UNIT V **9 Hours**

MISCELLANEOUS STRUCTURES

Design of flat slabs - Grid floors - Braced and unbraced r.c. walls - Limit analysis of hyperstatic structures- Fundamental principles - Moment redistribution - Moment -Rotation characteristics of RC sections - Plastichingles.

FOR FURTHER READING

Case studies of various types of R.C.Structures

Total: 45 Hours

Reference(s)

1. N. Krishnaraju, Advanced Reinforced Concrete Design, C. B. S. Publishers and Distributors, 2008
2. Ashok K. Jain, Reinforced Concrete Limit State Design, Nemchand & Bros.,1993
3. S. N. Sinha, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd.,2002
4. Varghese, Advanced Reinforced Concrete Design, Prentice Hall of India Pvt. Ltd., 2002
5. Jain and Jai Krishna, Plain and Reinforced Concrete, Vol. II, Nemchand Brothers,1986

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1		3					3			3				4			4								17
2				5				5				5			5										20
3			3			2				2			2			3			3						15
4			5			5					5			5				3							23
5		5			5			5				4				4			2						25
																								Total	100

Assessment Questions

Remember

1. What is meant by enhanced shear stress incorbels?
2. List out the applications of curvedbeams.
3. Describe the IS specification of lever arm of deepbeam.
4. What are the assumptions made in yield linetheory?
5. Define isotrophically reinforcementslab.
6. What are the standard methods analysed for portalframes?
7. Define the term plane ofrupture.

8. What is the production techniques involved inprefabrication?
9. Define a prefabricatedstructure.
10. What is the minimum thickness generally adopted for gridslab?
11. What are the fundamental principles adopted in momentredistribution?

Understand

1. Draw the stress distribution diagram for deepbeam.
2. Differentiate between shallow beam and deepbeam.
3. Locate the maximum positive and maximum negative bending moment of three span continuous beams.
4. What are the characteristic features of yieldlines?
5. Formation of one yield line may not cause collapse mechanism.Justify.
6. Write the final moment for orthotropically reinforced simply supported rectangle slab subjected toudl?
7. What are the two methods available for determining the ultimate load capacity ofslab?
8. What are the design factors to be considered while designingchimney?
9. What are the difference between bunker andsilo?
10. Which joint transmit forces through the hinge? andwhy?

Apply

1. A continuous beam of a multi-storey frame has three spans each of 8m. The characteristics dead load is 10kN/m and the characteristics live load is 15kN/m. Design the critical sections of the beam and sketch the details of reinforcements using the limit state method. Adopt M20 and Fe 415.
2. Using the yield – line theory, design a rectangular slab of size 4m X 6m which is simply supported along the edges and has to carry a service live load of $4kN/m^2$. Assume Coefficient of orthotrophy $\mu = 0.75$. M25 Concrete and Fe415 steel are to beused.
3. Design side walls and hopper bottom of a rectangular bunker of capacity 300kN to store coal. M20 Concrete and Fe415 steel are to be used. Given unit weight of coal is $8kN/m^3$. Angle of repose of coal is250.
4. Explain with neat sketches the various types of beam column joints encountered inprefabrication.
5. A R.C grid floor for a hall has a size 9m x 12m. The ribs are spaced 1.5 m c/c in mutually perpendicular directions. Live load on the floor is 2 kN/m^2. Use M20 concrete and Fe415 steel. Analyses the grid floor by Rankine Grashoff method for moment and shears. Design the floor completely. Sketch the details of reinforcement along the central rib in shorterdirection.

Analyse

1. Explain the procedure of curved beam design. And sketch the point of maximum BM, SF and torsion moment of six span curved beams.
2. Design a Corbel to carry an ultimate load of 600 kNat distance of 250 mm from the face of a column of size 400mm X 400mm. M25 Concrete and Fe415 steel are to be used. Draw the reinforcement details. Take bearing stress of concrete as $0.8f_{ck}$.
3. A reinforced concrete slab 5m X 5m is simply supported along the four edges and is reinforcement with 10mm diameter of Fe 415 steel bar at 150mm spacing on both the ways. The average effective depth of the slab is 100 mm, overall depth is 130mm. The slab carries a flooring of 50mm thick having unit weight of $22kN/m^3$. Determine the maximum permissible service load if M20 grade of concrete isused.
4. A reinforced concrete chimney 50m high above ground has an outside diameter of 4m. The thickness of the shell is 200mm at the top and it is increased to 250mm and 300mm at 18m and 30m from the top. A vertical steel bar is 1% of the cross section area. The total wind force above the section at 18m from top may be taken as 93kN. Find the stresses developed due to wind and

dead load at the section 18m from the top of the chimney. Assume modular ratiom=13.

Evaluate

5. A flat slab system consists of 5mx6m panels and is without drop and column head. It has to carry a live load of 4kN/m^2. It is to be designed using M20 grade concrete and Fe 415 steel. The size of the columns supporting the system is 500mm X 500 mm and the floor to floor height is 4.5m. Calculate a design moment is exterior panels at column and middle strips in bothdirections.
6. A portal frame with ends hinged is to be analysed for the followingdata:
   Spacing of portal frames =4m
   Height of columns = 4.5m
   Distance between column centre = 9m
   Live load on the roof = 1.5 kN/m^2
   RCC slab is provided over the portal frames.
   Design the slab, beam, column, hinge and foundations.

15CE013 GROUND IMPROVEMENT TECHNIQUES 3 0 0 3

Course Objectives

- To understand the principles, applications, and design procedures for various ground improvementtechniques.
- Gain competence in properly evaluating alternative solutions, and the effectiveness before, during and after using ground improvement.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Recall various ground improvementtechniques.
2. Design de-wateringsystems
3. Select appropriate method forstabilization
4. Select appropriate machinery and equipments forgrouting
5. Assess the effectiveness of a ground improvement technique by analytically/numerically

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1						2					
2	1	1	2	1								
3	1			2								
4	1			2								
5	1	2					2					

UNIT I **10 Hours**

NECESSITY OF GROUND IMPROVEMENT AND MECHANICAL STABILIZATION

Need and objectives of Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement, Suitability and feasibility of ground improvement techniques, Principles and methods of shallow and deep soil compaction-Vibro replacement (stone column & sand columns) and Vibro compaction- Dynamic compaction.

UNIT II **9 Hours**

DEWATERING TECHNIQUES

Ground Improvement using drainage techniques - Well points - Deep well- Vertical drains, vacuum consolidation, Electro- osmotic methods, Design of dewatering systems.

UNIT III **9 Hours**

STABILIZATION BY ADMIXTURES

Cement stabilization and cement columns, Lime stabilization and lime columns. Stabilization using industrial wastes, Methods of applications in the field- Stabilization of expansive clays.

UNIT IV **8 Hours**

STABILIZATION BY GROUTING

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring - Selection of grout - Designaspects

UNIT V **9 Hours**

GEOSYNTHETICS IN GROUND IMPROVEMENT

Concept of reinforcement - Types of reinforcement material -Stability analysis of geo grid reinforced earth retaining wall-Introduction to the use of Geotextiles for filtration, drainage and separation in road and otherworks.

FOR FURTHER READING

Soil nailing, rock anchoring, micro-piles, Stabilization of expansive soils

Total: 45 Hours

Reference(s)

1. Van Impe W.E., Text Book on Soil Improvement Technique and their Evolution, Balkema Publishers, Netherlands,1994
2. M. R. Hausman, Engineering Principles of Ground Modification, McGraw Hill Book Co., Singapore,1990

3. Purushothama Raj, P. Ground Improvement Techniques,Laxmi Publications, New Delhi,2005
4. Peter G. Nicholson,Soil Improvement and Ground Modification Methods, Butterworth-Heinemann publications, Elsevier,2015.
5. Moseley M.P. and Kirsch K.,Ground Improvement, 2nd Edition, Spon Press, Tailor & Francis Group, London,2004.
6. Koerner, R.M., Design with Geosynthetics, 6th Edition, Prentice Hall, New Jersey,2002

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	3	2			4	6				1			1	5				1							23
2	2	2			1	4				4			1	4				2							20
3	3				4	6	2						2	2				1							20
4	1	2			3	7	1		1	1			1	2											19
5	3	2			2	5			2	1				3											18
																								Total	100

Assessment Questions

Remember

1. Recall the principles of groundimprovement.
2. List out the factors that have to be considered while selecting an in situ densification technique for loosesand.
3. Definegrouting
4. Definedewatering
5. List two types ofgrouts
6. State the 3 methods ofunderpinning
7. List the purposes ofdewatering
8. State the difference between compaction and permeationgrouting
9. Define arearario
10. Defineunderpinning
11. State 2 needs ofunderpinning
12. List 3 types ofgrouting

Understand

1. State the techniques used to improve cohesive and granularsoil.
2. Give the characteristics of jet groutedsoils.
3. Name the types ofgrouting.
4. Write the functions of stonecolumn.
5. Discuss the need of dewatering of groundsoils.
6. Explainvibrofloatation.
7. How is the static cone penetration test different from standard penetrationtest?
8. Review the limits of soil parameters which suggest whether ground improvement required ornot
9. What do you understand soil stabilization bygrouting?

Apply

1. Recognize the use of sanddrains
2. How do you accelerate the consolidation in soft clay of thickness more than 10m?Explain.
3. Assess the improvement of foundation by any 2 underpinningmethods
4. Exemplify with a case study how underpinng is carriedout

Analyse

1. Enumerate the various methods that are used for lowering the ground water table during construction.
2. Describe the purpose of preloading and verticaldrains.
3. Infer two main reasons that do not allow the techniques used for in situ densification of sands to be successful for in situ densification ofclays.
4. Amongst the grouting methods, which method allows high output, good control over grouted zone around the grout hole and maximumversatility?
5. Compare the action of rigid piles with stonecolumns
6. Illustrate how the heavy tamping technique can be used to improve the ground. In what type of soil and ground conditions you recommend thistechnique.
7. Explain the significance of preloading on primary and secondary consolidation of saturated clay deposits

Evaluate

1. Predict any three engineering application of grouting which proves to be effective

15CE014 REPAIR AND REHABLITATION OF STRUCTURES

3 0 0 3

Course Objectives

- To emphasize the importance of maintenance an inspection ofstructures
- To impart fundamental knowledge on various repairingstrategies

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Demonstrate the various types of distress in concretestructures
2. Identify the effects due to climate, temperature, chemicals, wear and erosion onstructures
3. Analyze the failures in structure due to design and constructionerrors
4. Recommend the best Materials and Techniques forRepair
5. Identify suitable Engineered demolition techniques forstructures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	1			2	1							
3	1	2										
4	1			2	1							
5				2	1							

UNIT I **9 Hours**

MAINTENANCE AND REPAIR STRATEGIES

Maintenance, repair and rehabilitation -Facets of maintenance -Importance of maintenance -Diagnosis of distress -Assessment procedure for evaluating a damaged structure - Causes ofdeterioration.

UNIT II **9 Hours**

DISTRESS IN CONCRETE STRUCTURES -CAUSES, EFFECTS AND REMEDIAL MEASURES

Design and construction errors-Corrosion mechanism-Effects of cover thickness and cracking-Methods of corrosion protection - Corrosion inhibitors - Corrosion resistant steels-Coatings- Cathodic protection.

UNIT III **9 Hours**

SERVICEABILITY AND DURABILITY OF CONCRETE STRUCTURES

Durability of concrete in sea water - Thermal properties of concrete - Fire resistance - Resistance to freezing and thawing-Permeability of concrete - Sulphate attack -Methods of control. Quality assurance-Need-Components-Conceptual bases for quality assurance schemes

UNIT IV **9 Hours**

MATERIALS AND TECHNIQUES FOR REPAIR

Expansive cement - Polymer concrete - Sulphur infiltrated concrete - Ferro -cement Fibre reinforced concrete - Rust eliminator sand polymer coating for rebars during repair- Foamed concrete- Vacuum concrete- Gunite or shotcrete -Epoxy injection, mortar repair for cracks.Special concretes and mortars - Special cements for accelerated strength gain Trench less Technology for underground pipe laying

UNIT V **9 Hours**

REPAIRS TO STRUCTURES AND DEMOLITION OF STRUCTURES

Repair of structures distressed due to earthquake - Strengthening using FRP-Engineered demolition techniques forstructures.

FOR FURTHERREADING

Repairs to overcome low member strength -Deflection -Cracking - Chemical disruption - weathering corrosion -wear - fire - leakage and marine exposure

Total: 45 Hours

Reference(s)

1. ACCE(I),Madurai Centre,Workshop on Cracks,Corrosion andLeaks,July,2003
2. M.L.Gambhir,Concrete Technology,Tata Mc Graw Hill Publishing Co.,NewDelhi,2003
3. Peter H.Emmons , Concrete Repair and Maintenance Illustrated Problem Analysis, Repair Strategy,Techniques,GalgotiaPublication,2001

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	5	2			5												8								20
2	5					10			5																20
3	10				10																				20
4	10	10																							20
5		10				5			5																20
																								Total	100

Assessment Questions

Remember

1. DefineMaintenance.
2. What is meant by Rehabilitation of structures?
3. StateStrengthening.
4. List out the necessities ofmaintenance.
5. What are the important aspects of Rehabilitation?
6. What are the facets of maintenanceoperation?
7. List out the classifications of cracks based onwidth.
8. Name the different types ofmaintenance.
9. Identify the Deterioration of concrete due tocorrosion.
10. Statedistress.
11. How do you classifydistress?
12. DefineCrazing.
13. Define QualityAssurance.
14. Define“Mortar repair forCracks”.
15. Name the advantages of Diamondcuttings.
16. What is meant by specialconcrete?
17. List out the factors to be considered while selecting the tools to be used for job onhand.
18. State the assessment procedure for evaluating thestructure.
19. Define the term “Fire Damagedstructure”.

Understand

1. Classify the concretedemolition.
2. Distinguish between Active Crack and DormantCrack.
3. Explain the causes for cracks in finished partitionwalls
4. Explain the behaviour of RC elements due to faulty design and constructionerrors.
5. Discuss the different methods of flexural strengthening technique for reinforcedconcrete members and draw neatsketches.
6. Summarize the detail procedure of cathodic protectiontechnique
7. Distinguish between defects in concrete and masonrystructures.
8. Distinguish between defects in concrete and steelstructures.
9. Distinguish between defects in steel and masonrystructures.
10. Classify the types of defects in plastering.
11. Briefly explain the Special concretes and itsapplications.

Apply

1. Write the methods available for arrest thecracks.
2. Discover the rehabilitation works to be carried out in multi-storeyedbuilding.

3. Write short note on Expansivecement.
4. Sketch and represent the damage induced by corrosion ofsteel.
5. Illustrate the Crack stabilizationtechnique
6. Relate the Repair of fire damagedstructure.

Evaluate

1. Evaluate a damagedstructure.
2. Compare design errors and constructionerrors.
3. Criticize the Causes ofDeterioration
4. Write down the application of quality assurance schemes withexample.
5. Explain thefollowing
   i. Vacuumconcrete ii. Highperformanceconcrete iii. Fibre Reinforcedconcrete

15CE015 BUILDING SERVICES 3 0 0 3

Course Objectives

- To understand how a building can be made comfortable and safe with the services designed and installed
- To impart knowledge on basics of electrical wiring system
- To recognize the importance of fire detection andprotection

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Analyze the features of service machineries required for abuilding
2. Identify suitable electrical system and accessories to be installed during the construction of a building.
3. Identify the principles of illumination and Artificial lightsources
4. Describe the working principle of Refrigerants and Air conditioningsystems
5. Analyze the characteristics of fire safety equipment's for different type ofbuildings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	2									
2	3	2	1									
3	3	3	2									
4	3	1										
5	1	2	3									

UNIT I **9 Hours**

MACHINERIES

Lifts and Escalators - Special features required for physically handicapped and elderly - Single / Three phase supply - Determination of the power required for motors and generators - Solar panels their installation and applications

UNIT II **9 Hours**

ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity - Protective devices in electrical installations - Lightening arrester - Earthing - Types of earthing - ISI specifications - Types of wires, wiring systems - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears.

UNIT III **9 Hours**

PRINCIPLES OF ILLUMINATION

Visual tasks - Factors affecting visual tasks - Synthesis of light - Additive and subtractive synthesis of colour - Luminous flux - Candela - Solid angle illumination - Utilisation factor - Depreciation factor - MSCP - MHCP - Laws of illumination - Classification of lighting - Artificial light sources - LED lightings - Daylight factor - Luminous efficiency - Colour temperature - Colour rendering - Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types - Specifications of National Building Code ofIndia.

UNIT IV **9 Hours**

REFRIGERATION PRINCIPLES

Approximate Analysis of Bearing Wall Buildings - The Cross Wall Structure - The Long Wall Structure The Rigid Frame Structure Approximate Analysis for Vertical Loading - Approximate Analysis for Lateral Loading - Approximate Design of Rigid Frame Buildings-Lateral Deformation of Rigid Frame Buildings The Rigid Frame - Shear Wall Structure - The VierendeelStructure.

UNIT V **9 Hours**

FIRE SAFETY INSTALLATION

Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes systems - Special features required for physically handicapped and elderly in building types - Heat and smoke detectors - Fire Fighting pump and water storage - Dry and wet risers - Automatic sprinklers.

FOR FURTHER READING

Types of Electric Motors and Generators, Fire alarm system, Snorkel ladder

Total: 45 Hours

Reference(s)

1. Roger Greeno and Fred Hall, Building Services Handbook (8th edition), Routledge Publishers, 2015.
2. G. Steffy, Architectural Lighting Design, John Wiley and Sons,2008
3. 4. J. Killinger and L. Killinger, Heating and Cooling Essentials, Goodheart-Wilcox Publishers, 2003
4. C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi,1988
5. R. Udhayakumar , A text book of Building services, Eswar Press,2007
6. SP 7 (2005) : National Building Code of India 2005.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3				3					3			3				3		3			2			20
2		4				4					4				4			4							20
3	3				3				4			4			3			3			3				23
4		4					4			4			4							5					21
5	3						3			4				3			3								16
																								Total	100

Assessment Questions

Remember

1. Name some special features required in a commercial building for physically handicapped and elderly.
2. List the applications of solarpanels.
3. List the accessories in alift.
4. Why is earthing needed for electricalsystems?
5. What are the types of switchgears?
6. Distinguish between additive and subtractive synthesis ofcolour.
7. What do you mean by depreciation factor?
8. List the factors affecting visualtasks.
9. Write any four noncombustible materials used inbuildings.
10. What is snorkelladder?

Understand

1. Summarize how electricity is being generated from gas andwater.
2. Explain about the special features required for handicapped and elderly inlifts.
3. State the purpose of concretepump
4. Classify the protective devices in electricalinstallations.
5. Explain about the types of wiring system with a neatsketch.
6. Write out the quantification oflight
7. Explain the laws ofillumination.
8. State the function of a compressor in refrigeration.
9. How temperature is beingmeasured?
10. State the law ofthermodynamics.
11. Compare latent heat of fusion with latent heat ofevaporation.
12. Interpret the planning considerations for non-combustible construction in abuilding.

Apply

1. Explain various possibilities of fire hazards in current type buildings and how will you protect them fromdisaster.
2. Implement your idea for planning an electrical wiring in abuilding.
3. How will you execute the minimum level of illumination in a building for old agepeople?
4. How will you implement air handling units in an officebuilding?
5. What are the considerations to be taken for implementing a fire fightingpump?
6. What is the need of implementing automatic sprinklers in abuilding?

Analyse

1. How will you attribute the planning consideration in various types of building for firesafety?

2. Differentiate the working principle of motors and generators with a neatsketch.
3. Differentiate between pipe and rodearthing.
4. Distinguish between MSCP andMHCP.
5. Organize your ideas for providing air conditioning systems for various buildingstypes.
6. Differentiate between dry risers and wet risers

15CE016 BRIDGE ENGINEERING 3 0 0 3

Course Objectives

- To impart basic knowledge on the codal provisions for design ofbridges
- To introduce the design of reinforced concrete slab bridge decks, Tee beam and slab bridge decks, plate girder bridges and prestressed concretebridges
- To impact knowledge on the design of different types of bridge bearings, piers and abutments, and bridgefoundations

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Design of reinforced Concrete Slab Bridgedecks
2. Recall the design principles of Balanced Cantilever, Continuous girder, Rigid Frame and Arch bridges
3. Design Plate Girder and Steel Trussedbridges
4. Design Post - tensioned prestressed Concrete Slab Bridge deck and Post - tensioned prestressed Concrete Tee beam and Slab Bridgedeck
5. Design bearing, piers, abutments and bridgefoundations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1	2									
2	1						1					
3		1	2	2								
4		1	2	2								
5		1	2	2								

UNIT I **9 Hours**

SHORT SPAN R.C BRIDGES

Introduction - Definition and basic forms - Components of a bridge - Classification of bridges - IRC Loading Standards and specifications - Design of Reinforced Concrete Slab Bridge decks - Design of Tee Beam and Slab Bridge Deck

UNIT II **9 Hours**

LONG SPAN R.C BRIDGES

Design principles of Balanced Cantilever Bridges, Continuous girder Bridges, Rigid Frame Bridges and Arch bridges

UNIT III **9 Hours**

STEEL BRIDGES

General- Railway loadings- Dynamic effect-Railway culvert with steel beams-Design of Plate Girder Bridges and Steel Trussed bridges

UNIT IV **9 Hours**

PRESTRESSED CONCRETE BRIDGES

Introduction - Design of Post - tensioned prestressed Concrete Slab Bridge deck - Design of Post - tensioned prestressed Concrete Tee beam and Slab Bridge deck.

