B.E. (Civil Engineering)
Revised 2018 Regulations, Curriculum & Syllabi
(Candidates admitted during Academic Year 2021-2022)

BANNARI AMMAN INSTITUTE OF TECHNOLOGY
(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE - Accredited by NAAC with 'A' Grade)
SATHYAMANGALAM – 638 401 Erode District Tamil Nadu
Phone : 04295 226000 Fax : 04295 226666
Web:www.bitsathy.ac.in E-mail : stayahead@bitsathy.ac.in

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BANNARI AMMAN INSTITUTE OF TECHNOLOGY, SATHYAMANGALAM

REVISED REGULATIONS 2018

(CHOICE BASED CREDIT SYSTEM)

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

Regulation 2018 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 2018 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 2018-2019 for Regular admission (Academic year 2019-2020 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 Regular Admission

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

- 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 thereto.

(or)

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

1.2 Lateral Entry Admission

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 to time.

(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. is eligible 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. Agriculture Engineering
iii. Automobile Engineering
iv. Biomedical Engineering
v. Civil Engineering
vi. Computer Science and Engineering
vii. Electronics and Communication Engineering
viii. Electrical and Electronics Engineering
ix. Electronics and Instrumentation Engineering
x. Information Science and Engineering
xi. Mechanical Engineering
xii. Mechatronics

B. Tech. Programmes

i. Artificial Intelligence and Data Science
ii. Artificial Intelligence and Machine Learning
iii. Biotechnology
iv. Computer Science and Business Systems
v. Computer Technology

vi. Fashion Technology
vii. Food Technology
viii. Information Technology
ix. Textile Technology

3. STRUCTURE OF THE PROGRAMME

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

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

(ii) **Basic Engineering** courses including Engineering Graphics, Engineering Practices, Basics of Electrical, Electronics, Civil, Mechanical Engineering, Engineering Mechanics and Computer Programming.

(iii) **Humanities and Social Science** courses including Language Courses, Management Courses, Soft Skills and Professional Ethics.

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

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

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 based on the following

Contact period per week	Credits
1 Lecture / 1 Tutorial period	1
2 laboratory Periods (Laboratory / Seminar / Project Work / etc.)	1

3.3 All the B.E. / B.Tech. Students will study Communicative English I during the First Semester. In the Second Semester, they will be divided into two streams based on their English language proficiency assessed in the Continuous Assessment during

semester I, in which the upper segment will be provided an option to enroll and study Communicative English II / German / Japanese / French / Chinese / Hindi while the lower segment will study Communicative English II.

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) from his / her own discipline courses, during V to VII Semesters, if he/she satisfies the prerequisite for that particular course.

3.5 However, out of nine electives, every student shall be required to opt for, a minimum of one and subject to a maximum of three courses as open elective from the list of electives of the branch / branches other than his / her branch of specialisation, if he/she satisfies the prerequisite for that particular course.

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 VI 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 for the same batch of the students and a maximum batch size for a given course shall not exceed 40. In case of disciplines with multiple divisions (intake more than 60) different course(s) shall be offered to other batch(es) of students.

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 anyone of the Electives (other than open elective) of the Semester VII, he / she can do so by exercising his / her option in writing to the respective Head of the Department during the beginning of the VII Semester, following the equivalence norm, that one **regular elective** (in the **VII Semester**) is equivalent to **three one-credit courses** completed by the student during the previous semesters, III to VI. 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 II semesters shall be maintained in the Grade sheet as "Additional credits earned" (notconsidered for the computation of SGPA/CGPA).

3.7 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 the CGPA.

3.8 A Student may be permitted to credit only one online course with the approval of the Departmental Consultative Committee constituted by the Head of the Department, subject to a maximum of three credits. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by the CoE. A student can get exemption for a maximum of 3 credits during the entire programme (in lieu of Core elective or Open elective). The Head of the Department may identify a faculty member as coordinator for the course, who is responsible for the evaluation process. The course shall be evaluated through the End Semester Examination only. The evaluation methodology may be decided by the course faculty coordinator.

3.9 Industrial Training / Internship

The students may undergo Industrial training / Internship optionally for a period as specified in the table during summer / winter vacation and the credits earned will beindicated in the Mark Sheet. If the student earns three credits in Industrial Training / Internship, the student may drop one Professional Elective. In such cases, Industrial Training / Internship need to be undergone continuously from one organization only. However, if the number of credits earned is 1 or 2, these credits shall not be considered for classification of the degree. The students may also undergo Internship at Research organization / University (after due approval from the Department Consultative Committee) during summer / winter vacation, in lieu of Industrial training.

Duration of Training / Internship	Credits
2 Weeks	1
4 Weeks	2
6 Weeks	3

3.10 Socially Relevant Projects

A Student may be permitted to carry out a socially relevant project during semester II to semester VI in consultation with the Faculty Guide and submit the project report, in the prescribed format, at the end of the Semester for the valuation.

On successful completion of socially relevant project work, one credit will beindicated in the grade sheet (Additional credits), but these credits will not beconsidered for computing the CGPA.

4. VALUE ADDED COURSES

A Student can opt for the Value Added Courses offered by the various Department / Centres 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 THE PROGRAMME

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. Head of the Department shall ensure