UNIT V **9 Hours**

BEARINGS AND SUBSTRUCTURES

Bearings - Types of bearings - Design of Elastomeric bearings - Design of Piers and abutments - Foundations: Types of bridge foundations - Design of Pile Foundation and Well foundation

FOR FURTHER READING

Types of Electric Motors and Generators, Fire alarm system, Snorkel ladder

Total: 45 Hours

Reference(s)

1. Ken Hurst, Engineering Design Principles, Elsevier Science & Technology Books, May1999.
2. Richard Birmingham, Graham Cleland, Robert Driver & David Maffin, Understanding Engineering Design, Prentice Hall of India, 1998.
3. D. Johnson Victor, Essentials of Bridge Engineering, Oxford and IBH Publishing Co., New Delhi, Sixth edition,2014.
4. IRC: 6, 18, 21, 22, 24, 78 & 83
5. C. P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi, 1988
6. SP: 16 (S & T) - 1980, Design Aids to I.S.456-1978.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	3			4	6				1				4											20
2	2	2			5	5					3			3											20
3	3	3			2	3	3			3				3											20
4					4	5	2				5			4											20
5	2				1	5			4		5			3											20
Total																									100

Assessment Questions

Remember

1. Name the basic forms ofbridge.
2. What are the effects of bridge deck vibration due to the motion ofvehicles?
3. Write the advantage of continuousbridges.
4. List the components of boxculvert.
5. What are the elements of a plategirder?
6. Define steel trussbridge.
7. Define endblock.
8. List the benefits of using pre-stressed concretebridge.
9. What are the different types of bridgepier?
10. Name the components of wellfoundation.

Understand

1. How the Impact factor can be calculated for IRC Class Aloading?
2. What do you mean byresonance?
3. What is meant byArticulation?
4. In which situation balanced cantilever bridges are preferred?
5. What do you mean by End bearingstiffener?
6. What do you mean by horizontal and verticalstiffener?
7. What are the stages used in checking for stresses inprestressing
8. Distinguish between PSC and RCCbridges.
9. What are the purposeof providing bearing inbridges?
10. Under what circumstances the well foundation ispreferred.

Analyse

1. Outline the design principle of balanced cantilever bridges.

Evaluate

1. Design a RC slab culvert for a national highway for the following data.

Clear span = 6 m
Carriage way-Two lane
Live Load -IRC class AA Loading
Concrete-M25
steel fe415
wc - 100mm
footpath - 1.2m

2. A reinforced concrete slab deck for a culvert of effective span 6.5m is 500mm thick with two lane road way 7.5 m wide and footpaths 1m wide. Height of kerb is 300 mm, wearing coat is 100mm thick. If M20 grade concrete is used in the deck slab, Compute the Natural frequency of the deck slab and check for the safety of the deck against failure due to dynamic effects.
3. Design a double cantilever bridge deck slab to suit the following data.
   Total length of the bridge =77m
   Road Width 7.5m
   Foot path = 1.5m on either side
   Spacing of the T-Beams = 1.8m
   Loading IRC Class AA Tracked Vehicle.
   Use M20 grade concrete and Fe415 grade steel.
   Design the deck slab of the bridge.
4. Design of steel trussed highway bridge to suit the following data.
   Effective span=30m
   Road way= 7.5 m (two lane)
   Kerbs : 600 mm
   Loading : IRC Class AA Tracked Vehicle .
   Use M20 grade concrete and Fe 415 gradesteel
   Design the slab section of thebridge.
5. Design a plate girder to carry a super imposed load of 14 kN per m on an effective span of 20m.

Apply

1. Design a post tensioned pre-stressed concrete slab deck to suit thefollowingdata
   Clear span:10m
   Width of the bearing :400 mm
   Clear width of roadway : 7.5
   Footpath on either side
   kerb 600 mm deep class AA tracked vehicle Thickness of wearing coat 80 mm
   Compressive strength of concrete at transfer :35 N/mm2
   Use M40 grade concrete and 7 mm diameter high tensile wires with an ultimate tensile strength of 1500 N/mm2. For supplementary reinforcement adopt Fe415 grade bars.
2. Design the longitudinal girder of a post tensioned prestressed concrete T- beam slab bridge decks for a NH crossing for the followingdata.
   Effective span = 30m
   Width of road = 7.5m
   Kerb : 600mm on either side
   Foot path = 1.5 m wide on either side
   Thickness of slab = 250mm
   Thickness of WC= 80mm
   Spacing of cross girder = 5m
   Loading IRC Class AA or Class A
   Â Adopt M50 grade concrete and loss = 0.85
3. The pier of a major fly over bridge transmits a load of 8950kN at the foundation level. Design the number of Precast RCC Piles and a suitable Pile cap using the followingdata.

Width of Pier = 1m
Length of Pier = 9m
Size of Piles = 300mm by 300mm
Spacing of Piles = 1.5m
Materials: - M 20 Grade Concrete and Fe 415 HYSD bars

4. Design a well foundation for the Pier of a major highway bridge to suit the following data.
   Internal diameter of well =2.4m

   Type of Soil= Clay (k = 0.033)
   Depth of well= 20 m below bedlevel
   Materials: - M25 Grade Concrete and Fe 415 HYSD bars.

Create

1. Design a steel rocker bearing for transmitting a vertical reaction of 1000 kNand a horizontal reaction of 100 kN at the support of a bridge girder, assuming the permissible stresses according to IRC:83-1982.
2. A Design a reinforced concrete rocker bearing to transmit a support reaction of 600 kN. Adopt M-30 grade concrete and Fe – 415 grade HYSD bars. Permissible bearing stress in concrete is 8 N/mm^2.

15CE017 CONCEPTS OF ENGINEERING DESIGN 3 0 0 3

Course Objectives

- To provide a broad exposure to the students about the concepts of designs necessary in Civil Engineeringpractice
- To make the students familiar with National Building Code of India and other relevant codes for the functional design of residential and industrialbuildings

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Apply knowledge for the development of designs to meet defined and specifiedrequirements
2. Carry out the functional design of buildings as per IndianStandards
3. Recall general principles of fabrication
4. Recall the functional design of Industrial Buildings and factories as per Indian Standards-factories act
5. Prepare report andpresentation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2		1	2									
3	1											
4		1	2				2					
5	1											

UNIT I **9 Hours**

ENGINEERING DESIGN

Engineering design introduction and definition, Design process, Engineering design interfaces, Principles of Engineering Design- PDS criteria, Content of a PDS, Sample PDS, Principles, Exercises.

UNIT II **9 Hours**

CONCEPT GENERATION AND SELECTION

Introduction - Creativity Principle, Psychological set, Inversion, Analogy, Fantasy, Technological advances, Brainstorming, Morphological analysis, Presentation, Exercises. Concept selection - Subjective decision-making, Criteria ranking, Criteria weighting, Datum method, EVAD (Design Evaluation) method, Concept selection method,Exercises.

UNIT III **9 Hours**

DESIGN OF CAST IN SITU AND PREFABRICATED R.C. ELEMENTS

Energy embodiment design -Comparison of precast construction with monolithic construction - Types of prefabrication - casting and lifting of prefabricated components - Design of simple rectangular beams and I beams - Handling and erectionstresses

UNIT IV **9 Hours**

FUNCTIONAL DESIGN OF BUILDINGS

Functional design of Residential buildings - Rules and regulations related to flats as per National Building Code of India - Functional design of Industrial Buildings and factories as per Indian Standards-factories act

UNIT V **9 Hours**

REPORTS AND INTELLECTUAL PROPERTY RIGHTS

Presentation Techniques - Introduction, Concept sketches, Scheme drawing, Design report, Principles. Intellectual Property Rights - Introduction, Write the description of the invention, Pursue application.

FOR FURTHER READING

Problem Identification- Principles of Computer aided decision making - Case studies on existing residential, commercial and industrial buildings

Total: 45 Hours

Reference(s)

1. Ken Hurst, Engineering Design Principles, Elsevier Science & Technology Books, May1999.
2. National Building Code ofIndia
3. Richard Birmingham, Graham Cleland, Robert Driver & David Maffin, Understanding Engineering Design, Prentice Hall of India, 1998.
4. D. Johnson Victor, Essentials of Bridge Engineering, Oxford and IBH Publishing Co., New Delhi, Sixth edition,2014.
5. IRC: 6, 18, 21, 22, 24, 78 & 83.
6. SP: 16 (S & T) - 1980, Design Aids to I.S.456-1978.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3				3				4		4				3		3								20
2		3				3				3		4				4			3						20
3	2			2			4				4						4				4				20
4		3				3			3			3			3		3		3		2				23
5			5				5			5			2												17
																								Total	100

Assessment Questions

Remember

1. Write a short note on engineering designprinciples.
2. Define the SEED Design Process as given byPugh.
3. Briefly discuss about the content of PDS.
4. Mention some of the possible steps to develop creativity and explain it with anexample.
5. Explain in detail about the content of a product designspecification.
6. List the pre-production steps indesign
7. Elucidate the steps involved inscoring.
8. State configurationdesign
9. Draw the cyclic nature ofembodiment.
10. Write down the criteria’s used in the design for assembly andmanufacture.
11. Enumerate optimization by differentialcalculus.
12. Elucidate provisional materials and processesdetermination
13. Give the general requirements for industries.
14. Define functionaldesign
15. Give the structural layout of an industrial building and explain the variouscomponents.
16. Draw engineering drawingsequence.
17. Define schemedrawing.
18. List out the order ofdescription
19. Define PDS in designreport
20. Enumerate drawingmorphology
21. Elucidate inventiondisclosure

22. With an example clearly explainpatents
23. Explain the detailed design of footpressure

Understand

1. List out the responsibilities of designengineer.
2. Clearly explain the engineering designinterfaces.
3. Bring out the difference between Psychological set andinversion.
4. Name eight words that can give us alternate ways of looking at a situation orproblem.
5. How can the team choose the best concept, given that the designs are still quiteabstract?
6. How can a decision be made that is embraced by the whole team? How can desirable attributes of otherwise weak concepts be identified andused?
7. List out the main criteria used to select the combinations of materials andprocesses.

Apply

1. Why is iteration an important part of the designprocess?
2. Elucidate the Pugh's model of the designprocess.
3. Enumerate the design process for a building which is attacked by national terroristactivity.
4. Elucidate PDScriteria.
5. Consider the wide variety available for assisting the removal of a cork from the neck of a wine bottle. Select the optimum using the recommended decision makingprocess.
6. A market opportunity exists for a can opener which is operated by disabled people with only one hand. The device is to open the can in such a manner that the contents are not split or contaminated, the contents can be easily removed and no dangerous of jagged edges are left exposed. Write a specification for thedevice.
7. Name nine words that summarize the Principle of ConceptGeneration
8. Elucidate the steps involved in concept selectionmethod
9. Explicate the stages involved in concept screeningmethod.
10. Explicate the advantages and disadvantages of morphologicalanalysis.
11. Explain about inversion with suitableexample
12. With an example explain design for assembly andmanufacture
13. Sketch the product design model and explainclearly.

Analyse

1. Suggest some methods to improve creativity.

15CE018 FINITE ELEMENT ANALYSIS 3 0 0 3

Course Objectives

- To impact basic knowledge on the various steps involved in finite elementanalysis
- To introduce various types of one - two - three - dimensionalelements

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Recall basic concepts of Finite Element Analysis
2. Spot coordinates for variouselements
3. Analyse Truss and beam members by Finite elementMethod
4. Analyse one and two dimensionalmembers
5. Analyse the special parameters of thestructures

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2											
2	1											
3		2	1									
4		2	1									
5		2	1									

UNIT I **9 Hours**

INTRODUCTION

Introduction - Basic Concepts of Finite Element Analysis - Introduction to Elasticity - Steps in Finite Element Analysis - Virtual Work and Variational Principle - Galerkin Method- Finite Element Method: Displacement Approach - Stiffness Matrix and Boundary Conditions

UNIT II **9 Hours**

ELEMENT PROPERTIES

Natural Coordinates - Triangular Elements - Rectangular Elements - Lagrange and Serendipity Elements - Solid Elements -Isoparametric Formulation - Stiffness Matrix of Isoparametric Elements Numerical Integration: One, Two and Three Dimensional

UNIT III **9 Hours**

ANALYSIS OF STRUCTURES BY FEM

Stiffness of Truss Members - Analysis of Truss - Stiffness of Beam Members - Finite Element Analysis ofContinuous Beam - Plane Frame Analysis - Analysis ofGrids.

UNIT IV **9 Hours**

FEM FOR TWO AND THREE DIMENSIONAL STRESS ANALYSIS

Constant Strain Triangle - Linear Strain Triangle - Rectangular Elements -Numerical Evaluation of Element Stiffness -Computation of Stresses, Geometric Nonlinearity and Static Condensation - Axisymmetric Element -Finite Element Formulation of Axisymmetric Element -Finite Element Formulation for 3 Dimensional Elements

UNIT V **9 Hours**

OTHER APPLICATIONS OF FEM

Fluid flow analysis-vibration analysis-Elastic Stability analysis-Plate bending problem

FOR FURTHER READING

Use of finite element packages for the analysis of beams, frames, grids and deep beams.

Total: 45 Hours

Reference(s)

1. S.Rajasekaran, Finite Element methods in Engineering Design, Wheeler,1993
2. Chandrupatla, T.R., and Belegundu, A.D., Introduction to Finite Element in Engineering, Third Edition, Prentice Hall, India,2003
3. Krishnamoorthy C. S,"Finite Element Analysis Theory and Programming", Tata McGraw Hill Education,1994
4. David V. Hutton,"Fundamentals of Finite Element Analysis", Tata McGraw Hill,2004
5. Reddy J.N., An Introduction to Finite Element Method, McGraw-Hill, Intl. Student Edition,1985
6. Rao S.S, The Finite Element Method in Engineering, Pergaman Press,2003

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1		2	3		4		4			2		2		3											20
2	2			2		2			3				3				4				4				20
3		2					3			3		3		3	3				3						20
4	3		3		4				4				4				2								20
5		4				5			5				4					2							20
																								Total	100

Assessment Questions

Remember

1. What is the principal of virtualwork?
2. What are weighted residualmethods?
3. What do you mean by non-conformingelement?
4. What is the significance of jacobianmatrix?
5. What is linear triangularelement?

6. What is isoparametricrepresentation?
7. What is hermitian family ofelements?
8. Why constitutive matrix for axi-symmetric stress analysis is of order4x4?
9. Defineshell.
10. What are the degrees of freedom in BISelements?
11. What do you mean by consistent loadvector?
12. What are cylindricalcoordinates?
13. What are the different types of non-linearity?

Understand

1. State the principle in method of weightedresiduals.
2. Differentiate between Galerkin and Ritzmethod.
3. What do you understand by sub parametric, isoparametric and super parametric elements? Differentiate them with an example.
4. Write a note on ZIB8 and ZIB20 elements with respect to their formulation andimplementation.
5. How will you map a curved boundary in 3-Danalysis?
6. Give a brief account of semi loop shellelements.
7. How will you analysis aGIRD?
8. Compare Newton Raphson and modified Newton Raphsonmethods

Apply

1. Explain the basis steps involved in Finite ElementAnalysis.
2. Describe the different storage schemes and solution of large system of simultaneousequation.
3. Explain any two methods of weighted residuals withexamples
4. Explain Rayleigh Ritz method by taking anexample
5. Evaluate the stiffness matrix of a CST element whose co- ordinates are (10, 10), (30, 10), and (20, 30), adopt $\gamma = 0.25$,t=10mm
6. Explain how you will use your FE analysis for R.Cstructures.
7. Determine the shape function of an eight node rectangularelement
8. Explain the modified Newton Raphson method for solving nonlinearequations.

Analyse

1. Explore the various steps involved in FEA with a suitable example with the help of any one of the finite element packages based onFEM
2. Explain the finite strip method in FEM and state its application in structuralengineering

15CE019 ADVANCED STEEL DESIGN 3 0 0 3

Course Objectives

- To impart knowledge on steelconstructions
- To impart the knowledge on codal provisions for design of steelstructures

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Design connections in beams andcolumns
2. Design of IndustrialComponents
3. Analyse and design steel bunkers,chimneys andsilos
4. Design cold formedsections
5. Design tension & compressionmembers

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1	2									
2		1	2									
3		2	1									
4		1	2									
5		1	2									

UNIT I **9 Hours**

STRUCTURAL CONNECTIONS

Design of high strength function grip bolts Design of bolted connections at the junctions of beams and columns in frames - Design of un stiffened & stiffened seat connections - Welded connections - Eccentric connections -Beam end connections - Direct web fillet welded connections -Direct web Butt welded connection -Double plate web connection -Double angle web connection -Un-stiffened and stiffened seat connection -Continuous beam to column connection -Tubular connections -Continuous beam to beam connection.

UNIT II **9 Hours**

INDUSTRIAL BUILDINGS

Design of Industrial building frames - Section of roofing and wall materials - General - Framing - Bracing - Design of gantry girders and crane columns - Analysis of Trussed bents -Design example -Design of rigid joints knee for gableframes.

UNIT III **9 Hours**

ANALYSIS AND DESIGN OF SPECIAL STRUCTURES

Design of steel bunkers and silos - Janssen's theory - Airy's theory - Design parameters - design criteria - Design and detailing of guyed steel chimneys - Transmission line towers - Introduction -Types of towers - Tower configuration

UNIT IV **9 Hours**

LIGHT GAUGE SECTIONS

Design of cold formed sections - Concepts -Effective width - Stiffened sections -Multiple stiffened sections -Design for flexure -Design of light gauge columns -Torsional -Flexural buckling - Tension Members -Beam column -Connections - Design of light gauge steel studs

UNIT V **9 Hours**

PLASTIC ANALYSIS AND DESIGN

Plastic design of tension & compression members - Theory of plastic bending -Plastic hinge - Redistribution of moments -Failure mechanisms -Plastic analysis and design of fixed beams, continuous beams and portal frames by mechanism method

FOR FURTHER READING

Improving personality - Leading with integrity, enhancing Creativity - Effective Decision making - sensible communication - the listening game - Managing self - Meditation for peace - yoga for life

Total: 45 Hours

Reference(s)

1. N. Subramanian, Design of Steel Structures, Oxford University Press2008
2. S. K. Duggal, Limit State Design of Steel Structures, Tata , Mc Graw Hill Education Pvt Ltd, NewDelhi
3. IS 800 - 2007, General Construction in Steel Code of Practice, BIS, NewDelhi
4. R. Murugesan and A. P. Arulmanickam, Steel Tables in SI Units, Pratheeba Publishers, Coimbatore,2009
5. Reddy J.N., An Introduction to Finite Element Method, McGraw-Hill, Intl. Student Edition,1985
6. Rao S.S, The Finite Element Method in Engineering, Pergaman Press,2003

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1		6			6	6																			18
2	2	2			4	4			2	6															20
3	2				2	2				4			4	6											20
4	2				2					2			2	6				6							20
5		2				2				4				4			2	6							20
																								Total	98

Assessment Questions

Remember

1. Define the term blockshear.
2. What are the types of boltedjoint?

3. Name the types of tensionmember.
4. How will you find net sectional area in chainriveting?
5. Give the Euler's formula to calculate the bucklingload.
6. Define slendernessratio.
7. Write down the formula to find Elastic criticalstress.
8. What is built up beams? Mention itstypes.
9. Describe the assumptions made in analysis of rooftrusses.
10. Define beamcolumn.
11. Define the term blockshear.

Understand

1. Differentiate between Characteristic load and factoredload.
2. What do you mean by pryingforce?
3. When tension splices are needed in the tensionmember?
4. Why lug angles are provided in the tensionmember?
5. What do you mean by 'Webcrippling'?
6. When splicing of a column becomesnecessary?
7. What is the difference between laterally supported and laterally unsupportedbeams?
8. How the loads are transferred by abeam?
9. Distinguish between determinate and indeterminatetrusses.
10. What is the function of abracing?

Analyse

1. How will you calculate permissible bending stress in compression and tension for laterally unsupportedbeams?
2. How will you calculate design bending moment for I – sectionpurlin?
3. How will you find maximum bending moment for anglesection.

Evaluate

1. How will you calculate Nominal diameter of thebolt?
2. How the effective throat thickness will be computed in case of incomplete penetration buttweld?
3. How the design strength of tension member iscalculated?
4. What is the radious of gyration for a hollow steel shaft, outside diameter 150mm and inside diameter 100mm is to be used as acolumn.
5. How can you calculate maximum slenderness ratio for flat bars of width b and thickness t used forlacingsystem?
6. How will you calculate permissible bending stress in compression and tension for laterally supportedbeams?

Create

1. Design a single angle discontinuous strut for a roof truss to carry a load of 95kN. The length of the strut between the centres of intersection is2.50m.

15CE020 REMOTE SENSING AND GIS 3 0 0 3

Course Objectives

- To impart knowledge on the principles of Remote Sensing and itslimitations
- To communicate the knowledge on the basic characteristics of remote sensingimagery
- To provide a basic understanding of GIS modeling concepts, components, requirements and applications

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Identify the earth surface features and energy interactions in theatmosphere.
2. Interpret the data from Images using Different Image Processingtechniques
3. Classify and analyze the database concepts ofGIS
4. Integrate remote sensing data with GIS software for developingimageries.
5. Apply RS and GIS techniques for variousapplications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2	1	2			2							
3	2	2			3							
4	2	2	2		3							
5	3	2			3							

UNIT I **9 Hours**

REMOTE SENSING

Definition and its components - History of remote sensing and Indian Space Program. Electromagnetic spectrum - wavelength regions important to remote sensing - Wave theory, Particle theory, Stefan-Boltzman Law - Atmospheric scattering, absorption - Atmospheric windows - spectral reflectance of EMR with earth surface, water, vegetation and soil- spectral signature concepts - Platform andSensors.

UNIT II **9 Hours**

IMAGE INTERPRETATION AND ANALYSIS

Types of Data Products - Types of image interpretation - Basic elements of image interpretation - Visual interpretation keys - Digital Image Processing - Pre-processing - Image enhancement techniques - Multispectral Image classification - Supervised and unsupervised.

UNIT III **9 Hours**

GEOGRAPHICAL INFORMATION SYSTEM AND ITS ANALYSIS

Maps - Map projections - Types of map projections- GIS definition - Basic components of GIS - Data type - Spatial and non-spatial data - Database concepts - Vector and Raster data structures, Data compression, Edgematching

UNIT IV **9 Hours**

DATA INPUT EDITING AND ANALYSIS

Data stream - Input methods - GPS for data capture-Editing- Data Retrieval - Query - Simple Analysis - Spatial Analysis - Overlay - Vector Data Analysis - Raster Data Analysis- Topological analysis - Modeling surfaces - DEM - DTM - Slope Model - Integration of Remote Sensing andGIS.

UNIT V **9 Hours**

REMOTE SENSING AND GIS APPLICATIONS

Applications- Landuse - Water Resources and Watershed management - Irrigation and Agriculture - Environmental studies - ground water exploration - Defence Application - Wasteland Management - Weather Forecast - Flood and Storm Routing - Emergency Management and Real Estate.

FOR FURTHER READING

Indian Remote Sensing Satellites- Standard GIS Packages- Application of Mobile and Web GIS

Total: 45 Hours

Reference(s)

1. M. Anji Reddy, Remote sensing and Geographical Information Systems, Third Edition, BS Publications, India,2006.
2. T.M. Lillesand and R.W. Kiefer, Remote Sensing and Image Interpretation, John Willey and sons, inc. New York,2002.
3. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, NewDelhi
4. R. Murugesan and A. P. Arulmanickam, Steel Tables in SI Units, Pratheeba Publishers, Coimbatore,2009

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	6	4			4	6																			20
2	5		5		2	2				2	4														20
3	2	4	4		4	6																			20
4	2		4		4	4				2	4														20
5	2		4		2		6		4	2															20
																								Total	100

Assessment Questions
Remember

1. State Stefan-Boltzman and Wein's DisplacementLaw.
2. Enumerate the elements ofresolution.
3. Differentiate between Active and Passivesensors.
4. Enumerate the advantages of activesensors.
5. Differentiate between Active and Passivesensors.
6. Define AtmosphericWindows.
7. Discuss on spectral signature and its rule in identifying objects with suitablediagrams.
8. Explain the role of a scanner in remote sensing and describe the different types of scanners used in remotesensing.
9. List out the two type of sensors and discussdetail.
10. What are the components ofGIS?
11. Compare raster and vector data model.
12. What is map projection and explain the differentiate types of map projections with their characteristics.
13. What is meant by DBMS. Explain its concepts andcomponents?
14. List the advantages and disadvantages of the different GIS datamodels.
15. Differentiate between vector and raster dataanalysis.
16. Define topologicaloverlay.
17. Explain GIS output.
18. Explain about the integration of remote sensing andGIS.
19. Explain shorly about triangulated IrregularNetwork.
20. List out the application of remote sensing related to naturalresource
21. List out the remote sensing softwares used for highwayalignment
22. Write short note on spectral reflectance of soil inIndia.
23. Explain in detail about the application of Remote sensing and GIS in about the spectral reflectance of water resourcemanagement.
24. Define land use and land cover and briefly expalin about land use and land coverclassification
25. Explain in detail about the application of Remote sensing and GIS inagriculture
26. Explain in detail about the application of Remote sensing and GIS in EnvironmentalStudies.

Understand

1. Draw the Wavemodel.
2. Explain the spectral reflective characteristics of water, vegetation and soil in visible and infrared regions.
3. Explain the orbital and sensor characteristics of any one of the Indian remote sensingsatellites.
4. Discuss the principles to be understood with respect to scattering and absorption of EM energy for remote sensingapplications.
5. Discuss the principles to be understood with respect to scattering and absorption of EM energy for remote sensingapplications.
6. Draw the components of remotesensing.
7. Compare the real and ideal Remote Sensing System. Explain them indetail.
8. Explain the spectral reflective characteristics of water, vegetation and soil in visible and Infrared regions.
9. Discuss the principles to be understood with respect to scattering and absorption of EM energy for remote sensingapplications.
10. Define database managementsystem.
11. Define edgematching.
12. Compare the advantages and disadvantages of raster and vector datamodels

15CE021 INDUSTRIAL WASTE MANAGEMENT 3 0 0 3

Course Objectives

- To provide basic knowledge on the management practices of solid and liquidwaste
- To impart knowledge on the collection, transport and disposal of solidwaste
- To emphasize the need for solid and liquid wastemanagement

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Identity the characteristics of solid and liquid wastes from variousindustry.
2. Select the method of treatments and the disposal of industrial effluents.
3. Predict the contaminants present in the effluents fromindustry.
4. Differentiate various treatment technologies involved in treating wastewater
5. Manage hazardouswastes

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2					2					
2	1	2					2					
3	1	2		2								
4	1	1			2							
5	1	2		1								

UNIT I **9 Hours**

INTRODUCTION

Types of industries and industrial pollution- Characteristics of industrial wastes - Population equivalent - Bioassay studies - effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health - Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

UNIT II **9 Hours**

CLEANER PRODUCTION

Waste management Approach - Waste Audit - Zero discharge - Volume and strength reduction - Material and process modifications - Recycle, reuse and by product recovery - Applications.

UNIT III **9 Hours**

POLLUTION FROM MAJOR INDUSTRIES

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants - Wastewater reclamation concepts

UNIT IV **9 Hours**

TREATMENT TECHNOLOGIES

Equalisation - Neutralisation - Removal of suspended and dissolved organic solids - Chemical oxidation - Adsorption - Removal of dissolved inorganics - Combined treatment of industrial and municipal wastes - Residue management - Dewatering - Disposal.

UNIT V **9 Hours**

HAZARDOUS WASTE MANAGEMENT

Hazardous wastes - Physico chemical treatment - solidification - incineration - Secured land fills

FOR FURTHER READING

Case study of industrial waste management in any two cities in Tamil Nadu - in any one cities in North India. Any two Case study of industrial waste management in any part of the world with innovations in Engineering and Technology.

Total: 45 Hours

Reference(s)

1. M.N.Rao & A.K.Dutta, Wastewater Treatment, Oxford - IBH Publication,1995
2. W .W. Eckenfelder Jr., Industrial Water Pollution Control, McGraw-Hill Book Company, New Delhi,2000.
3. T.T.Shen, Industrial Pollution Prevention, Springer, 1999.1998
4. R.L.Stephenson and J.B.Blackburn, Jr., Industrial Wastewater Systems Hand book, Lewis Publisher, New Yark,1998
5. H.M.Freeman, Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi,1995.
6. Bishop, P.L., Pollution Prevention: Fundamental & Practice, McGraw-Hill,2000

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	4					4				4			3		3		2								20
2	3		3		3	4				2		2						3							20
3	4		4			3				3		3		3											20
4	4			4						4						4			4						20
5	2		2			3		5			4						3	1							20
																								Total	100

Assessment Questions
Remember

1. Recall the types of industries and industrialpollution
2. List out the effects of industrial effluents onstreams.
3. List removal of dissolved inorganicmatter.
4. Define solidwaste.
5. List out the methods of unit operations used for separation andprocessing.
6. Classify the characteristics of industrialwastes.

Understand

1. State waste managementApproach.
2. DefineEqualization
3. StateAdsorption.
4. List out the sources of wastegeneration.
5. Define anaerobic methods for materials recovery and treatment.
6. Outlinelandfills.
7. Define resource and energyrecovery.
8. State integrated wastemanagement.
9. Illustrate bioassaystudies
10. Explain wasteaudit.
11. Summarize reuse and byproductrecovery.
12. Explain waste treatment flow sheets for textilesindustries.
13. Summarize the Combined treatment of industrial and municipalwastes.
14. Illustrate Chemicaloxidation.
15. Explain anaerobic methods for materials recovery andtreatment.
16. Illustrate integrated wastemanagement
17. llustrate physicochemicaltreatment.
18. Explainsolidification.
19. Illustrateincineration
20. Explain removal of dissolvedinorganics.

Apply

1. Demonstrate bioassaystudies.
2. Write sewage treatment plants and humanhealth.
3. Illustrate electroplatingindustries.
4. Uses of residue management.Illustrate.
5. Prepare waste treatment flow sheets for fertilizerplant.
6. Illustrate Legal and organizational foundation of solid wastemanagement.
7. Compute sampling and characterization of liquid and solidwaste.
8. Write unit operations used for separation andprocessing.
9. Define hazardous waste..
10. Demonstrate landfillremediation
11. Write about Industry specific solid wastemanagement.
12. Demonstrate integrated wastemanagement.

Analyse

1. Explain Populationequivalent.
2. Explain Populationequivalent.
3. Collect the effects of industrial effluents onstreams.
4. Design any one method of material and processmodifications..

5. Sumarize wastewater reclamationconcepts
6. Synthesize Residuemanagement.
7. Explain the monitoringresponsibilities.
8. Write future changes in wastecomposition
9. Construct materials recoveryfacilities.
10. Summarize transport means and methods of solidwaste.
11. Explain landfillremediation.

15CE022 DESIGN OF TIMBER, MASONRY AND STEEL ELEMENTS

3 0 0 3

Course Objectives

- To impart fundamental knowledge on the design philosophy of timber masonry and steel structures
- To make the students understand the design principles of timber masonry and steel structural elements

Programme Outcomes (POs)

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Design the wooden members subjected to axial forces and bendingmoment
2. Design the Steel members subjected to tension andcompression
3. Design the masonrypier
4. Design the masonrywalls
5. Design steel members withconnections

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1	2									
2		1	2									
3		1	2									
4		1	2									
5		1	2									

UNIT I **9 Hours**

BASICS OF STRUCTURAL DESIGN

Definition and classification of structures - Structural systems - Basic structural requirements - Strength, stability and stiffness - Design methods - Working stress method - Limit state method -Code of practice - Choice between different structural materials - Masonry, timber, concrete and steel - Types of loads - Dead load - Live load -Wind load - Earthquake load.

UNIT II **9 Hours**

TIMBER STRUCTURES

General - Factors affecting strength of timber - Allowable stresses in tension, compression and flexure- Design of rectangular beams - Design of timber joists of Madras terrace - Design of tension members - Design of compression members of solid and box sections - Design of bolted and nailed connections

UNIT III **9 Hours**

DESIGN OF MASONRY PIERS

Determination of permissible compressive stresses in masonry - Design of masonry column subjected to axial and eccentric loading - Design of reinforced brick masonry - Design of composite brick masonry - Design of masonry arches in building - Design of masonry retaining wall

UNIT IV **9 Hours**

DESIGN OF MASONRY WALL

BRICK MASONRY WALL:Types of walls - Design of solid load bearing wall for axial loads - Design of solid load bearing wall for eccentric loads - Design of wall with opening - Design of cavity wall - Design of stiffened and unstiffened wall.HOLLOW BLOCK MASONRY WALL:Materials for Hollow Blocks as per IS 2185 - Size of the Hollow blocks - Methods of Manufacturing Hollow Blocks - Tests on Hollow Blocks - Design and Construction of Hollow Block Masonry Walls STONE MASONRY WALL:Permissible stresses in stone masonry - Design and Construction of Solid load bearingwall

UNIT V **9 Hours**

DESIGN OF STEEL MEMBERS

Properties of Structural Steel - Bolted and welded Connections - Design of tension and compression members - Types of weld - Strength of fillet and butt welded joints - Design of bolted and welded connections of member sunder axial force

FOR FURTHER READING

Case studies on timber, masonry and steel structures.

Total: 45 Hours

Reference(s)

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Design of steel structures, Laxmi Publications(P) Ltd,2007
2. W. M. C McKenzie, Design of Structural Elements, Macmillan Publishers,2013
3. IS: 1905 - 1980, Indian Standard Code of Practice for Structural Safety of Buildings, Masonry Walls,Indian Standards Institution, 19811998
4. IS: 883 - 1994, Code of Practice for Design of Structural Timber in Buildings, BIS NewDelhi
5. IS: 2185 (Part I) - 2005, Indian Standard Specification for Concrete Masonry Units Part I Hollow and Solid Concrete Blocks BIS NewDelhi
6. IS: 2185 (Part II) - 1983, Indian Standard Specification for Concrete Masonry Units Part II, Hollowand Solid Light Weight Concrete Blocks, BIS New Delhi

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	4	2				2			6	6															20
2	2	2			2	2					6			6											20
3	2					6					6				6										20
4		2				4	2				6			6											20
5	2	2				2	2				6				6										20
																								Total	100

Assessment Questions

Remember

1. Define astructure.
2. List the structural elements with anexample.
3. List the structures based on theirproperties.
4. List the structures based on the supporting systems with example.
5. Define the followingterms:
   (a) Strength (b) Stability (c)Stiffness
6. List the various types ofloads
7. Define working stress method ofdesign
8. Define limit state method ofdesign
9. List the types ofbond.
10. What are the various types ofbricks?
11. Define Slendernessratio
12. List the grades oftimber
13. List the principal factors for the depth of foundation
14. Define abeam

Understand

1. Identifying the formula for calculating allowablestree
2. Summarise the factors which affects the safe bearing capacity ofsoils
3. Under what circumstances are nailed joints preferable intimber?
4. Classify the types of joints based on strengthconsideration.
5. Classify the column according to its slenderness ratiovalue.
6. Distinguish between ultimate limit state and serviceability ratiovalue.
7. Compare built-up solid column and built-up hollowcolumn

8. Identify the various factors affecting the strength oftimber.
9. Classify the different types of loads acting on astructure.

Apply

1. Compute the cross sectional areafactor
2. Give the value of load factor (KL) for different loadingconditions
3. Give the formula for calculating effective thickness in cavitywalls
4. Give the allowable deflection value for different types ofbeams
5. Give the permissible stress for built up steelcolumn.
6. Give the formula for horizontal shear in rectangularbeam
7. Outline the procedure for the design of spacedcolumns
8. Give the four basic steps necessary for designing a flexuralbeam.
9. How is end thrust of an archcalculated?

Analyse

1. Design the allowable axial load per m length of a 240 mm cavity wall with 40 mmcavity.
2. Design the load carrying capacity of a brick concrete pier of size 342 x 684 mm laterally restrained by wall in both directions throughout the height. Assume it has a concrete core of 114 x 456mm.
3. Design a nail joint for joint forces between 20 to 25 kN ofsoftwood.
4. Design a single angle discontinuous strut for a roof truss to carry a load of 95kN. The length of the strut between the centres of intersection is2.50m.

15CE023 DESIGN OF PRESTRESSED CONCRETE STRUCTURES **3 0 0 3**

Course Objectives

- To impart knowledge on the basic principles of prestress concretestructures
- To impart the design philosophy of prestressed beams, tanks, pipes, polesetc

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Analyse the stresses in prestressed concrete member due to prestressingforce
2. Design the layout of cables for Type I and Type II beams based on calculation of moment of resistance.
3. Compute the deflections and anchorage zonestresses.
4. Implement the methods for achieving continuity inbeams.
5. Evaluate the design of circular prestressing and the uses of non prestressedreinforcement.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	3	1									
2	1	2	3									
3	1	2	1									
4	1	1	1									
5	1	1	2									

UNIT I **9 Hours**

INTRODUCTION

Basic principles of Prestressing - Classification and types - Advantages over ordinary reinforced concrete - Materials - high strength concrete and high tensile steel - Methods of Prestressing - Freyssinet, Magnel Blaton, Lee Mc Call and Killick anchorage systems - Analysis of sections for stresses by stress concept, strength concept and load balancingconcept.

UNIT II **9 Hours**

DESIGN FOR FLEXURE AND SHEAR

Basic assumptions for calculating flexural stresses - Permissible stresses in steel and concrete as per I.S.1343 Code - Design of sections of Type I and Type II post- tensioned and pre -tensioned beams -

Check for strength limit state based on I.S.1343 Code - Location of wires in pre-tensioned beams - Design for shear based on I.S.1343 Code.

UNIT III **9 Hours**

DEFLECTION AND DESIGN OF ANCHORAGE ZONE

Factors influencing deflections - Short term deflections of uncracked members - Prediction of long term deflections due to creep and shrinkage - Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and I.S.1343 code - Design of anchorage zonereinforcement.

UNIT IV **9 Hours**

COMPOSITE BEAMS

Types of R.C.C. - P.S.C composite beams - Analysis and design of composite beams - Analysis for secondary moments - Concordant cable and linear transformation - Calculation of stresses - Principles of design.

UNIT V **9 Hours**

MISCELLANEOUS STRUCTURES

Design of tanks, sleepers and tension members - Use of non-prestressed reinforcement - Definition, methods of achieving, merits and demerits of partial Prestressing

FOR FURTHER READING

Losses of prestress - Layout of cables - Check for transfer bond length in pre - tensioned beams - Methods of achieving Continuity in continuous beams - Design of pipes - poles.

Total: 45 Hours

Reference(s)

1. Krishna Raju, N., Prestressed Concrete, Tata Mc Graw Hill Publishing Company, New Delhi, 1995.
2. Lin, T.Y. and Ned.H.Burns, Design of Prestressed Concrete Structures, John Wiley & Sons, New York,1982.
3. Rajagopalan, N., Prestressed Concrete, Narosa Publishing House, New Delhi,2002.
4. Mallik, S.K. and Gupta, A.P., Prestressed Concrete, Oxford &IBH Publishing Co., Pvt.Ltd., India,1986.
5. Arthur H.Nilson, Design of Prestressed Concrete, John Wiley & Sons, New York, 1978.Concrete Blocks BIS NewDelhi
6. Dayaratnam,P., Prestressed Concrete Structures, Oxford and IBH, New Delhi,1982.

Assessment Pattern

Unit/RBT	**Remember**				**Understand**				**Apply**				**Analyse**				**Evaluate**				**Create**				**Total**
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	2	2			2	7	7																		20
2	2	2			2	2									6				6						20
3	2	2			2	2							2	4	2				4						20
4	2	2			2	2								2	4			4	2						20
5	2	2			2	2								4	2		4		2						20
Total																									100

Assessment Questions

Remember

1. State the basic principle of prestressed concretestructures.
2. Why did the early attempts in prestressing use ordinary mild steelfail?
3. List out the assumptions in strain compatibilitymethod.
4. Define the term Line ofThrust.
5. Name some of the various methods generally used for the investigation of anchorage zone stresses.
6. Explain the terms a) Primary Moment b) Secondary Moment c) ResultantMoment
7. Outline the merits and demerits of partialprestressing.
8. Define concordantcables.
9. List out the advantages of prestressed concretepoles.

Understand

1. Explain why high strength concrete is used for prestressed concretestructures?
2. Why high strength concrete is used in prestressedconcrete?
3. Briefly outline the Magnel method of computing the horizontal and transverse stress in end blocks subjected to concentrated force fromanchorage.
4. Describe the failure due to flexure shearcracks?
5. Summarize about the long term deflections of cracked prestressed concretebeams
6. Discuss the various factors influencing the design ofsleepers.
7. Sketch the various methods of achieving continuity in prestressed concretemembers.

Analyse

1. A simply supported prestressed concrete beam spanning over 10 m is of rectangular section 500mm wide by 750 mm deep. The beam is prestressed by a parabolic cable having an eccentricity of 200 mm at the centre of the span and zero at the end supports. The effective force in the cable is 1600 kN. If the beam supports a total uniformly distributed load of 40 kN/m, which includes the selfweight.

    i. Evaluate the extreme fibre stresses at the mid span section using the internal resisting couple methodand
    ii. Calculate the force required in the cable having the same eccentricity to balance a total load of 50 kN/m on thebeam.

2. A pretension prestressed concrete sleeper 300 mm wide by 250 mm deep is prestressed using 9 wires of 7 mm diameter. Four wires are located at top and 5 wires near the soffit. The effective cover being 40 mm. The initial stress in the wires is 1256 N/mm^2. Assuming the modular ratio 6, estimate the percentage loss of stress in the top and bottom wires due to elastic deformation of concrete.
3. A pretension girder having a T section is made up of a flange 200 mm side and 60 mm thick. The overall depth of the girder is 660 mm. the thickness of the web is 60 mm. the horizontal prestress at a point 300 mm from the soffit is 10N/mm^2. the shear stress due to transverse load acting at the same point is 2.5 N/mm^2. determine the increase in the principal tensile stress at this point if the T section is subjected to a torque of kNm

Evaluate

1. A class III type partially prestressed T-girder designed to support a live load of 8 kN/m over an effective span is 20 m is made up of a top flange 1000 mm wide by 120 mm thick, with a rib of 300mmwide.Theoveralldepthofthegirderis720mm.Thetensionedsteelconsistsofnine Strandsof 12.5 mm diameter with a tensile strength of 1750 N/mm^2 located at 585 mm from the top. The untensioned steel is of seven cold-worked deformed bars, of 25 mm diameter with fy=425 N/mm^2, located 80 mm from the soffit of the girder. The effective prestressing force in the tendons is 830 kN. Estimate the width of the cracks developed under service loads and check the crack width using the hypothetical tensile stresses provided for in the IScodes.
2. A concrete beam with a rectangular section 300 mm wide and 500 mm deep is prestressed by 2 post tensioned cables of area 600 mm^2 each. Initially stressed to 1600 N/mm^2. The cables are located at a constant eccentricity of 100 mm through out the length of the beam having a span of 10 m. the modulus of elasticity of steel and concrete is 210 and 38 N/mm^{2}respectively.

    i. Neglecting all losses, find the deflection at the centre of span when it is supporting its ownweight.
    ii. Allowing for 20 percent loss in prestress, find the final deflection at the centre of span when it carries an imposed load of 18 kN/m. Dc=24kN/m^2.

2. A high tensile cable comprising 12 strands of 15 mm diameter with an effective force of 2500 kN is anchored concentrically in an end block of post tensioned beam. The end block is 400mm wide by 800 mm deep and the anchor plate is 200 mm wide by 260 mm deep. Design suitable anchorage zone reinforcements using Fe 415 grade HYSD bars using IS 1343 code provisions.

15CE024 PLANNING AND MANAGEMENT FOR HOUSING

3 0 0 3

Course Objectives

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housingprojects.
- To focuses on cost effective construction materials andmethods
- Emphasis has also been given on the principles of sustainable housing policies andprogrammes

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Recall the principles and policies of housingsector
2. Differentiate housingprograms
3. Design the housingunits
4. Evaluate the function and performance ofhousing
5. Analyse cash flow inhousing

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	1											
3		1	2									
4		1	2									
5		2										

UNIT I **9 Hours**

INTRODUCTION TO HOUSING

Definition of Basic Terms House, Home, House hold, Apartments, Multi-storeyed Buildings, Special Buildings, Objective and Strategies of National Housing Policies, Principle of sustainable Housing, Housing Laws at state level, Bye laws at urban and Rural Local Bodies - levels, Development control Regulation, Institutions for Housing at National, State and Local Levels

UNIT II **9 Hours**

HOUSING PROGRAMMES

Basic Concepts, contents and standards for Housing Programmes sites and services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slump Housing Programmes, Role of Public, Private, and Non-governmentalOrganisations

UNIT III **9 Hours**

PLANNING AND DESIGN OF HOUSING PROJECTS

Formulation of Housing Projects Site Analysis, Layout design, Design of Housing Units (Design Problems)

UNIT IV **9 Hours**

CONSTRUCTION TECHNIQUES AND COST EFFECTIVE MATERIALS

New construction Techniques - Cost effective Modern Construction Materials, Building centers - concepts, Function and Performance Evaluation

UNIT V **9 Hours**

HOUSING FINANCE AND PROJECT APPRAISAL

Appraisal of Housing Projects Housing Finance, Cost Recovery Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of housing Units, Rents, Recovery Pattern (Problems)

FOR FURTHER READING

Land Use and Soil Suitability analysis - Building Bylaws and Rules and Development Control Regulations

Total: 45 Hours

Reference(s)

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, sage Publications Pvt.Ltd., New Delhi,1990
2. Francis Cherunilam and Odeyar D Heggae, Housing in India, Himalaya Publishing House, Bombay1997
3. Development Control Rules for Chennai Metropolitian Are, CMA, Chennai2004
4. UNCHS National Experiences with Shelter Delivery for the poorest Groups, UNCHS (Habitat), Nairobi,1994
5. Arthur H.Nilson, Design of Prestressed Concrete, John Wiley & Sons, New York,1978.
6. Dayaratnam,P., Prestressed Concrete Structures, Oxford and IBH, New Delhi,1982.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	2			2	14																			20
2	2	2			2	2				4					4				4						20
3	2	2			2	2					4			4						4					20
4	2	2			2	2				4					4					4					20
5	2	2			2	2					4			4						4					20
																								Total	100

Assessment Questions
Remember

1. State the basic principle of prestressed concrete structures.
2. Why did the early attempts in prestressing use ordinary mild steel fail?
3. List out the assumptions in strain compatibility method.
4. Define the term Line of Thrust.
5. Name some of the various methods generally used for the investigation of anchorage zone stresses.
6. Explain the terms a) Primary Moment b) Secondary Moment c) Resultant Moment
7. Outline the merits and demerits of partial prestressing.
8. Define concordant cables.
9. List out the advantages of prestressed concrete poles.

Understand

1. Explain why high strength concrete is used for prestressed concrete structures?
2. Why high strength concrete is used in prestressed concrete?
3. Briefly outline the Magnel method of computing the horizontal and transverse stress in end blocks subjected to concentrated force from anchorage.
4. Describe the failure due to flexure shear cracks?
5. Summarize about the long term deflections of cracked prestressed concrete beams
6. Discuss the various factors influencing the design of sleepers.
7. Sketch the various methods of achieving continuity in prestressed concrete members.

Apply

1. A simply supported prestressed concrete beam spanning over 10 m is of rectangular section 500mm wide by 750 mm deep. The beam is prestressed by a parabolic cable having an eccentricity of 200 mm at the centre of the span and zero at the end supports. The effective force in the cable is 1600 kN. If the beam supports a total uniformly distributed load of 40 kN/m, which includes the self weight.
   1. Evaluate the extreme fibre stresses at the mid span section using the internal resisting couple method and
   2. Calculate the force required in the cable having the same eccentricity to balance a total load of 50 kN/m on the beam.
2. A pretension prestressed concrete sleeper 300 mm wide by 250 mm deep is prestressed using 9 wires of 7 mm diameter. Four wires are located at top and 5 wires near the soffit. The effective cover being 40 mm. The initial stress in the wires is 1256 N/mm^2. Assuming the modular ratio 6, estimate the percentage loss of stress in the top and bottom wires due to elastic deformation of concrete.
3. A pretension girder having a T section is made up of a flange 200 mm side and 60 mm thick. The overall depth of the girder is 660 mm. the thickness of the web is 60 mm. the horizontal prestress at a point 300 mm from the soffit is 10N/mm^2. the shear stress due to transverse load acting at the same point is 2.5 N/mm^2. determine the increase in the principal tensile stress at this point if the T section is subjected to a torque of kNm
4. A class III type partially prestressed T-girder designed to support a live load of 8 kN/m over an effective span is 20 m is made up of a top flange 1000 mm wide by 120 mm thick, with a rib of 300mm wide. The overall depth of the girder is 720 mm. The tensioned steel consists of nine strands of 12.5 mm diameter with a tensile strength of 1750 N/mm^2 located at 585 mm from the top. The untensioned steel is of seven cold-worked deformed bars, of 25 mm diameter with fy=425 N/mm^2, located 80 mm from the soffit of the girder. The effective prestressing force in the tendons is 830 kN. Estimate the width of the cracks developed under service loads and check the crack width using the hypothetical tensile stresses provided for in the IS codes.

5. A concrete beam with a rectangular section 300 mm wide and 500 mm deep is prestressed by 2 post tensioned cables of area 600 mm^2 each. Initially stressed to 1600 N/mm^2. The cables are located at a constant eccentricity of 100 mm through out the length of the beam having a span of 10 m. the modulus of elasticity of steel and concrete is 210 and 38 N/mm^2 respectively.Neglecting all losses, find the deflection at the centre of span when it is supporting its own weight.Allowing for 20 percent loss in prestress, find the final deflection at the centre of span when it carries an imposed load of 18 kN/m. Dc=24 kN/m^2.
6. A high tensile cable comprising 12 strands of 15 mm diameter with an effective force of 2500 kN is anchored concentrically in an end block of post tensioned beam. The end block is 400mm wide by 800 mm deep and the anchor plate is 200 mm wide by 260 mm deep. Design suitable anchorage zone reinforcements using Fe 415 grade HYSD bars using IS 1343 code provisions.

15CE025 CONSTRUCTION MANAGEMENT PRINCIPLES FOR CIVIL ENGINEERS

3 0 0 3

Course Objectives

- To learn the fundamental concepts of Construction management Principles in the field of Construction Engineering andManagement
- To know about the Construction economics and Evaluate PublicProjects
- To study about Construction Planning, Scheduling along with ResourceManagement

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineeringpractice.

Course Outcomes (COs)

1. Evaluate project on the basic of construction management and cash flowconcepts
2. Formulate and execute various contracts documents andprocedures
3. Implement on planning and scheduling of activities usingsoftware's
4. Apply the concepts of resource planning, allocation and controlmethods
5. Adopt the Quality and safety measures in constructionsites

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1			1								
2	1			2								
3	1							2				
4	1					2						
5	1						2					

UNIT I **9 Hours**

CONSTRUCTION PROJECT FORMULATION

Introduction to Construction Management - Project Organization - Construction Economics - Economic Decision Making - Time value of money - cash flow diagrams - Evaluation Alternatives - Effect of Inflation on cash flow - Evaluation of Public Projects

UNIT II **9 Hours**

CONSTRUCTION CONTRACT

Construction contract - contract document - classification of engineering contract - bidding process - CPWD contract conditions - FIDIC form contract agreement-subcontracting - earnest money deposit - security deposit -arbitration.

UNIT III **9 Hours**

CONSTRUCTION PLANNING AND SCHEDULING

Introduction - types of project plans - work breakdown structure - planning techniques - bar charts - preparation of network diagram - critical path method - program evaluation and review technique - lab components: introduction to Microsoft projects and primavera - Preparation of schedule for a project by using Microsoft projects and primavera

UNIT IV **9 Hours**

RESOURCE MANAGEMENT

Basic concepts of resource management-class of labour - labour productivity - Classification construction equipment - selection of construction equipment - methods of calculating depreciation - replacement model - material management functions - inventory management -project cost management.

UNIT V **9 Hours**

CONSTRUCTION QUALITY AND SAFETY MANAGEMENT

Construction quality - inspection,quality control and quality assurance - total quality management - quality gurus and their teachings - cost of quality - ISO standards - conquas - audit - evaluation of safety - accident causation theories - foundation of a major injury - health and safety act and regulations - cost of accidents - role of safety personnel - causes of accidents -principles of safety - safety and health managementsystem

FOR FURTHER READING

Preparation of scheduling for a project by using Microsoft Projects and Primavera

Total: 45 Hours

Reference(s)

1. Kumar Neeraj Jha, construction project management", Dorling Kindersley, NewDelhi.2013.
2. Sengupta .B, Guha .H, construction management and planning, Tata Mcgraw Hill,New Delhi,2001.
3. Sharma .S.C, "Construction engineering and management" ,KhannaPublishers,Delhi,2008.
4. Murugesan .G, "Total quality management" ,LaxmiPublications,Delhi,2013.
5. CADD Center manual, "Project planning and management by using MS Project" ,CADD Centre Training Services Pvt,2010.
6. Hanna, T.H., "Field Instrumentation in Geotechnical Engineering", Trans Tech.,1985.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	3	2		1	3	3		1	3			1				1	2							22
2	1	2	1		2	2	2		1	3			1				2	1			1				19
3	1	1	2		3	2	1		2	2			2				1	1			1				19
4	2	3	3		1	3	1		2	1			2				2	1							21
5	1	2	2		1	3	2		1	1			2				1	2			1				19
																								Total	100

Assessment Questions
Understand

1. Distinguish disturbed and undisturbed soil sample
2. Mention any 3 types of samplers? Which sampler is used for collecting undisturbed sample?
3. Explain the factors deciding the depth, position & number of boreholes
4. List out the four methods of soil exploration
5. What is area ratio?
6. What are the points to be observed in reconnaissance survey?
7. What is soil investigation report?
8. What are the stages of soil exploration?
9. What is site reconnaissance?
10. What do you understand by site investigation?
11. Mention 4 objectives of site investigation.
12. Describe SPT procedure.
13. What is meant by seating drive?
14. What is SPT N value?
15. Explain significant depth
16. What is sampling of soil?
17. Explain the significance of outside clearance in a sampling tube?
18. What is mean by preservation samples?
19. Explain wash boring method of advancing bore hole on C-phi soil
20. Discuss the factors affecting location and depth of foundation.
21. Describe salient features of a good sub soil investigation report
22. Explain the principle of seismic method of soil exploration
23. Explain Standard Penetration Test with a neat sketch
24. Explain the factors deciding the depth, position and number of bore holes
25. Explain any two types of samplers with neat sketches

15CE026 TOTAL STATION AND GPS SURVEYING 3 0 0 3

Course Objectives

- To introduce the fundamental as well as some advanced concepts withapplications of Global Positioning System(GPS).
- To impart knowledge about Total Station, its utility andoperations.
- To train the students for downloading and processing the acquired data from Total Station for effectiveApplications.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Understand the Earth's Geodetic and Referencesystem.
2. Apply the concepts and components ofGPS.
3. Apply the basic principles of GPS, its merits and demerits in real worldproblems.
4. Apply the various errors and biases for effective usage of output fromGPS.
5. Recognise various applications of GPSdata.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2			1								
2	1											
3	1			2								
4		1	2									
5	1	1	1									

UNIT I **9 Hours**

INTRODUCTION TO GEODESY

Definitions and fundamentals of Geodesy, Earth Geoid and Ellipsoid of rotation, Reference surface, Geodetic systems, Indian Geodetic System, Coordinate systems.

UNIT II **9 Hours**

FUNDAMENTALS OF GLOBAL POSITIONING SYSTEM

History: NAVSTAR GPS, GLONASS, Indian Regional Navigational Satellite System (IRNSS) - Design objectives - Details of segments space, control and user - Advantages and current limitation.

UNIT III **10 Hours**

GPS SIGNAL STRUCTURE

GPS codes: C/A, P - GPS receiver: Structure of receivers and Types - Receiver selection - Principles of position fixing: Pseudo ranging - Types of ephemerides and Data formats.

UNIT IV **8 Hours**

TOTAL STATION

Introduction to Total Station - Instrument - Setting Up the Total Station - Configuration of instrument - Orientation of Total Station - Angle And Distance Measurement - Coordinate Measurement - Establishment of Control Stations - Topographic data collection and Recording - As Built Survey - Remote Elevation Measurement - Missing Line Measurement - Offset Measurement - Setting Out/Construction layout - Resection Measurement - Area and VolumeCalculation

UNIT V **9 Hours**

DATA DOWNLOADING AND PROCESSING

Introduction to downloading and processing softwares.Downloading a Raw data from Total Station Instrument. Converting a Raw File to a Field File - Creating the Map File/ Symbol Library - Reduction of Field file using the map file - Generating T IN - Editing Point/ Target Height - Editing TIN - Creating Contours - Contour Labels - Editing erroneous Coding - Plotting

FOR FURTHER READING

Applications: Cadastral surveys - Remote Sensing and GIS - Military applications and Vehicle Tracking.

Total: 45 Hours

Reference(s)

1. Akash Deep Sharma, "Global Positioning System", MD Publication Pvt. Ltd, New Delhi (India), 2008.
2. Hofmann Wellenhof, B., Lichtenegger, H. and Collins, J., "Global Positioning System: Theory and Practice", Springer, Berlin (Germany),1994.
3. Bradford W. Parkinson, James J. Spiker Jr., "Global Positioning System: Theory and Applications", Vol I and II, American Institute of Aeronautics and Astronautics: Washington (USA),1996.
4. Gunter Seeber, "Satellite Geodesy", Walter de Gruyter, Berlin (Germany),2003.
5. Anji Reddy .M, "Textbook of Remote Sensing and Geographical Information System", BS Publications, Hydrabad (India),2012.
6. SatheeshGopi, "Global Positioning System - Principles and Applications", Tata McGraw-Hill Publishing Company Limited, New Delhi (India), 2005(India), Pvt. Ltd., Hyderabad,2006.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	1	2			1	3	3		1	2	2			2				2			1				20
2	1	2	1		1	2	3		1	1	3			1				3			1				20
3	2	3	2		1	2	3		1	2	1			1				2			2				22
4	1	2			1	4	1		2	3				3				1			1				19
5	1	3	1		1	2	1		2	2				2				2			2				19
																								Total	100

Assessment Questions

Remember

1. What are geocomposites?
2. List any 4 geosynthetic products
3. State 3 functions of geogrids
4. State 3 functions of geotextile
5. Define geocomposite
6. State 3 functions of GCL
7. Define ultimate tensile strength of geotextile
8. State 3 functions of geotextiles
9. List 4 uses of geosynthetics

Understand

1. What are the soil-reinforcement interaction parameters ?
2. What is the long term design strength (TLTDS)of the reinforcement ?
3. List the 4 main functions of geosynthetics
4. Enumerate the different geosynthetic products used for reinforcement
5. Elaborate different geosynthetic products used in soil seperation
6. Give example for geosynthetics to be used as soil reinforcement
7. Differenciate between geotextile and geomembrane
8. Differenciate between woven and non-woven geotextile
9. Explain tensile strength test on geotextile
10. Elaborate the indexÂ properties of geosynthetic products
11. How will you evaluate the permeability of geotextile
12. Differentiate permeability and transmissivity
13. How will you assess the tensile strength of geogrid
14. What is MSW?
15. What are the stability checks to be carried out for reinforced earth wall?

Apply

1. What is the primary application of geocell
2. Enumerate a situation where geocomposites play major role

15CE028 INDUSTRIAL POLLUTION PREVENTION AND CLEANER PRODUCTION

3 0 0 3

Course Objectives

- To introduce the fundamental concepts of pollution prevention and cleanerproduction
- To impart the techniques of pollution prevention and environment audit for cleanerproduction

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Recall Environmental Policies and Regulations to encourage PollutionPrevention
2. Apply the pollution preventiontechniques.
3. Analsye the cost and environmentalfeasibility
4. Exercise the environmental Management through Life CycleAssessment.
5. Recall Industrial Applications of Pollution Prevention andControl

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2											
2	1	2	2									
3	1	3										
4	1	1										
5		1		1								

UNIT I **9 Hours**

INTRODUCTION

Industrial Activity and Environment - Industrialization and Sustainable Development - Indicators of Sustainability Strategies - Barriers to Sustainability - Industrial Ecology - Pollution Prevention (PP) and Cleaner Production (CP) in achieving Sustainability- Prevention versus Control of Industrial Pollution - Environmental Policies and Regulations to encourage Pollution Prevention and Cleaner Production - Regulatory versus Market-based approaches

UNIT II **9 Hours**

POLLUTION PREVENTION TECHNIQUES

Concept of Pollution Prevention and Cleaner Production - Definition - Importance - Historical Evolution - Benefits- Promotion - barriers - Role of Industry- Government and Institutions - Environmental Management Hierarchy - Source Reduction techniques - Process and Equipment Optimization- Reuse-Recover- Recycle- Raw material substitution

UNIT III **11 Hours**

ANALYSIS OF POLLUTION

Pollution Prevention and Cleaner Production Project development and implementation - Overview of CP -Assessment steps and skills-Preparing the site- Information gathering- Flow diagram-Material balance, PP and CP Option generation- Technical and Environmental Feasibility analysis- Total Cost analysis - PP and CP Financing, Establishing a Program - Organizing a Program-Preparing a program plan - Measuring progress - Pollution Prevention and Cleaner Production Awareness Plan - Waste Audit- Environmental Statement.

UNIT IV **10 Hours**

ENVIRONMENTAL ASSESSMENT

Life Cycle Assessment and Environmental Management Systems- Elements of LCA - Life Cycle Costing - Eco labeling - Designs for the Environment - International Environmental Standards- ISO 14001 - EnvironmentalAudit.

UNIT V **6 Hours**

CASE STUDIES

Industrial Applications of PP and CP- LCA, EMS and Environmental Audits.

FOR FURTHER READING

Internet information and Other PP and CP Resources

Total: 45 Hours

Reference(s)

1. Paul L. Bishop, "Pollution Prevention: Fundamentals and Practice", McGraw- Hill International, 2010.
2. James G. Mann and V.A. Liu, "Industrial Water Reuse and Wastewater Minimization", McGraw Hill,2009.
3. World Bank Group, "Pollution Prevention and Abatement Handbook-Towards Cleaner Production", World Bank and UNE, Washington D.C.,2008.
4. Freeman .H.M, "Industrial Pollution Prevention Handbook", McGraw Hill,2005.
5. Prasad Moda C. Visvanathan and MandarParasnis, "Cleaner Production Audit Environmental System Reviews", No. 38, Asian Institute of Technology; Bangkok,2005

15CE030 PAVEMENTS - DESIGN AND CONSTRUCTION

3 0 0 3

Course Objectives

- To make students to study about the pavement materials of flexible and rigidpavements
- To know about the pavement construction procedures and itsequipments
- To analyze and design flexible and rigidpavements
- To learn about the pavement evaluation and overlaydesign

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Differentiate between the flexible and rigid pavements with the knowledge of materialsused
2. Prepare charts for working procedures for construction of pavements along with equipments to be used
3. Design flexiblepavements
4. Design rigidpavements
5. Evaluate thepavements

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	1										
2	1	2										
3		2	3									
4		2	3									
5	1	2										

UNIT I **9 Hours**

PAVEMENT MATERIALS AND COMPONENTS

Bitumen - types and grades - properties and testing of materials - Types of granular and bituminous mixes- polymer modified bitumen, Geo synthetics- Cement - grades - chemical composition - hydration of cement - testing - admixtures - fibres - properties and testing of pavement qualityconcrete

UNIT II **9 Hours**

CONSTRUCTION PROCEDURES AND EQUIPMENT

Types of pavements -Methods of construction and field control checks for various types of flexible pavement layers - methods of construction of Cement concrete pavements layers - joints - Excavators, graders, vibratory rollers, sensor pavers, computerized asphalt mix plant, plants and trucks for ready mix concrete, slip form paver - working principle, advantages and limitations

UNIT III **9 Hours**

ANALYSIS AND DESIGN OF FLEXIBLE PAVEMENTS

Stresses and deflections in homogeneous masses - Analysis of flexible pavement,Bossinesq'stheory,Burmister's theory- Various approaches of flexible pavement designmethods - empirical, Semi-empirical method - IRC designmethod.

UNIT IV **9 Hours**

ANALYSIS AND DESIGN OF RIGID PAVEMENTS

Stresses and deflections in rigid pavements - Westergaard's analysis, IRC design charts - wheel load stress, warping stress, frictional stress and combination of stresses - types of joints - Design of slab and joints - IRC method ofdesign.

UNIT V **9 Hours**

PAVEMENT EVALUATION AND STRENGTHENING

Method of pavement evaluation - Distresses in flexible pavements and rigid pavements - Structural evaluation of flexible and rigid pavements - Evaluation by deflection measurements- design of overlays.

FOR FURTHER READING

Potholes - Different Methods of Pothole Repair - Repair Techniques - Cold Tar

Total: 45 Hours

Reference(s)

1. Standard Specifications and Code of Practice for Construction of Concrete Roads,IRC15-2002.
2. Guidelines for the Design of flexible Pavements, Indian Road Congress, IRC37-2001.
3. Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress, IRC58-2002.
4. Peurify.R.L.,Construction Planning, Equipment and Method, McGraw Hill Publishers, New York,2006.
5. Yoder .E.J and Witezak,Principlesof Pavement Design, John Wiley and Sons,2005.

15CE031 AIR POLLUTION CONTROL AND MANAGEMENT

3 0 0 3

Course Objectives

- To learn the concept of air pollution and its controlmeasures.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Recall concept of air pollution and various airpollutants
2. Classify and characteristics the various air pollutants and identify theirsources
3. Identify the plume patterns and dispersionmechanism
4. Design the air pollution and controlequipments
5. Suitably modify the preventivemeasures

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	1	2										
3	1	2	1									
4	1	1	2									
5	1											

UNIT I **9 Hours**

INTRODUCTION

Air resource management system - Air quality management - Scales of air pollution problem - Sources and classification of pollutants and their effect on human health vegetation and property - Global implications of air pollution - Meteorology Fundamentals - Atmospheric stability - Micrometeorology - Atmospheric turbulence - Mechanical and thermalturbulence.

UNIT II **9 Hours**

CONTROL OF PARTICULATE MATTERS

Settling chambers - Filters, gravitational, Centrifugal - multiple type cyclones- prediction of collection efficiency- pressure drop- wet collectors- Electrostatic Precipitation theory - ESP design - Operational Considerations - Process Control and Monitoring.

UNIT III **9 Hours**

CONTROL OF GASEOUS MATTERS

Absorption - Principles - Description of equipment-packed and plate columns - Design and performance equations - Adsorption - Principal adsorbents - Equipment descriptions - Design and performance equations - Condensation - Design and performance equation - Incineration - Equipment description - Design and performance equations - Biological air pollution control technologies.

UNIT IV **9 Hours**

EMERGING TRENDS

Process modification - Automobile air pollution and its control - Fuel modification - Mechanical particulate collectors - Entrainment separation - Internal combustion engines - Membrane process - Ultraviolet photolysis - High efficiency particulate air filters - Technical and economic feasibility of selected emerging technologies for air pollution control - Control of indoor air quality

UNIT V **9 Hours**

AIR QUALITY MANAGEMENT

Air quality standards - Air quality monitoring - Preventive measures - Air pollution control efforts - Zoning - Town planning regulation of new industries - Legislation and enforcement - Environmental Impact Assessment and Air quality

FOR FURTHER READING

Radioactive pollution and its control

Total: 45 Hours

Reference(s)

1. Anjaneyulu .D, "Air Pollution and Control Technologies", Allied Publishers, Mumbai,2002.
2. Rao .M.N, and Rao .H. V. N, "Air Pollution Control", Tata-McGraw-Hill, New Delhi,2006.
3. Rao .C.S, "Environmental Pollution Control Engineering", Wiley Eastern Ltd., NewDelhi,2006.
4. Heumann .W.L, "Industrial Air Pollution Control Systems", McGraw-Hill, New Yark,2007.
5. Mahajan .S.P, "Pollution Control in Process Industries", Tata McGraw-Hill Publishing Company, New Delhi,2002.
6. Garg .S.K, "Environmental Engineering Vol. II", Khanna Publishers, New Delhi, 2005.

15CE034 ROCK MECHANICS AND APPLICATIONS 3 0 0 3

Course Objectives

- To impart knowledge on rock mechanics and its application to slope stabilityproblems

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

Course Outcomes (COs)

1. Classify the rocks based on their indexproperties
2. Evaluate the behaviour of rockunder
3. Suggest various techniques to improve the in-situ strength of rocks.
4. Evaluate the bearing Capacity of foundations onrocks
5. Recall installation methods for rockreinforcement

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2		1		2								
3	1	2										
4		1		2								
5	1											

UNIT I **9 Hours**

CLASSIFICATION OF ROCKS

Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations

UNIT II **9 Hours**

STRENGTH CRITERIA OF ROCKS

Behaviour of rock under hydrostatic compression and deviatoric loading - Modes of rock failure - planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut-off.

UNIT III **9 Hours**

INSITU STRESSES IN ROCKS

Insitu stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavation - case studies

UNIT IV **9 Hours**

SLOPE STABILITY AND BEARING CAPACITY OF ROCKS

Rock slopes - role of discontinuities in slope failure, slope analysis and factor of safety - remedial measures for critical slopes - Bearing Capacity of foundations on rocks

UNIT V **9 Hours**

ROCK REINFORCEMENT

Reinforcement of fractured and joined rocks - shot creting, bolting, anchoring, installation methods - Case studies

FOR FURTHER READINGS

Case studies related to critical slopes on rocks and the remedial measures

Total: 45 Hours

Reference(s)

1. Goodman, R.E., Introduction to rock mechanics, John Willey and Sons,1989.
2. Hudson, A. and Harrison, P., Engineering Rock mechanics - An introduction to the principles, Pergamon publications,1997.
3. Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and Metallurgy, U.K.1981.
4. Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York,2002.
5. T. Ramamurthy, Editor, Engineering in Rocks for Slopes Foundations and Tunnels, PHI Learning Pvt. Ltd.,2014
6. Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springerverlag, Berlin,1990.

15CE035 ARCHITECTURE AND URBAN PLANNING 3 0 0 3

Course Objectives

- To provide a knowledge on fundamentals of architecture and urbanplanning.
- To impart training on preparation of different types of plans, implementation and management for sustainabledevelopment

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Design buildings with respect to architectural point ofview
2. Assess and select the best urban layout plan
3. Prepare the Environmental Impact Assessment for any civilproject.
4. Assess of the proposals with the knowledge of cost-benefitanalysis
5. Assess the management systems fordevelopment

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1	2									
2	1	2										
3	1	2										
4	1	2										
5			1									

UNIT I **9 Hours**

ARCHITECTURAL AND CLIMATE RESPONSIVE DESIGN

Architectural design - An analysis - Integration of function and aesthetics - Introduction to basic elements and principles of design - Factors that determine climate - Characteristics of climate types - Design for various climate types

UNIT II **9 Hours**

BUILDING TYPES

Building types - Classification of residential, industries and public building - Planning concepts - Residential, institutional, commercial and Industrial - Application of anthropometry and space standards - Building rules and regulations - Building services. Layout regulations Safety standards

UNIT III **9 Hours**

URBAN PLANNING PROCESS

Urban planning - Development plan - Needs, goals, and contents - Factors to be considered in development plan - collection of data - surveys - procedure for preparation - guidelines of development plan - important measures and stages of development plan. Town planning - objects - principles - necessity - forms - stages. Plan implementation - Chandigarh casestudy

UNIT IV **9 Hours**

URBAN PROJECT EVALUATION

Project evaluation - Economic evaluation [Benefit cost ratio method, Net present value and Internal rate of return - problems] - Environmental impact assessment and Cash flow analysis Basic introduction about Housing,, transportation and traffic improvementprojects

UNIT V **9 Hours**

DEVELOPMENT MANAGEMENT SYSTEMS

Planning standards - The basic frame work - distribution of land use - Infrastructure - Physical infrastructure - Social infrastructure - Commercial activity - variations in norms and standards by size of settlement - Development control rules - Zoning regulations - Building bye-laws.

FOR FURTHER READINGS

Co-ordination between urban local bodies and other functional agencies such as water supply & sewerage boards, housing boards including slum boards and planning authorities

Total: 45 Hours

Reference(s)

1. VRA. Saathappan and K. Yogeshwari, Principles of Architecture, Raamalingaa Publication,2005
2. M. Pratap Rao, Urban Planning, CBS Publishers and Distributors, New Delhi,2005
3. Gallian B Arthur and Simon Eisner, The Urban Pattern, City Planning and Design, Affiliated Press Pvt., Ltd., New Delhi,1995
4. Margaret Roberts, AnIntroduction to Town Planning and Planning Techniques, Hutchinson, London,1990.
5. Francis D.K. Ching, Architecture: Form, Space and Order, VNR, N.Y.,1999
6. B. Givoni , Man Climate and Architecture , Applied Science, Barking ESSEX,1982

15CE036 GEOENVIRONMENTAL ENGINEERING 3 0 0 3

Course Objectives

- To impart knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques thereby protecting environment.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Identify the soil-pollutant interaction and assess the modification of soilproperties
2. Categorize the process of contaminant transport and characterize the contaminatedsites
3. Classify different techniques for the remediation of contaminatedSites
4. Design the cover system by identifying the suitable components oflandfill
5. Analyze the possible utilization of waste based on theircharacteristics

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2					2						
2	3					1						
3		2				2						
4	1		2									
5	1	2				1						

UNIT I **8 Hours**

SOIL WASTE INTERACTION

Role of Geo-environmental Engineering - sources, generation and classification of wastes- causes and consequences of soil pollution -factors influencing soil-pollutant interaction - modification of index, chemical and engineering properties - physical and physico-chemical mechanisms

UNIT II **9 Hours**

CONTAMINATED TRANSPORT AND SITE CHARACTERISATION

Transport of contaminant in subsurface - advection, diffusion, dispersion - chemical process - biological process, sorption, desorption, precipitation, dissolution, oxidation, complexation, ion exchange, volatization, biodegradation - characterization of contaminated sites

UNIT III **9 Hours**

WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES

Insitu containment - vertical and horizontal barrier-surface cover - soil remediation - soil vapour extraction, electrokinetic remediation, soil heating, vitrification, bio remediation, phyto remediation - ground water remediation -pump and treat, Insitu flushing, permeable reacting barrier

UNIT IV **9 Hours**

LAND FILLS AND SURFACE IMPOUNDMENTS

Source and characteristics of waste - site selection for landfills - components of landfills - liner system - soil, geomembrane, geosynthetic clay, geocomposite liner system - leachate collection - final cover design
-monitoring landfill.

UNIT V **10 Hours**

STABILISATION OF WASTE

Evaluation of waste materials- flyash, municipal sludge, plastics, scrap tire, blast furnace slag, construction waste, wood waste and their physical, chemical and biological characteristics-potential reuse- utilization of waste and soilstabilization

Total : 45 hours

FOR FURTHER READING

Case studies related to landfill liners and stabilisation of waste

Reference(s)

1. Daniel B.E, Geotechnical Practice for waste disposal, Chapman & Hall, London,2012.
2. Hari D. Sharma and Krishna R.Reddy, Geo-Environmental Engineering - John Wiley and Sons, INC, USA,2004.
3. Westlake, K., Landfill Waste pollution and Control, Albion Publishing Ltd., England,2014.
4. Wentz, C.A., Hazardous Waste Management, McGraw Hill, Singapore,1995.
5. Ott, W.R., Environmental Indices, Theory and Practice, Ann Arbor,1978.
6. Lagrega, M.d., Buckingham, P.L., and Evans, J.C., Hazardous Waste Management, McGraw Hill, Inc. Singapore,2010

ENTREPRENEURSHIP ELECTIVES

15GE001 ENTREPRENEURSHIP DEVELOPMENT I 3 0 0 3

Course Objectives

- Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc

Course Outcomes (COs)

- Able to gain Knowledge about entrepreneurship, motivation and business.
- Able to develop small scale industries in different field.

UNIT I **9 Hours**

BASICS OF ENTREPRENEURSHIP

Nature, scope and types of Entrepreneurship, Entrepreneur Personality Characteristics, Entrepreneurship process. Role of entrepreneurship in economic development

UNIT II **9 Hours**

GENERATION OF IDEAS

Creativity and Innovation, Lateral Thinking, Generation of Alternatives, Fractionation, Reversal Method, Brain Storming, Analogies

UNIT III **9 Hours**

LEGAL ASPECTS OF BUSINESS

Contract act-Indian contract act, Essential elements of valid contract, classification of contracts, sale of goods act- Formation of contract of sale, negotiable instruments- promissory note, bills and cheques, partnership, limited liability partnership (LLP), companies act-kinds, formation, memorandum of association, articles of association.

UNIT IV **9 Hours**

BUSINESS FINANCE

Project evaluation and investment criteria (cases), sources of finance, financial statements, break even analysis, cash flow analysis.

UNIT V **9 Hours**

OPERATIONS MANAGEMENT

Importance- functions-deciding on the production system- facility decisions: plant location, plant layout (cases), capacity requirement planning- inventory management (cases)-lean manufacturing, Six sigma.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi: 2005
2. Prasanna Chandra, Projects Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill Publishing Company Limited, New Delhi: 2000.
3. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill: 2006.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2										
2	3	1										
3	3	2										
4	3	2										
5	3	1										

Assessment Questions

Remember

4. What is entrepreneurship?
5. What are the factors that motivate people to go into business?
6. Define a small-scale industry
7. Who is an intrapreneur?
8. State functions of SISI
9. What is serial entrepreneur?
10. What is Technopreneurship?
11. What is reversal method?
12. What is brainstorming?
13. What do you mean by term business idea?
14. Mention any two schemes Indian government provides to the development of entrepreneurship
15. What is a project report?
16. What is project scheduling?
17. Mention any four techniques available for project scheduling.
18. What is contract act?
19. Define MOU.
20. Mention any five external sources of finance to an entrepreneur.
21. Classify the financial needs of an organization
22. Why is motivational theories important for an entrepreneur?

Understand

23. Why is entrepreneurship important of growth of a nation?
24. Mention the essential quality required for someone to be an entrepreneur.
25. How is network analysis helpful to the development of an entrepreneur?
26. Mention the essential requirements for a virtual capital.
27. How under-capitalization affects an entrepreneur
28. Mention the causes of dissolution of a firm.
29. How important is the support of IDBI to an entrepreneur?
30. What are the salient features of New Small Enterprise Policy, 1991?
31. Why scheduling is very important for a production design?

Apply

32. If you want to become as an entrepreneur, what will be your idea?
33. Select any one of the creative idea generation method and suggest an innovation that you can implement in your business.
34. Write a short notes on various legal aspects that you have to consider to run you business.
35. How will you generate your capital and other financial supports?
36. In case of getting enough financial support, plan your business and plot the various stages using any of the tools or techniques

Create

37. Draft a sample project report for your business
38. Do a network analysis using PERT and CPM for your business plan.
39. Write a brief report to apply to a financial organization for seeking financial support to your business

15GE002 ENTREPRENEURSHIP DEVELOPMENT II 3 0 0 3

Course Objectives

- Evolve the marketing mix for promoting the product /services
- Handle the human resources andtaxation
- Understand Government industrial policies / support provided and prepare a businessplan

Course Outcomes (COs)

1. Increase in awareness of the entrepreneurship Development for engineering decisions.

UNIT I **9 Hours**

MARKETING MANAGEMENT

Marketing environment,Segmentation, Targeting and positioning, Formulating marketing strategies,Marketing research, marketing plan, marketing mix(cases)

UNIT II **9 Hours**

HUMAN RESOURCE MANAGEMENT

Human Resource Planning (Cases), Recruitment, Selection, Training and Development, HRIS, Factories Act 1948 (an over view)

UNIT III **9 Hours**

BUSINESS TAXATION

Direct taxation, Income tax, Corporate tax, MAT, Tax holidays, Wealth tax, Professional tax (Cases).Indirect taxation, Excise duty, Customs, Sales and Service tax, VAT, Octroi, GST (Cases)

UNIT IV **9 Hours**

GOVERNMENT SUPPORT

Industrial policy of Central and State Government, National Institute-NIESBUD, IIE, EDI. State Level Institutions-TIIC, CED, MSME, Financial Institutions

UNIT V **9 Hours**

BUSINESS PLAN PREPARATION

Purpose of writing a business plan, Capital outlay, Technical feasibility, Production plan, HR plan, Market survey and Marketing plan, Financial plan and Viability, Government approvals, SWOTanalysis.

Total: 45 Hours

Reference(s)

1. Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi:2005.
2. Philip Kotler., Marketing Management, Prentice Hall of India, New Delhi:2003
3. Aswathappa K, Human Resource and Personnel Management - Text and Cases, Tata McGraw Hill:2007.
4. Jain P C., Handbook for New Entrepreneurs, EDII, Oxford University Press, New Delhi:2002.
5. Akhileshwar Pathak, Legal Aspects of Business, Tata McGraw Hill:2006.
6. http://niesbud.nic.in/agencies.htm

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	2			2	2			2	2					2	2				2				2	20
2	2									6					6							6			20
3		3				2					3			3					3		3			3	20
4			3				3			3					3		3		3				2		20
5			3				3					3			3						3	2		3	20
																								Total	100

Assessment Questions
Remember

1. Who are Fabian Entrepreneur?
2. Mention the three functions of NSIC?
3. Narrate the role of IDBI in the development of Entrepreneurship?
4. What are the stages in a Project Lifecycle?
5. Give the meaning of Feasibility Report
6. What is Motivating Training?
7. Who is a Small Scale Entrepreneur?
8. How to develop Rural Entrepreneur?
9. What are the Social Problems of Women Entrepreneur?
10. What are the types of entrepreneurs?
11. List the various qualities of entrepreneur.
12. What is entrepreneurship training?
13. State the role of NISIET.
14. List the challenges and opportunities available in SSI's?

Understand

15. What are the elements of EDP?
16. How would you Classify Projects?
17. What is the role played by commercial banks in the development of entrepreneur?
18. What are the target groups of EDP?
19. What are the major problems faced by Small Entrepreneur?
20. What are the problems & prospects for women entrepreneur in India?

Apply

21. Describe the various functions performed by Entrepreneurs?

22. Explain the role of different agencies in the development of Entrepreneur?
23. Discuss the criteria for selecting a particular project?
24. Describe the role of Entrepreneur in the Development of Country?
25. Define business idea. Elaborate the problems and opportunities for an entrepreneur.
26. Elaborate the schemes offered by commercial banks for development of entrepreneurship.

OPEN ELECTIVES

15CE0YA GREEN BUILDINGS 3 0 0 3

Course Objectives

- To impart knowledge on the sustainable constructionstrategies
- To introduce the concept of greenbuildings.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Identify the requirements of greenbuildings
2. Explain the green building design process andassessment
3. Select a suitable sustainable landscaping and energy strategies for greenbuilding
4. Select a suitable sustainable hydrologic landscaping and energy strategies for greenbuilding
5. Illustrate green building commissioning andimplementation

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1		1			2	3					
2	1		1			2	3					
3	1		1			2	3					
4	1		1			2	3					
5	1		1			2	3					

UNIT I **9 Hours**

SUSTAINABLE CONSTRUCTION AND GREEN BUILDING REQUIREMENTS

Ethics and sustainability - Increased CO2 trade - Sustainable construction - Major environmental and resource concerns - Green building movement and obstacles - Green building requirements -Perceived use of green building

UNIT II **9 Hours**

GREEN BUILDING PROCESS AND ASSESSMENT

Conventional versus green building delivery systems - Execution of green building process - Integrated design process - Ecological design -Merits and demerits -Historical perspective – LEEDbuilding

assessment standard - LEED certification process - International building assessment standards - Building rating system in India and its future - Case study of a green building

UNIT III **9 Hours**

SUSTAINABLE LANDSCAPING AND ENERGY

Land and landscape approaches for green buildings -sustainable landscapes - Landscaping water efficiency Storm water management - Heat island mitigation - Building energy issues - Building energy design strategies - Building envelope - Active mechanical systems -Innovative energy optimization strategies - Smart buildings and energy managementsystems

UNIT IV **9 Hours**

BUILDING HYDROLOGIC SYSTEM AND MATERIAL LOOPS

High performance building water supply strategy - High performance building wastewater strategy - Green building materials issues and priorities - LCA of building materials and products - Emerging construction materials and products - Construction and demolition waste management Design for deconstruction and disassembly - Closing material loops inpractice

UNIT V **9 Hours**

GREEN BUILDING IMPLEMENTATION

Site protection planning - Health and safety planning - Reducing the footprint of construction operations - Essentials of building commissioning - Costs and benefits of building commissioning- The economics of green buildings - Quantifying green building costs - Future directions in green buildings- Case study for high performance green buildings

FOR FURTHER READING

LEED & IGBC AP certification procedure **Total: 45 Hours**

Reference(s)

1. Charles. J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, Inc., New Jersey,2008
2. M. Bauer, P. Mosle and M. Schwarz, Green Building: Guidebook for Sustainable Architecture, Springer - Verlag Berlin Heidelberg,2010
3. Jerry Yudelson, Marketing Green Building Services: Strategies for success, Elsevier,2008
4. Jerry Yudelson, Marketing Green Buildings: Guide for Engineering, Construction and Architecture, The Fairmont Press Inc.,2006
5. Angela. M. Dean, Green by Design: Creating a Home for Sustainable Living, Gibbs Smith Publication,2003

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	1	2	1		2	4	2		1	3			1	1				1				1			20
2	1	3			1	3	3		2	2			1	1				2				1			20
3	2	3			2	3	3		1	2			1	1				1				1			20
4	1	2			2	3	2		1	3			1	1				2				2			20
5	2	2			1	3	2		2	3			1	2				1				1			20
																								Total	100

Assessment Questions

Remember

1. Define SHGC
2. Name any 4 ozone depleting chemicals in HVAC
3. Name the building materials that affect IEQ?
4. Name any four emerging green construction materials
5. What is U-Value or U-factor?
6. Define xeriscaping
7. List the components of eco-roof system
8. What is LCA of building material?
9. What do you understand by closing material loop?
10. Differenciate hard cost and soft cost
11. Mention four key points to be considered to develop a case for high-performance buildings.

Understand

1. Mention any 3 negative footprint of construction operations in the environment
2. Explain any 4 innovative energy optimization strategies
3. Explain High Performance Building Waste water supply strategy including landscaping
4. How Construction and Demolition of waste is managed in Green Buildings?
5. Write briefly on Emerging Construction materials and Products.
6. State the Costs and benefits of building commissioning
7. Brief about the methods to achieve sustainable landscape
8. Brief about building management systems
9. Write briefly on Major environmental and resource concern.
10. Explain briefly on Green Building delivery system.
11. Explain briefly the Assessment standards and Certification processes of LEED.

Apply

1. How orientation of building involves in energy optimization?
2. Differenciate between gray and black water
3. Explain any 6 passive and active energy design strategies for building envelope
4. Give a Case study of a green building.

15CE0YB HAZARDOUS WASTE MANAGEMENT AND SITE REMEDIATION

3 0 0 3

Course Objectives

- To provide basic knowledge on the theory and management practices of hazardouswaste
- To impart knowledge on treatment methods of hazardouswaste
- To emphasize the need for hazardous wastemanagement

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Classify hazardouswastes
2. Identify the best treatment method for hazardous wastemanagement
3. Assess risk in disposing the hazardouswastes
4. Manage bio-medicalwastes
5. Manage e-wastesdisposals

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2											
2	1					2						
3	1	1				2						
4	1	2				2						
5	1	2				2						

UNIT I **9 Hours**

INTRODUCTION

Impact of hazardous waste on health and society - Basics of hazardous waste management - Waste generation and quantification - Hazardous characteristics - Classification of hazardous waste Control of hazardouswaste

UNIT II **9 Hours**

TREATMENT METHODS

Treatment methods - Neutralization - Oxidation -Reduction - Precipitation - Solidification and stabilization -Incineration Control of radioactive pollution

UNIT III **9 Hours**

DISPOSAL OF HAZARDOUS WASTES

Final disposal of radioactive wastes - Risk assessment -Carcinogenesis - Dose - Response assessment - Risk exposure assessment Safe disposal techniques

UNIT IV **9 Hours**

BIOMEDICAL AND PLASTIC WASTES BIOMEDICAL WASTES

Definition - Source and generation of biomedical waste-Biomedical waste management. Plastic waste: Dangers of plastic waste - Recycling of plastic waste Disposal of plastic waste

UNIT V **9 Hours**

E-W ASTE

Introduction - Health hazards - E-waste management - Recycle of electronic materials - Disposal of e-waste Case studies

FOR FURTHER READING

The scientific landfill: Concept -function -site selection and approval -acceptable wastes -Design and construction-Liners: clay, geomembrane, HDPE, geonet, geotextile -Treatment and disposal of leachate - Combined and separate treatment. Siteremediation -Remedial techniques

Total: 45 Hours

Reference(s)

1. P. Sincero and A. Sincero, Environmental Engineering, PHI Learning Pvt. Ltd.,2010
2. C. Bhatia, Solid and Hazardous Waste Management, Atlantic Publishers,2007
3. K. Sasikumar and SanoopGopiKrishna , Solid Waste Management, PHI Learning Pvt. Ltd.,2009

15CE0YC DISASTER MITIGATION AND MANAGEMENT **3 0 0 3**

Course Objectives

- To provide an exposure on the various elements of naturaldisasters
- To impart knowledge on measurement, effect and management techniques for differentdisasters

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable

development.

Course Outcomes (COs)

1. Characterize the various natural and man- madedisasters
2. Identify the various types of disasters in coastal and marine and techniques to control marine pollution
3. Explain the causes, effects of atmosphericpollution
4. Analyze the impacts of landdisasters
5. Interpret the importance of various disaster managementtechniques

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1		1				2						
2		1				3						
3		1				2	3					
4		1				2						
5			1			3	2					

UNIT I **9 Hours**

INTRODUCTION TO DISASTER MANAGEMENT

Contemporary natural and man- made disasters - Fundamentals of disasters-Causal factors of disasters-Poverty - Population growth - Rapid urbanization - Transitions in cultural practices - Environmental degradation -War and civil strife - Earthquakes -Tropical cyclones - Floods -Droughts - Environmental pollution - Deforestation -Desertification - Epidemics - Chemical and industrial accidents

UNIT II **9 Hours**

COASTAL AND MARINE DISASTERS

Hydrological-Coastal and marine disasters -Flood hazards- Control and management-Dams and dam bursts-Tsunami-Water and ground water hazards - Sea level rise -Coastal and marine degradation - Marine pollution - Techniques of marine pollutioncontrol

UNIT III **9 Hours**

ATMOSPHERIC DISASTERS

Atmospheric disasters - Green house effect and global climate - Air pollution and acid rain - Ozone depletion - Forestrelated disasters - Bio diversity extinction - Deforestation and loss of biological diversity - genetic manipulation - Bio -safety andCBD

UNIT IV **9 Hours**

LAND DISASTERS

Geological -Mass movement and land disasters - Earthquake - Volcanism - Mass movement hazards - Land Degration and land use -Droughts and famines - Deserts and desertification - Ground water over - exploitation - dryness and wildfires - Technological disasters - Mining disasters - War - chemicals and the environment

UNIT V **9 Hours**

MISCELLANEOUS TOPICS

Wind and water driven disasters - Flood forecasting, mitigation, planning and management - Tropical cyclones - Storms -Hurricanes -Tornadoes - Lightning and frost disasters. Case studies - Regulating hazardous industries in India - Control of toxic chemical sand chemical pollution in India

FOR FURTHER READING

Fundamentals of disasters, Environmental pollution Challenges to raise the capacity of at risk populations in coping with natural, social and economicdisasters

Total: 45 Hours

Reference(s)

1. B.K.Khanna, All you wanted to know about disasters, New India Publishing Agency, NewDelhi, 2005
2. William L Waugh, Living with hazards, dealing with disasters: An Introduction to Emergency Management, Amazon Publications,2002
3. P.Jegadish Gandhi, Disaster mitigation and management Deep &Deep Publications,2007
4. Patrick Leon Abbott, Natural Disasters, Amazon Publications,2002
5. Ben Wisner, At Risk : Natural Hazards, People vulnerability and disasters, Amazon Publications, 2001
6. D.B.N.Murthy, Disaster management: text and case studies, Deep & Deep Publications,2007

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	2	6			6	6																			20
2		6			2	12																			20
3						10								10											20
4	6	2			4	8																			20
5					4	6							4	6											12
																								Total	100

Assessment Questions

Remember

1. Define epidemics
2. What is meant by ozone depletion?
3. List out the methods for mitigation and flood forecasting
4. Define disaster or calamity.
5. Define the stages of disaster management cycle.
6. State marine control techniques.
7. Define hydrological cycle.
8. State genetic manipulation
9. Define ozone depletion.
10. Identify the causes for earthquake.
11. Name some mining disasters.
12. List out wind driven disasters.
13. Sate some flood forecasting techniques.

Understand

1. Explain the concept of green house effect?
2. What are the fundamentals of disasters?
3. When the storms and Hurricanes will occur?
4. When the genetic manipulation occurs?

5. What do you mean by Disaster Management?
6. Give an example for calculating population growth.
7. Predict the reasons for dam bursts.
8. Distinguish between flood and tsunami.
9. Summarize green house effect.
10. Generalizes CBD.
11. What do you understand by ground water?
12. What are the basic concepts for desertification?
13. Distinguish between Lightning and frost disasters?
14. Predict some chemical pollution in India

Apply

1. Exemplify the importance of land disasters and its mitigation effects
2. What are the methods for manmade disaster management techniques?
3. Explain the role of media in disaster prepardness?
4. List out the casual factors of disasters.
5. Compare between natural and manmade disasters.
6. Analyze the various techniques for marine pollution control
7. Identify the causes for sea level rise.
8. Outline the various forest related disasters.
9. Illustrate in detail about flood hazards.
10. Compute the theory of mass movement in land disasters.
11. Compare between earthquake and volcanism.
12. Illustrate any two case studies on frost disasters.
13. Compute the methods used reducing chemical pollution in India.

15CE0YD ENVIRONMENTAL IMPACT ASSESSMENT 3 0 0 3

Course Objectives

- To emphasize the need forEIA.
- To provide basic knowledge on the components, methods and quality control measures ofEIA
- To make the students understand the importance of documentation and monitoring of EIA along with casestudies.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions.

Course Outcomes (COs)

1. Analyse the key features of EIA with reference to legislator aspects inIndia.
2. Evaluate EIATechnics
3. Predict the impact of any project on environmental issues related to land, water, air, flora and fauna, noise, energy andsocio-economics.
4. Practice the various documentation and report procedures forEIA.
5. Conduct publicawareness

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	1											
3	1	2										
4	1											
5									2	3		

UNIT I **9 Hours**

INTRODUCTION

Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - Environmental Risk Assessment (ERA) - Legal and Regulatory aspects in India - Types and limitations of EIA - Issues in EIA - National - Cross sectoral - Social and cultural - Terms of Reference inEIA

UNIT II **9 Hours**

COMPONENTS AND QUALITY ANALYSIS

Components - Screening - Setting - Analysis - Prediction of impacts - Mitigation - Matrices - Networks - Checklists - Impact Assessment techniques - Cost benefit analysis - Analysis of alternatives; Trends in EIA practice and evaluation criteria - Capacity building for quality assurance - Expert System in EIA Formats of regulations

UNIT III **9 Hours**

PREDICTION, ASSESSMENT AND MITIGATION

Methods for Prediction and assessment of impacts on Air - Water - Soil - Noise - Biological - Cultural - Social - Economic environments - Standards and guidelines for evaluation - Options for mitigation of impacts - Policies for decision making

UNIT IV **9 Hours**

DOCUMENTATION AND MONITORING

Document planning - Collection and organization of relevant information - Use of visual display materials - Team writing - Reminder checklists - Environmental monitoring - Guidelines - Policies - Planning of monitoring programmes - Environmental Management Plan -Post projectaudit

UNIT V **9 Hours**

PUBLIC PARTICIPATION

Objectives of public participation - regulatory requirements - merits and de-merits - conducting public participation - conflict management - dispute resolution Questionnaires for decision making

FOR FURTHER READING

Case studies of EIA for developmental projects - Cement plant, Thermal Power Station, Hydro-Electric Power Project, Mining Industry, Oil Explorations.

Total: 45 Hours

Reference(s)

1. L. W. Canter, Environmental Impact Assessment, McGraw Hill, New York,1996.
2. Policy Intervention Analysis: environmental Impact Assessment, Ritu Paliwal, Leena Srivastava, The Energy and Resources Institute (TERI), TERI Press, Durbari Seth Block,IHC Complex, Lodhi Road, New Delhi - 110 003, India,2014
3. Handbook of Environmental Decision Making in India: An EIA Model (Handbooks Series), O.V.Nandimath, Oxford University Press of India,2008
4. J. Petts, Handbook of Environmental Impact Assessment Vol. I and II, Blackwell Science, London,1999.
5. The World Bank Group, Environmental Assessment Source book Vol. I, II and III, The World Bank, Washington,1991.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3	4				5							4	4											20
2		3			2	3				3			5		4										20
3	2		3		2	3							5	5											20
4	3	2			3	2					3			2	2			3							20
5	2	4								4	5											5			20
																								Total	100

Assessment Questions

Remember

1. Elucidate the concept of EIA.
2. What are the various issues to be considered for EIA?
3. Name some methods for EIA prediction
4. What is mitigation?

Understand

1. Elaborate on the checklist for environmental monitoring.
2. Narrate the methods for collecting relevant information for EIA.
3. List the general issues ot be considered for conducting EIA
4. Identify the limitations of EIA.
5. Interpret the use of the visual display materials for environmental monitoring of any project.
6. Illustrate some major regulatory aspects of EIA in India.
7. Narrate the important environmental impacts to be considered for a developmental project.
8. What are the guide lines for public health monitoring for EIA?
9. Enumerate the merits and de-merits of involving public in decision making at any phase of EIA.

Apply

1. Applying the guide lines for monitoring of a thermal power plant project, prepare a Management Plan, enumerate the merits and de-merits of involving public in decision making at any phase of EIA.
2. Explain the general methodology for assessing the impacts of any project on power production.
3. Explain the importance of cost benefit analysis
4. Enumerate the importance of analysis of the alternatives of the impacts in project
5. Prepare an analytical report on the various factors that affect the society and environment in general for major developmental project.

Analyse

1. Outline the trend in EIA practice.
2. Analyse the several legislative aspects which are to be considered for preparing an EIA report.
3. Narrate the steps for evaluation criteria for a given project
4. Diiferentiate between screening and setting
5. Develop and analyse the feed back questionare for cement maufacturing factory project

Evaluate

1. Evaluate the main environmentalÂ features of a project by attaching due relative weightage to each.
2. Predict the major impacts to be considered for anyone of the following projects:

a. Thermal Power Plant b. Mining c. Oil Exploration

Create

1. Applying the principles of EIA, create an EIA report on a mining / hydro electric/ project

15CE0YE BUILDING SERVICES 3 0 0 3

Course Objectives

- To understand how a building can be made comfortable and safe with the services designed and installed
- To impart knowledge on basics of electrical wiring system
- To recognize the importance of fire detection andprotection

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Analyze the features of service machineries required for abuilding
2. Identify suitable electrical system and accessories to be installed during the construction of a building.
3. Identify the principles of illumination and Artificial lightsources
4. Describe the working principle of Refrigerants and Air conditioningsystems

5. Analyze the characteristics of fire safety equipments for different type ofbuildings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	1	2									
2	3	2	1									
3	3	3	2									
4	3	1										
5	1	2	3									

UNIT I **9 Hours**

MACHINERIES

Lifts and Escalators -Special features required for physically handicapped and elderly -Single / Three phase supply- Determination of the power required for motors and generators - Solar panels their installation and applications.

UNIT II **9 Hours**

ELECTRICAL SYSTEMS IN BUILDINGS

Basics of electricity - Protective devices in electrical installations - Lightening arrester - Earthing-Types of earthing - ISI specifications - Types of wires, wiring systems - Planning electrical wiring for building - Main and distribution boards - Transformers and switchgears.

UNIT III **9 Hours**

PRINCIPLES OF ILLUMINATION

Visual tasks - Factors affecting visual tasks - Synthesis of light - Additive and subtractive synthesis of colour - Luminous flux - Candela - Solid angle illumination - Utilisation factor - Depreciation factor - MSCP - MHCP - Laws of illumination - Classification of lighting - Artificial light sources - LED lightings - Daylight factor- Luminous efficiency - Colour temperature - Colour rendering - Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types - Specifications of National Building Code ofIndia.

UNIT IV **9 Hours**

REFRIGERATION PRINCIPLES

Thermodynamics - Heat - Temperature - Change of state -Sensible heat - Latent heat of fusion, evaporation, sublimation - Saturation temperature - Super heated vapour - Subcooled liquid - Refrigerants - Vapour compression cycle - Starters - Air handling units -Water piping - Window type and packaged air-conditioners - Chilled water plant- Vapour Absorption Machine(VAM) - Air conditioning systems for different types of buildings.

UNIT V **9 Hours**

FIRE SAFETY INSTALLATION

Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes systems - Special features required for physically handicapped and elderly in building types - Heat and smoke detectors - Fire Fighting pump and water storage - Dry and wet risers - Automatic sprinklers.

FOR FURTHER READING

Types of Electric Motors and Generators, Fire alarm system, Snorkel ladder

Total: 45 Hours

Reference(s)

1. SP 7 (2005): National Building Code of India2005
2. Roger Greeno and Fred Hall, Building Services Handbook (8th edition), Routledge Publishers, 2015.
3. G. Steffy, Architectural Lighting Design, John Wiley and Sons,2008
4. J. Killinger and L. Killinger, Heating and Cooling Essentials, Goodheart-Wilcox Publishers,2003
5. Electrical Safety, Fire Safety Engineering and Safety Management, Reprint, 2016, S.Rao& Prof. H.L.Saluja
6. ASHRAE, Fundamentals and Equipment, ASHRAE Inc.,2005

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	2	3			4	6				1				4											20
2	2	2			5	5					3			2				1							20
3	3	3			2	3	3			3				2				1							20
4					4	5	2				5			4											20
5	2				1	5			4		5			3											20
																								Total	100

Assessment Questions

Remember

1. Name some special features required for a commercial building for physically handicapped and elderly.
2. List the applications of solar panels.
3. List the accessories in a lift
4. Why is earthing needed for electrical systems?
5. What are the types of Switch gears?
6. Distinguish between additive and subtractive synthesis of colour.
7. What do you mean by depreciation factor?
8. List the factors affecting visual tasks.
9. Write any four non combustible materials used in buildings.
10. What is snorkel ladder?
11. Name some special features required in a commerical building for physically handicapped and elderly
12. What is snorkel ladder?
13. What do you mean by depreciation factor?
14. List the factors affecting visual tasks.

Understand

1. Summarize how electricity is being generated from gas and water.
2. Explain about the special features required for handicapped and elderly in lifts
3. State the purpose of concrete pump
4. Classify the protective devices in electrical installations.
5. Explain about the types of wiring system with a neat sketch.
6. Write out the quantification of light.
7. Explain the laws of illumination
8. State the function of a compressor in refrigerator
9. How temperature is being measured?
10. State the law of thermodynamics.
11. Compare latent heat of fusion with latent heat of evaporation
12. Interpret the planning considerations for non - combustible construction in a building.
13. Explain about the special features required for handicapped and elderly in lifts.

Apply

1. Explain various possibilities of fire hazard in current type buildings and how will you protect them from disaster.
2. Implement your idea for planning an electrical wiring in a building.
3. How will you execute the minimum level of illumination in a building for old age people?
4. How will you implement air handling units in an office building?
5. What are the considerations to be taken for implementing a fire fighting pump?
6. What is the need of implementing automatic sprinklers in a building?

Analyse

1. Differentiate the working principle of motors and generators with a neat sketch.
2. Differentiate between pipe and rod earthing
3. Distinguish between MSCP and MHCP.
4. Differentiate between dry risers and wet risers

15CE0YF REMOTE SENSING AND GIS 3 0 0 3

Course Objectives

- To impart knowledge on the principles of Remote Sensing and itslimitations
- To communicate the knowledge on the basic characteristics of remote sensingimagery
- To provide a basic understanding of GIS modeling concepts, components, requirements and applications

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods

including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineeringpractice.
k. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team, to manage projects and in multidisciplinaryenvironments.

Course Outcomes (COs)

1. Enhance the knowledge on physical principle of remote sensing and interactions of radiations in earth surface andatmosphere.
2. Carry out independent research problem related to acquisition, storage, manipulation, analysis and display of realistic environmentaldata.
3. Synthesize the map by adopting GIS methodology and concepts including data models and spatial analysis.
4. To prepare documents of several data analysis and design specifications of a data model for GIS applications.
5. To apply the knowledge of remote sensing and GIS for several applications like Land use and Land Cover, Agriculture and Water Resources, Waste Land Management, Defense Applications etc

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1						1					
2	1		1	1		1		1				
3		1	1		1		1					
4	1		1	1	2		1				2	
5	1	1			1		1					

UNIT I **9 Hours**

REMOTE SENSING

Definition and its components - History of remote sensing and Indian Space Program. Electromagnetic spectrum - wavelength regions important to remote sensing - Wave theory, Particle theory, Stefan- Boltzman Law - Atmospheric scattering, absorption - Atmospheric windows - spectral reflectance of EMR with earth surface, water, vegetation and soil- spectral signature concepts - Platform andSensors.

UNIT II **9 Hours**

IMAGE INTERPRETATION AND ANALYSIS

Types of Data Products - Types of image interpretation - Basic elements of image interpretation - Visual interpretation keys - Digital Image Processing - Pre-processing - Image enhancement techniques - Multispectral Image classification - Supervised and unsupervised.

UNIT III **9 Hours**

GEOGRAPHICAL INFORMATION SYSTEM AND ITS ANALYSIS

Maps - Map projections - Types of map projections- GIS definition - Basic components of GIS - Data type - Spatial and non-spatial data - Database concepts - Vector and Raster data structures, Data compression, Edgematching

UNIT IV **9 Hours**

DATA INPUT EDITING AND ANALYSIS

Data stream - Input methods - GPS for data capture-Editing- Data Retrieval - Query - Simple Analysis - Spatial Analysis - Overlay - Vector Data Analysis - Raster Data Analysis- Topological analysis - Modeling surfaces - DEM -DTM - Slope Model - Integration of Remote Sensing and GIS.

UNIT V **9 Hours**

REMOTE SENSING AND GIS APPLICATIONS

Applications- Landuse - Water Resources and Watershed management - Irrigation and Agriculture - Environmental studies - ground water exploration - Defence Application - Wasteland Management - Weather Forecast - Flood and Storm Routing - Emergency Management and Real Estate.

FOR FURTHER READING

Indian Remote Sensing Satellites- Standard GIS Packages- Application of Mobile and Web GIS

Total: 45 Hours

Reference(s)

1. M. Anji Reddy, Remote sensing and Geographical Information Systems, Third Edition, BS Publications, India,2006.

2. T.M. Lillesand and R.W. Kicter, Remote Sensing and Image interpretation, John Willey and sons, inc. New York,2002.

15CE0YG INDUSTRIAL WASTE MANAGEMENT 3 0 0 3

Course Objectives

- To provide basic knowledge on the management practices of solid and liquid waste
- To impart knowledge on the collection, transport and disposal of solid waste
- To emphasize the need for solid and liquid waste management

Course Outcomes (COs)

1. Identity the characteristics of solid and liquid waste from various industry.
2. Identify the methods of treatments and the disposal of various industrial effluent.

UNIT I **9 Hours**

INTRODUCTION

Types of industries and industrial pollution - Characteristics of industrial wastes -Population equivalent - Bioassay studies - effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health -Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

UNIT II **9 Hours**

CLEANER PRODUCTION

Waste management Approach - Waste Audit - Zero discharge - Volume and strength reduction - Material and process modifications - Recycle, reuse and byproduct recovery - Applications.

UNIT III **9 Hours**

POLLUTION FROM MAJOR INDUSTRIES

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants - Wastewater reclamation concepts.

UNIT IV **9 Hours**

TREATMENT TECHNOLOGIES

Equalisation - Neutralisation - Removal of suspended and dissolved organic solids - Chemical oxidation - Adsorption - Removal of dissolved inorganics - Combined treatment of industrial and municipal wastes - Residue management - Dewatering - Disposal.

UNIT V **9 Hours**

HAZARDOUS WASTE MANAGEMENT

Hazardous wastes - Physico chemical treatment - solidification - incineration -Secured land fills

FOR FURTHER READING

Case study of industrial waste management in any two cities in Tamil Nadu - in any one cities in North India. Any two Case study of industrial waste management in any part of the world with innovations in Engineering and Technology.

Total: 45 Hours

Reference(s)

1. M.N.Rao & A.K.Dutta, Wastewater Treatment, Oxford - IBH Publication, 1995.
2. W .W. Eckenfelder Jr., Industrial Water Pollution Control, McGraw-Hill Book Company, New Delhi, 2000
3. T.T.Shen, Industrial Pollution Prevention, Springer, 1999.
4. R.L.Stephenson and J.B.Blackburn, Jr., Industrial Wastewater Systems Hand book, Lewis Publisher, New Yark, 1998
5. H.M.Freeman, Industrial Pollution Prevention Hand Book, McGraw-Hill Inc., New Delhi, 1995.
6. Bishop, P.L., Pollution Prevention: Fundamental & Practice, McGraw-Hill, 2000.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	**F**	**C**	**P**	**M**	
1	4	2				2			6	6															20
2	2	2			2	2					6			6											20
3	2					6					6				6										20
4		2				4	2				6			6											20
5	2	2				2	2				6				6										20
																								Total	100

Assessment Questions

Remember

1. Recall the types of industries and industrial pollution.
2. List out the effects of industrial effluents on streams.
3. State waste management Approach.
4. Define Equalization
5. State Adsorption.
6. List removal of dissolved inorganic matter.
7. List out the sources of waste generation.
8. Define solid waste.
9. List out the methods of unit operations used for separation and processing.
10. Define anaerobic methods for materials recovery and treatment.
11. Outline landfills
12. Define resource and energy recovery.
13. State integrated waste management.

Understand

1. Classify the characteristics of industrial wastes.
2. Illustrate bioassay studies.
3. Explain waste audit.
4. Summarize reuse and byproduct recovery
5. Explain waste treatment flow sheets for textiles industries.
6. Summarize the Combined treatment of industrial and municipal wastes.
7. Illustrate Chemical oxidation.
8. Explain anaerobic methods for materials recovery and treatment.
9. Illustrate integrated waste management.
10. Illustrate physicochemical treatment
11. Explain solidification.
12. Illustrate incineration.
13. Explain removal of dissolved inorganics.

Apply

1. Demonstrate bioassay studies.
2. Write sewage treatment plants and human health.
3. Illustrate electroplating industries.
4. Uses of residue management. Illustrate.
5. Prepare waste treatment flow sheets for fertilizer plant.
6. Illustrate Legal and organizational foundation of solid waste management.
7. Compute sampling and characterization of liquid and solid waste.

8. Write unit operations used for separation and processing.
9. Define hazardous waste.
10. Demonstrate landfill remediation.
11. Write about Industry specific solid waste management.
12. Demonstrate integrated waste management.

Analyse

1. Explain Population equivalent.
2. Collect the effects of industrial effluents on streams.
3. Design any one method of material and process modifications
4. Summarize wastewater reclamation concepts.
5. Synthesize Residue management.
6. Explain the monitoring responsibilities.

Evaluate

1. Write future changes in waste composition.
2. Construct materials recovery facilities.
3. Summarize transport means and methods of solid waste.
4. Explain landfill remediation.

Create

1. Develop the methods of treatments of sugar industry

15CE0YH WEALTH FROM WASTE 3 0 0 3

Course Objectives

- To expose students to the need of reuse and recycle the resources focusing on sustainability and conservation
- To emphasis the significance of energy and resource recovery from wastematerials
- To prepare the students to design and optimize suitable resource utilization system from micro-level tomacro-level

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Classify the sources of waste and identify the process of recyclingit
2. Characterize solid wastes and identify suitable processing methods through materials recovery facilities.
3. Compare the feasibility of technologies for RDF and waste disposal

4. Differentiate biochemical and thermo-chemical conversion of waste to energy in terms of their sustainability
5. Explain the principles of industrial waste management and economic feasibility for reuse and recycling

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2				3						
2	1	3										
3	1	2										
4	2					2						
5	1				3	2						

UNIT I **9 Hours**

INTRODUCTION

Classification and sources of waste - domestic, industrial and agriculture sources- industrial wastes- mineral wastes - physical, chemical and biological properties of waste as a fuel - waste minimizing options - recovery and recycle - waste handling methods - preparation of recycled fuel -energy fromwaste
- incineration - pyrolysis - emission reduction during combustion of waste - Kinds of waste available/generated bypeople

UNIT II **9 Hours**

SOILD WASTE PROCESSING AND RESOURCE RECOVERY

Characterization of solid wastes - logistics of waste collection system - recycling of solid wastes - purity of materials and market issues - factors affecting composting process - environmental considerations of mass burn - materials recovery facilities (MRF) - unit operations in MRF - material separation and processing at MRF - materials flow in MRF - environmental pollution control - Ideas for reusing and recycling the waste generated byresidents

UNIT III **9 Hours**

TECHNOLOGIES FOR WASTE DISPOSAL AND ENERGY RECOVERY

Organic waste blending systems -utilization and treatment of fly ash -direct replacement of cement - waste land development- soil amendment to grow crops - landfill gas for energy - Refuse Derived Fuel (RDF) - design and fuel analysis of waste to energy systems - New technologies for bio-thermal processing ofwastes

UNIT IV **9 Hours**

BIOCHEMICAL CONVERSION FOR ENERGY PRODUCTION

Sources of energy generation - anaerobic digestion biogas production - types of biogas plant - biomethanation from sludge digestion - bio-energy assessment -integrated biomass gasification for electricity generation -potential of organic waste for hydrogen production - bio-fuel production, refining and technology - thermo-chemical conversions - industrial applications of gasifiers - utilization and advantages of briquetting - environmental impacts of biochemical and thermo-chemical conversion - Case profile of success stories of waste to wealth

UNIT V **9 Hours**

INDUSTRIAL WASTE MANAGEMENT

Principles of industrial waste management - amount and types of plastic waste - recycling of plastic waste-cement manufacture from industrial solid waste - resource recovery from major industries - economic analysis of energy production from waste - cost-benefit analysis - life cycle analysis - market analysis for the components of waste stream - Develop prototype/ project for reuse and recycling of plasticwaste

FOR FURTHERREADING

Advanced wastewater treatment processes - benefits of reuse in agriculture - costs of reuse projects and economic justification - factors essential for the success of reuse projects- public participation in communitydevelopment

Total: 45 Hours

Reference(s)

1. B. Lal, P.M. Sarma, Priyangshu M. (2011) Wealth from Waste: Trends and Technologies, 3rd Edition, The Energy and Resources Institute, New Delhi,2011
2. W. McDonough, M. Braungart, Cradle to Cradle: Remaking theWay We Make Things, United States: North Point Press,2002
3. C. Parker, Roberts, Energy from Waste - An Evaluation of Conversion Technologies, Elsevier Applied Science, London,1985
4. K. Shah, Basics of Solid and Hazardous Waste Management Technology, Prentice Hall,2005
5. M. Datta, Waste Disposal in Engineered Landfills, Narosa Publishing House,1997

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	3				2	3							3	2				3							16
2	2	3				3							3		3			3						3	20
3		2				5			2	3				3				3				2			20
4	2	2			2	2	3				2				2			2	2			2			21
5		2				3				3	2			2		2		3				3		3	23
																								Total	100

Assessment Questions

Remember

1. List any four important factors involved in deciding final cost of purchased electricity.
2. Name the principles of energy management.
3. Define 'energy management'.
4. Define MSW and classify it into various types.
5. Name various sources of plastic waste.
6. Discuss various processes and phases of composting.
7. Write short notes on Degradable plastics
8. Write short notes on Processes for plastic waste degradation
9. Write short notes on GHG emissions due to composting
10. Name the six characteristics of the waste because of which any waste can be classified as hazardous waste

Understand

1. Explain fuel substitution and list one example of fuel substitution
2. Differentiate between System engineering models and system analysis tools in ISWM
3. Differentiate between Pyrolysis, combustion and gasification
4. Discuss various issues related to landfilling. Explain waste decomposition process in a landfill
5. Discuss various processes for thermal treatment of solid wastes. Discuss necessary conditions for MSW incineration.
6. Explain each of the steps or processes involved during MSW incineration.
7. Explain Recycling?
8. Name some products from recyclable materials?
9. What does the recycling symbol with the three arrows represent?
10. Explain the steps to stop the foul smell sometimes emitted by a compost pile.
11. Explain how an incinerator works.
12. Explain the different types of landfills.
13. What are the advantages to using a shredder for MSW processing in a MRF? What are the disadvantages?
14. List the key components of the receiving area of an MSW processing facility.
15. List and discuss some of the major safety hazards associated with shredding MSW.
16. List and discuss some of the major safety hazards associated with shredding MSW.
17. List and discuss some of the major safety hazards associated with shredding MSW.
18. List and discuss some of the major safety hazards associated with shredding MSW.
19. How does resource recovery affect the overall cost of solid waste management?
20. In your home, which waste materials do you now separate?
21. List some of the alternative recycling markets for paper, glass, and plastics
22. How do source reduction, reuse, and recycling differ?
23. What are the primary approaches to recycling MSW?
24. How many lifetimes do office paper or newsprint have before it can no longer be effectively recycled? Aluminum? Steel? Glass?

Apply

1. A landfill area of (150 m x 100 m) is available for handling one years' municipal solid waste (MSW) for a town of 5,00,000 people. Assuming that average per capita MSW discard per year in town is 0.05 tonne, landfill density is 500 kg/m³, and that the 15 percent of the landfill cell volume is used for soil cover, estimate the landfill lift in one year
2. A landfill area of (150 m x 100 m) is available for handling 25 years' municipal solid waste (MSW) for a town of 5,00,000 people. Out of the total landfill area only 80% is actually available for land fill and other is used for auxiliary services. Assuming that average per capita MSW discard per year in town is 0.05 tonne, landfill density is 500 kg/m³, and that the 15 percent of the actual landfill cell volume is used for soil cover, estimate (a) the landfill lift in one year. (b) number of years for which the land fill can be used if the landfill can't be increased beyond 25 m.
3. List out some items at your home that can be recycled?
4. Consider a 400 MT/day resource recovery facility. Assume all MSW is received in 15 m3 (20 yd3) compactor trucks, providing an average density of 900 kg/m3. During a routine work day and assuming normal equipment operation, how many trucks can be accommodated per hour?
5. Calculate the waste thickness for a conveyor belt measuring 1.1 m with an average belt speed of 17.5 m/min. Waste loading rate is 28 MT/h and the average density of the waste on the belt is 120 kg/m3.
6. An eddy current separator (see below) is to separate aluminum product from an input stream of shredded MSW. The feed rate to the separator is 1500 kg/h. The feed is known to contain 55 kg of aluminum and 1445 kg of reject. After operating for 1 h, a total of 65 kg of material is collected in the

product stream. On close inspection it is found that 46 kg of product is aluminum. Calculate the percent recovery of aluminum product, the purity of the product, and the overall efficiency of the separator.

7. A magnetic separator is employed at a MRF for ferrous recovery from MSW. The feed rate to the separator is 1255 kg/h. The feed contains 4.2% ferrous. A total of 40 kg is collected in the product stream and 32 kg is actually ferrous. Calculate the recovery, purity, and efficiency of the unit operation.
8. What are the primary contamination concerns with recycled glass? Recycled aluminum?

Analyse

1. classify energy conservation measures
2. Discuss standards methods for managing MSW in short
3. Explain various methods for reducing the impacts of plastic waste. Classify plastic waste recycling and discuss various phases of plastic waste recycling.
4. Discuss how we can increase composting activities in our community.
5. Discuss the merits and demerits of source reduction.
6. Illustrate some examples of source reduction.

Evaluate

1. Discuss various acts, rules and legislations related to plastic wastes in India.
2. Discuss how illegal dumping and burn barrels are bad for the environment and community.
3. The number of MRFs in the United States and India has increased dramatically over the past decade. Explain the causes for this increase, based on factors such as economics,NIMBY, and environmental concerns
4. Suppose the city was to avoid working with a materials broker and instead work directly with material buyers. What agreements should be specified in a proposal from a recycled materials buyer?

Create

1. Suppose your community has decided to develop a waste management program with a goal of substantially greater waste recycling and materials recovery. The three major alternatives are source separation, a dirty MRF, and a clean MRF. Discuss the key factors for consideration by the community in order to make an educated decision about the optimum alternative. Consider issues such as short- and long-term economics, public acceptance, environment and aesthetics, and convenience to local citizens.

15CE0YI RISK AND SAFETY MANAGEMENT 3 0 0 3

Course Objectives

- To study the various risk and safety management for successful completion of construction projects.
- To impart knowledge on industrial risks and their safety management.
- To study the various active installations provided in the buildings to ensure the safety for both men and materials.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and

engineeringsciences.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.
g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Recall the basic ideas on precaution duringconstruction
2. Identify the hazards and its remedial measures in theindustry
3. Understand the importance of environmentalsafety
4. Understand the role of individual in prevention ofpollution..
5. Use of various installations like fire extinguisher, smoke detectors, fire alarm systems in the industry.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2		2			1							
3						1	2					
4						2			1			
5					2	2						

UNIT I **9 Hours**

INTRODUCTION

Risk assessment and control- Legal Basis for Risk Assessment - Hazards, remedial measures - Safety and health policy- Motivation of employees - Workplace Precautions - Management responsibilities, Individual responsibilities - Training for Safety and Health- Insurance coverage of Industrial plant & personnel

UNIT II **10 Hours**

CONSTRUCTION SAFETY

Quality and Safety Concerns in Construction -Organizing for Quality and Safety - Work and Material Specifications - Importance of Safety during project construction - Accidents and their Causes - General precaution to hazardous atmosphere and materials - Safety facilities at construction sites - Training to project staff and operation staff - Emergency rescue equipment - Costs of Construction Injuries - Legal Implications.

UNIT III **9 Hours**

INDUSTRIAL RISKS AND SAFETY MEASURES

Risks in Industrial applications- Objectives of safety management in Industries - Electrical safety- Hazards in refineries and process plants - Safety with respect to plant and machinery- Industrial accidents and prevention- Explosive act 1884 and Petroleum act 1934 - Employees state insurance act 1948- Industrial noise and noise control- Industrial Psychology- Safety measures to avoid occupationaldiseases.

UNIT IV **9 Hours**

ENVIRONMENTAL SAFETY

Scope and Importance of Environmental safety- Environmental impact assessment (EIA) - Environmental pollution - Sustainable development- Global warming, greenhouse effect, urbanization - Role of Government in environment protection- National Committee on environmental Planning (NCP)- Environmental Appraisal Committee (EAC) - Role of individual in prevention of pollution.

UNIT V **8 Hours**

DESIGN AND INSTALLATION

Fire extinguishing appliances -Selection requirements, installation and maintenance - Sprinkler system - Maintenance of sprinkler installation - Pressure gauges, Installation of control valves - Fire protection requirements for buildings and riser system- Fire alarm Systems, Manually operated fire alarms - Smoke detectors, Fire extinguishing appliances in multi storied buildings, hotels etc.

FOR FURTHER READING

General requirements of Safety in Concrete - Concrete forms and shoring, reinforcing steel -Electrical safety in constructions - Work on live equipment -Safety activities of the ILO (International Labour Organization)- Process safety management (P.S.M) as per OSHA- Optical detector, Radiation detector, infra-red detector, ultra violet detector- Block diagram of a fire alarm systems - Case studies on examples of fire hazard in India.

Total: 45 Hours

Reference(s)

1. Risk assessment- A Practical Guide, 1993, Institution of Occupational Safetyand Health, United Kingdom.
2. Rao.S and Saluja H.L., Electrical Safety, Fire Safety Engineering and Safety Management, Khanna Publishers, first edition,1998.
3. Grundy. J. ,Construction Technology, Viva Books Pvt. Ltd.,2006
4. R.K. Jain & Sunil S. Rao, Industrial safety health and environment Management system, Khanna Publishers, Secondedition,2008.
5. V.K. Jain, New Age International Publishers, 2nd Edition, First Print 1996 Re-print2002
6. Brendra Mohan San, Fire Protection And Prevention, UBS Publishers & Distributors Pvt Ltd, 1st Edition,2008.

Assessment Pattern

Unit/RBT	Remember				Understand				Apply				Analyse				Evaluate				Create				Total
	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	F	C	P	M	
1	4	5			2	3			5				5												19
2	5	4			4	5				5				5											23
3	4	3			3	3			5	4			5	4											22
4	4				4	4				6				6											18
5	3				4	4			3	4			3	4											18
																								Total	100

Assessment Questions

Remember

1. What is meant by risk assessment?
2. Recognize any 4 training for safety and health of the employees.
3. Recall the importance of safety used in construction.
4. List out any 4 emergency rescue equipment during construction.
5. Define - Explosive act 1884 and Petroleum act 1934
6. Write any 3 precautions to reduce Industrial noise.
7. Recall the need for public awareness about environment.
8. List any 5 Roles of individuals in the prevention of pollution.
9. What is a pressure gauge.
10. Write any 4 uses of optical detector.

Understand

1. Explain the Legal Basis for Risk Assessment
2. Formulate the Management responsibilities and Individual responsibilities in an industry.
3. Explain the Costs of Construction Injuries
4. Identify the General precaution to hazardous atmosphere and materials
5. Give the Hazards in refineries and process plants
6. Explain Industrial Psychology and related safety measures to avoid occupational diseases.
7. Explain the need for environmental safety.
8. Explain about Sustainable development
9. Give the selection requirements of Fire extinguishing appliances
10. Classify the various fire safety installations used in industrial safety.

Apply

1. Explain the characteristics of a management
2. Define management. Explain functions and principles of management.
3. How would you evaluate the need for critical point control?
4. How will you assess a) quality control b) Maintenance control c) purchase control?
5. Discuss importance of safety in construction site. Describe some common causes of accidents.
6. Explain the necessity of labour legislation. Explain any two labour laws.
7. Identify and enlist the materials required for the construction of 10 storey apartment building. How you will manage the materials at construction site
8. Classify the equipments required in construction industry.
9. Explain the safety measures to be adopted in the installation of RCC Roof truss.
10. Discuss the aspects of construction equipments that are required to be studied and mastered in order to accomplish cost effective and timely completion of construction projects.

Evaluate

1. What is risk? Give the type of risk a security will face.
2. In what way, the risk management helps to conduct the construction process effectively?
3. How should an organization maintain sound and noise risk management?
4. Explain in detail about the various measures associated with risk determination and give their relative importance.
5. Explain the electrical safety measures in construction pointing out the purpose of each.

Create

1. A Multi storied RC Building is to be constructed two house, 16-2 bedroom flat. Suggest a suitable scheme for this construction.

15CE0YJ PROJECT FORMULATION AND APPRAISAL 3 0 0 3

Course Objectives

- On completion of this course the students will be able to know the formulations of projects, projects costing, appraisal andfinancing.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Perform preliminaryanalysis
2. Estimate cash flow and itsprincipal
3. Estimate Interestrates
4. Measure and assessrisk
5. Recall the Scope of TechnologyTransfer.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2		2										
3		2										
4		1										
5	1											

UNIT I **9 Hours**

PROJECT FORMULATION

Project -Concepts- Capital investments- Capital budgeting - feasibility study - preliminary analysis - market, technical, financial, economic and ecological - Market and Demand analysis- Detailed technical analysis.

UNIT II **9 Hours**

TIME VALUE OF MONEY

Time Value of Money - time lines and notations, Future value of single amount, Present value of single amount, Future value of an annuity, Present value of an annuity-Simple interest-Compound interest - project cash Flows-principles of cash flow estimation.

UNIT III **9 Hours**

COSTING

Costing: Investment Criteria- Discounting criteria-Net present value (NPV), Benefit cost ratio (BCR), internal rate of return (IRR)- Non-Discounting criteria - Pay Back Period, Accounting rate of return(ARR).

UNIT IV **9 Hours**

FINANCIAL ASPECTS

Financial aspects: Financing of projects - means of finance - Equity and Debt - financial institutions-cost of Capital- Risk Analysis, Sources and Measures of risk-Methods of risk analysis- Analysis of standalone risk, Analysis of contextual risk -special schemes.

UNIT V **9 Hours**

PRIVATE SECTOR PARTICIPATION

Private sector participation in Infrastructure Development Projects -BOT, BOLT, BOOT -Technology Transfer and Foreign Collaboration -Scope of Technology Transfer.

Total: 45 Hours

Reference(s)

1. . Prasanna Chandra, "Projects -Planning Analysis Selection Implementation & Review",Fourth Edition,. Tata McGraw Hill Publishing Company Ltd., NewDelhi.2009.
2. Joy P.K. "Total Project Management - The Indian Context (Chapters 3 7)",New Delhi, Macmillan India Ltd.,2002.
3. "United Nations Industrial Development Organization (UNIDO) Manual for thenpreparation of Industrial Feasibility Studies", (IDSI Reproduction) Bombay,2007.
4. Barcus. S.W and Wilkinson.J.V. "Hand Book of Management Consulting Services", McGraw Hill, New York,2006.

ONE CREDIT COURSES

15CE0XA E-WASTE MANAGEMENT 1 0 0 1

Course Objectives

- To provide basic knowledge on the management practices ofe-waste
- To emphasize the need for e- wastemanagement
- To create awareness among the students about the effects ofe-waste

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Recall the current practices of e-wastecollection
2. Adopt 3S system in wastemanagement

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	2											

UNIT I **15 Hours**

E - WASTE MANAGEMENT

Introduction - E-waste pathways - composition of E-waste - Need for E-waste Management - E-waste generation in developing and developed countries - Current practices on collection - Storage - Segregation - Transportation system - Treatment system - Reduce - Recycle - Reuse - Legislation in India- restriction on import of e-waste under hazardous waste management rule - Green Electronics and Green Computing practices - Life cycleassessment.

Total: 15 Hours

15CE0XB INTERIOR DESIGN 1 0 0 1

Course Objectives

- To understand the history of Building Information Modeling(BIM)
- To understand the workflow in developingBIM
- To understand the importance of sustainable BIM for variousstakeholders

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Recall the varieties ofwood
2. Recall the process ofpaintings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	1											

UNIT I

INTERIOR DESIGN

Plywoods , block boards & particle boards-Types of plywood-Grades of plywood-Woods used in plywood Thickness & sizes of plywood-Woods-Varieties of wood-Woods used for joineries-Woods used for interiors Seasoning of woods-Sizes, planks and allowances for processing-Painting & polishing-Types of priemer paints & putty-Types of polishing-Life of polish-Hardwares-Hinges, glass, tower bolts - sizes & thickness. Stoppers, closers, magnetic catchers and ball catchers,-Types of locks and keys-Floorings, screens & curtains.Types of flooring-Size & thickness of materials-Types of screens-Types ofcurtains

Total: 15 Hours

15CE0XC CONSTRUCTION COMMUNICATION 1 0 0 1

Course Objectives

- Develop students' communication skills in managing constructionprojects.
- Communicate effectively regarding subjects related to constructionactivities

Programme Outcomes (POs)

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
i. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions.

Course Outcomes (COs)

1. Apply communication models toconstruction
2. Communicate effectively regarding subjects related to constructionactivities;
3. Recall the role of communication in enablingchanges

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1					1					2		
2										2		
3									1	2		

UNIT I **5 Hours**

COMMUNICATION CONCEPTS AND CONTEXTS

1.IntroductionDefining communication - The importance of effective communication - The principles of effective communication - The role and importance of effective communication to the project manager
2.The challenges of communicating in the construction project environment The nature of project - based working - The communication imperative for construction organisations - New communication challenges for the contemporary construction industry -Communication challenges for the construction project manager - Task Manager Role in Communication
3.Theoretical perspectives on construction communication. The development and value of communication theory - Theoretical models of communication -Applying communication models to construction - Barriers to effective communication - Effects of Poor Communication in Construction

UNIT II **5 Hours**

COMMUNICATION TYPES AND TECHNIQUES

4.Interpersonal Communication Defining interpersonal communication - The nature of effective interpersonal communication within construction - The importance of effective interpersonal communication for construction project performance - Verbal interpersonal communication in construction Non-verbal interpersonal communication in construction
5.Group and team communication Group development and team roles - Inter -group communication

6.Organisational communication: Introduction - Understanding communication within organisation - The nature of communication within construction organisations - Developing an organisational communicationstrategy

7. Corporate communication Introduction - Principles of mass communication - Managing the corporate image of a construction organisation - Managing the corporate image of construction industry - Communicating corporate and social responsibility

UNIT III **5 Hours**

FUTURE DIRECTIONS FOR CONSTRUCTION COMMUNICATION

Information and communications technology Introduction -The utilizationof ICT in the construction industry - Some examples of ICT innovations in construction - Realizing the potential of ICT in the future - Maximizing use of Modern Technology – Standardizing the ConstructionLanguage Conclusions and directionsinconstructioncommunication Introduction - The construction communication context - Future construction communication challenges - The role of communication in enabling changes - Some future researchdirections

Total: 15 Hours

15CE0XD LESSON FROM FAILURE OF STRUCTURES 1 0 0 1

Course Objectives

- Identify the types of failure and its causes in R.C and steelstructures.
- Justify a suitable remedial measure for prevention from failure and repair ofstructures.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.

Course Outcomes (COs)

1. Recall the type of Failures
2. Design and detail as per codalprovision

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2		1	2									

UNIT I **15 Hours**

LESSONS FROM FAILURE OF STRUCTURES

Types of Failures - Causes of failure - Failure of R.C Structures and Steel Structures - Investigations and condition assessment - Prevention of failure - Control Measures in Planning, Design and detailing, Construction Management, Execution - Remedial Measures - Importance of Maintenance - Experiments on failure Model - repair, restoration and Strengthening techniques- Case Studies.

Total: 15 Hours

15CE0XE TOPOGRAPHIC MAPS 1 0 0 1

Course Objectives

- Construct a contour or topographic map for a largearea.
- Compute the gradient and distance on topographicmaps

Programme Outcomes (POs)

d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. measure distances on topographicmaps
2. Differentiate various measuringmethods

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1				2								
2					1							

UNIT I **15 Hours**
TOPOGRAPHIC MAPS
Maps - small scale and large scale maps -topographic maps - marginal information - conventional signs and symbols used to show relief, land use, drainage, vegetation - transportation and communication - settlements - contours - contour diagrams of relief features - cross - section - calculation of gradient - measurement of distances on topographic maps –rotometar method - thread method - square method - graph paper method

Total: 15 Hours

15CE0XF PRACTICAL PROJECT GUIDANCE AND PERSONALITY DEVELOPMENT **1 0 0 1**

Course Objectives

- Implement time management in construction industry and improve their leadershipskills

Programme Outcomes (POs)

f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Manage time in constructionIndustry
2. Set goals in completing theproject

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1						1						
2						2						

UNIT I **15 Hours**

PRACTICAL PROJECT GUIDANCE

Introduction- Leadership in construction industry- Time management in construction activities- Goal setting in project- Effective communication-Construction safety management- Self development and motivation towards success in construction industry.

Total: 15 Hours

15CE0XG RECENT PRACTICES IN PLANNING, DESIGN, CONSTRUCTION AND MAINTENANCE OF BUILDING **1 0 0 1**

Course Objectives

- Illustrate the construction procedure by practicalapproach.
- Quantify the rate of a building by empiricalformulae.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmentalconsiderations.
f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Recall basic design ofstructures
2. Understand Vasthu- and-ManaiyadiSasthra

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1			1									
2	2					1						

UNIT I **15 Hours**

RECENT PRACTICES IN PLANNING, DESIGN, CONSTRUCTION AND MAINTENANCE OF BUILDING

History & Evolution of Civil Engineering - Basic Architecture for Buildings - Planning of Buildings - Recent Concepts and Approaches -Vasthu- and –ManaiyadiSasthra- in Building Practice. Urban Planning - an overview Green Buildings - an overview - IS Codes, TN Building Practice, NBC, etc- Basic Design of Structures: Practical Approach. Building Project under Construction. (Basic exposure on planning, design, construction and project management). Building Drawings, AutoCAD, Basics of Estimating and Quantity Survey - Construction Materials, Construction Equipment, Construction Technology & new Construction Practices - Basic Construction Management. Maintenance of Building Infrastructures - an overview. Creativity and Innovation in modern CivilConstruction.

Total: 15 Hours

15CE0XH IRRIGATION MANAGEMENT: PRESENT AND FUTURE **1 0 0 1**

Course Objectives

- Criticize water budgeting and the use of conservation ofwater.
- Assess the type of irrigation method to be adapted to a particularcrop.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.
e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

Course Outcomes (COs)

1. Gain knowledge on model irrigation systems andpractices
2. Implement Automation in Water ResourcesManagement

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2											
2				1	2							

UNIT I **15 Hours**

IRRIGATION MANAGEMENT: PRESENT AND FUTURE

History & Evolution of Irrigation Engineering - Basics of Irrigation Management - Tank Systems in Tamilnadu - Irrigation through System and Non-System Tanks - Modern Irrigation Systems: Dams and Appurtenant Structures - Hydraulic Structures in Irrigation, O& M of Irrigation Infrastructures - Aliyar Dam, Contour Canal, Hydro Power Station, Irrigation Canal Systems - Irrigation Management: Duty, Assessment of Crop Water Requirement by Scientific methods, Modern Irrigation Practices (Drip, Sprinkler, Micro Sprinkler, etc.), Participatory Irrigation Management (PIM), Community Collaborative Water Management, Water Budgeting - Water conservation in Irrigation: Emerging Trends - Automation in Water Resources Management - Water conservation through Organic Farming - Water: Are We Smart enough? (Million Steps for Water) - (Sensitizing the Students Community on Water Conservation)

Total: 15 Hours

15CE0XI LARGE SCALE PLANNING SYSTEMS 1 0 0 1

Course Objectives

- Summarize the system methodology and planning in systemengineering.
- Choose the methodology of forecasting and assessment for large scale programplanning.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Differentiate various Systems Methodology andPlanning
2. Understand and Manage Constraints and itsprinciples

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2											
2	1											

UNIT I **15 Hours**

LARGE SCALE PLANNING SYSTEMS

Systems thinking: Introduction, Problem Situation, Systems &Cybernatics, System Models, Hard/Soft Systems, Soft Systems Methodology, Soft System Examples/Case studies, Ashby's Requisite Variety Theory. Systems Methodology and Planning: Halls Morphological Box, Seven Phases of System Engineering, Seven Steps of System Engineering, Program Planning Linkage, Goals, Objectives, Constraints, Alterable, Measures etc., Example: Energy Supply and Demand, Value System Synthesis and Linkage. Technology Forecasting and Assessment: Philosophical Basis for TA/TF, Limits to growth model, Methodology in TA/TF- Brainstorming, Delphi, Relevance Tree Techniques, System Dynamics-Examples. Theory of Constraints: Fundamental Principles of the theory of Constraints, Understanding and ManagingConstraints

Total: 15 Hours

15CE0XJ ARBITRATION AND DISPUTE RESOLUTION 1 0 0 1

Course Objectives

- Interpret details of engineering contracts and itsessentials.
- Exemplify the arbitration of engineering contracts with Indian arbitrationact..

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Gain broad understanding about contracts in constructionindustry
2. Dispute resolution mechanism under the Indian judicialSystem

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	2											

UNIT I **15 Hours**

ARBITRATION AND DISPUTE RESOLUTION

Introduction to contracts in construction industry: Brief details of engineering contracts - definition, types and essentials of contracts, - brief details of Geneva protocols and its conventions. Arbitration of Engineering Contracts - Background of Arbitration in India, Indian Arbitration Act 1937, UNCITRAL model law, forms of arbitration - arbitration agreement, Commencement of arbitral proceedings, Constitution of arbitral tribunal, Institutional procedure of arbitration, Impartiality and independence of arbitrators jurisdiction of arbitral tribunal, Interim measures, Enforcement of awards. Negotiation, Mediation and conciliation - concepts and purpose, statutory back ground ADR and mediation rules, Duty of mediator and disclose facts, Power of Court in mediation. Alternate Dispute resolution - Structure of Indian Judicial, The arbitration and reconciliation ordinance 1996, The dispute resolution mechanism under the Indian judicial System, Litigation in Indian courts, case studies.

Total: 15 Hours

15CE0XK PROJECT DELIVERY SYSTEM IN BUILDING SECTOR 1 0 0 1

Course Objectives

- To make the students to understand the benefits of Project deliverysystem
- To make the students to understand the impact of Project deliverysystem

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of thelimitations.

f. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

Course Outcomes (COs)

1. Understand the roles and responsibilities of GovernmentRegulators
2. Understand the impact and benefits of Project deliverysystem

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1				2							
2	1				2							

UNIT I **2 Hours**
OVERVIEW OF PDS
Introduction - Use of PDS - Current and future participation in Delivery Systems.

UNIT II **3 Hours**
BENEFITS OF PDS
Overview of key benefits - Sustainability and quality - Lean Project Delivery System

UNIT III **3 Hours**
IMPACT
Construction project costs - Construction schedule and Project Monitory

UNIT IV **4 Hours**
RISK ALLOCATION
Roles and responsibilities of Government Regulators - Risk allocation - Liabilities and penalties - Legal perspective - Arbitration - Insurance and its role in Project Delivery

UNIT V **3 Hours**
EMERGING DELIVERY SYSTEMS
Factors influencing adoption of emerging delivery systems - Obstacle and positive influences

Total: 15 Hours

15CE0XO ENVIRONMENTAL CONSERVATION IN RIVER BASINS FOR SUSTAINABLEDEVELOPMENT I 1 0 0 1

Course Objectives

- To discuss different aspects of water resource development and management on watershedbasis
- Toreflectoncertaintechnicalaspects whichneed tobelookedatfromriverbasinpointofview.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Understand various components of RiverBasins
2. Understand various Environment Functions in RiverBasins

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2	2											

UNIT I **5 Hours**

RIVER BASINS FUNCTIONS

Introduction - Definition of River Basin - River Basin functions - various components of River Basins- Forest area - Catchment area - Dam and reservoirs - Lakes and Tanks - Rivers confluence Point.

UNIT II **5 Hours**

ENVIRONMENT FUNCTIONS IN RIVER BASINS

Environment definition-Various components of Environment - ECO system - Bio diversity- Forest and Water Resources - Types of forest - Bio hot spots of River basin - Importance of Flora and Fauna.

UNIT III **5 Hours**

ENVIRONMENTAL DEGRADATION

Catchment degradation - Forest degradation change of land one pattern - Encroachments due to Urbanization and Industrialization - Impacts of Educational Institutions and spiritual institutions - Tourism impacts dumping solid water - discharge of Liquid waste - Causes and impacts of Environmental degradation.

Total: 15 Hours

15CE0XP ENVIRONMENTAL CONSERVATION IN RIVER BASINS FOR SUSTAINABLEDEVELOPMENT- II 1 0 0 1

Course Objectives

- To discuss different aspects of water resource development and management on watershedbasis
- Toreflectoncertaintechnicalaspects whichneedtobelookedatfromriverbasinpointofview.

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineeringsciences.

Course Outcomes (COs)

1. Gain knowledge about Eco-friendly Technologies for SustainableDevelopment
2. Know about Eco-friendly Technologies for UrbanDevelopment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2	2	1										

UNIT I **7 Hours**

ECO-FRIENDLY TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT

Pollution control acts-Air Act - Water Act - Environmental Act Forest act - MSWM rules - E-Waste Rules - Definition of sustainable development origin concept and Activities - Eco friendly Technology in all sectors - Cleaner production Approaches in Industries- catchmentmanagement

UNIT II **8 Hours**

ECO-FRIENDLY TECHNOLOGY FOR URBAN DEVELOPMENT

Urban Management- Watershed Management in Ralegam siddhi village - Katchrali lake and Mookanery Lake conservation- Ooty lake conservation and STP in ooty lake - CETP - in dyeing and tannery - CDM in textile dyeing and sago industries-Water Resources Management - Industrial waste Water Management- Promotion of organic farming- home composting and roof gardenetc

Total: 15 Hours

15CE0XQ FOUNDATION STRUCTURES - A CASE STUDY APPROACH **1 0 0 1**

CourseObjectives

- To impart fundamental knowledge on investigation of the site and selection of suitablefoundation
- To impart knowledge on the design concepts of different types offoundations

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.

Course Outcomes (COs)

1. Know various types offoundation
2. Design Foundation for Industrial Structures &Water StorageTanks

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1	2										
2		2	3									

UNIT I **3 Hours**
PILE FOUNDATION
Pile action on load bearing type - Pile action on friction type with related case study

UNIT II **3 Hours**
RAFT FOUNDATION
Plate action of Raft foundation - Piled raft concepts and its applications

UNIT III **3 Hours**
ANALYTICAL STUDY OF RAFT FOUNDATION
Creation of Raft plate - Behavior of raft plate subjected to different loading conditions

UNIT IV **3 Hours**
ECCENTRIC FOUNDATION SYSTEM
Eccentric foundation design with its relevant case studies

UNIT V **3 Hours**
FOUNDATION INDUSTRIAL STRUCTURES
Industrial foundation spec - Components of industrial units - Storage tanks and its applications

Total: 15 Hours

15CE0XR ANALYSIS AND DESIGN OF BRIDGE USING STAAD PRO

1 0 0 1

Course Objectives

Analysis and design of Substructure and bridge design

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Course Outcomes (COs)

1. Analysis and design of box culvert and substructure
2. Analysis and design of RCC I-Girder, Diaphragm and Deck Slab

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3	2										
2	2	2										

UNIT I **15 Hours**

INTRODUCTION

Introduction to Bridges and STAAD PRO - Explanation of IRC codes used for bridge designing - Design of Box Culvert and using STAAD PRO - Design of RCC I-Girder, Diaphragm and Deck Slab - Design of Substructure and Foundation using software analysis.

Total: 15 Hours

15CE0XS CONSTRUCTION CHEMICALS IN CONSTRUCTION INDUSTRY - THE SIGNIFICANCE

1 0 0 1

Course Objectives

- To impart knowledge on construction chemicals and its applications

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Course Outcomes (COs)

1. To understand the basic properties and applications of various types of construction chemicals
2. To address and resolve field problems related to construction at site and thereafter building distress

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1											
2	2											

UNIT I **4 Hours**

CONCRETE ADMIXTURES - PROPERTIES AND APPLICATIONS

FlyAsh - SilicaFume - GGBFS - Natural Pozzolans - Plasticizers - Superplasticizers - Air Entrainers - Waterproofing Admixtures - Anti washout Admixtures for underwater concreting - Shotcrete Admixtures - Pumping Aids - LightWeight Admixtures - Corrosion Inhibiting Admixtures - Viscosity Modifying Admixtures - Expansive Agents -Stabilizers/Activators

UNIT II **4 Hours**

WATERPROOFING MEMBRANCES / COATINGS - PROPERTIES AND APPLICATIONS

Self adhesive membranes - Torch-on membranes - Non-adhesive membranes - Loose laying membranes - Polymer cement - Polyurethanes - SBR Latex - Acrylic - Bituminous - Emulsions - Cementitious - Epoxy - Polysulphides, Polyurethanes, Silicone

UNIT III **3 Hours**

FLOORING COMPOUNDS AND CHEMICALS- PROPERTIES AND APPLICATIONS

Decorative – Heavyduty - Hygienic - Chemical Resistant - Abrasion Resistant - Washable - Completely leveled - Seamless - Repairable –Nonstaining

UNIT IV **3 Hours**

REPAIRS AND REHABILITATION CHEMICALS - PROPERTIES AND APPLICATIONS

Cracks - Patch - Filling - Retrofitting - enhancements - widening

Total: 15 Hours

Reference(s)

1. Construction Chemicals, Publisher: SBP Consultants & Engineers Pvt. Ltd., Jain Books Agency, New Delhi Code No.18877 - 472 pages
2. Chemical Materials for Construction by Philip Maslow, Structures Publishing Company - 1974 - 570 pages.

15CE0XT INTEGRATED WATERSHED DEVELOPMENT AND MANAGEMENT

1 0 0 1

Course Objectives

- To impart knowledge on watershed management Strategies and solutions

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

g. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Course Outcomes (COs)

1. Illustrate the Strategies and Problems associated with watershed management
2. Summarise the case study on Watershed development and Management

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	1						1					
2	2						1					

UNIT I **8 Hours**

INTEGRATED WATERSHED MANAGEMENT

Watershed Management Concerns - Watershed Management Strategies - Problems Associated with watersheds and possible solutions

UNIT II **7 Hours**

WATERSHED MANAGEMENT MEASURES

Solutions associated with watershed Management - A simple GIS model to compute Run Off from a watershed - A Case Study of Watershed development and Management

Total: 15 Hours

15CE0XU HEALTHY CONSTRUCTION PRACTICE AND ETHICS

1 0 0 1

Course Objectives
- To impart knowledge on healthy construction practices
- To explore the trends in construction project management systems

Programme Outcomes (POs)
a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Course Outcomes (COs)
1. Analyse the Construction Sequence of a building and its Materials
2. Identify the physical and mechanical properties of construction materials
3. Explain the Precast Construction Practices
4. Formulate the recent trends in Project management practice
5. Illustrate the methodologies on Precast and Prefab construction Practices

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P
1	2	1									
2	3	1		1							
3	3	1		2							
4	2	1		1							
5	3	1		2							

UNIT I **3 Hours**

CONSTRUCTION SEQUENCE OF A BUILDING AND MATERIALS
Introduction to Healthy Construction Practices - Construction Sequence - Estimation of Materials - Cement - Gradation of Aggregates - Sieve Analysis - Important properties of Aggregates - Typical limits for solids in water - Limits of Chloride content of Concrete - Durability Criteria as per IS 456- 2000 - Materials testing codes.

UNIT II **3 Hours**

STAGES OF CONSTRUCTION OF A BUILDING
Formwork - Cover Blocks for Durability - Water - Segregation & Bleeding - Placing of Concrete - Pumping of Concrete - Compaction - Curing - Strength and Curing - Brickwork - Mortar and Plaster - Factors affecting mortar properties - Surface Preparation - Surface - Monolithic concrete - Surface - Brickwork - Mix proportions for Plaster- Batching and Mixing - Common Defects in Plaster - Structural cracks- Spalling.

UNIT III **3 Hours**

PRECAST CONSTRUCTION PRACTICES
Comparison: Site-cast - Precast at plant - Types of pre cast system - Equipments Advantages - Limitations - Management System - Functions - Policies and procedures Material storage and protection - Controlling small tools and supplies - Material handling and fabrication - The - secrets - of efficient prefabrication- Subcontractor management - Issuing a subcontract

- Analyzing bids and issuing subcontracts - Safety & Health Management - Hazards - Rules in construction area under safety outline: Project start-up and closed-out.

UNIT IV **3 Hours**

PROJECT INTEGRATION MANAGEMENT PRACTICES

Recent Trend in Project Management Practice - Changing the Process- Communications Management - Communications Management Plan - Using Only Hard Skills - Application of Soft Skills - Why people work - Intrinsic vs. Extrinsic Motivation - Project Success Factor - onsite communication management- Communication Techniques - Communication Summary

UNIT V **3 Hours**

INNOVATIVE PRECAST / PREFAB CONSTRUCTION PRACTICES

Meeting Challenges through Innovative Technology - Introduction of the House System - Installation of High Frequency Pre-Fabricated Steel structure with Simple hand tools - MgO Water & Fire Proof Floor Boards - External Mounting Of MgO Walls Sandwich Wall Panel On Steel Structure Columns & Beams - MgO Board For Internal & External Ceiling System - Low Cost Housing Construction - Steel Structure Building System Installation - An Overview OF MgO Wall & Floor Board & Panel Application - Chemical Compositions - MgO Board uses & Applications- conclusion.

Total: 15 Hours

Reference(s)

1. Steven Bliss ,Best Practices Guide to Residential Construction: Materials, Finishes, and Details, 1st Edition

15CE0XW BEHAVIOUR OF SHEAR WALL IN MULTISTOREY BUILDING 1001

Course Objectives

- Analyze and design reinforced concrete structural members under bending, shear and axial loads according to the ACI and IS code requirements

Programme Outcomes (POs)

a. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

e. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

Course Outcomes (COs)

1. Analysis and design process of shear wall construction
2. Utilize advanced computer software packages (SAP2000 and/or ETABS) for the analysis and design of steel structures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	3		3									
2	3				2							

UNIT I **15 Hours**

INTRODUCTION

Define Shear Wall Building - Advantages of Shear Walls in RC Buildings-Architectural Aspects of Shear Walls - placement of shear wall - Shear walls in RC Buildings - Different geometries of buildings - Detailing of main reinforcement in shear walls as per IS:13920-1993 - Reinforcement Bars in RC Walls - Codes for design of shear wall - design considerations - shear strength walls - flexural strength - Boundary elements - Seismic Behavior of wall - Case study on Behavior of shear walls under high axial load ratio - Testing Methodology .

Total: 15 Hours

Reference(s)

1. Mohiuddin Ali Khan "Earthquake-Resistant Structures: Design, Build and Retrofit",Elsevier, Science & Technology, 2012
2. PankajAgarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India, 2009.
3. Paulay,T and Priestley, M.J.N., "Seismic Design of Reinforced Concrete and Masonry buildings", John Wiley and Sons, 1992.
4. S K Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, 2007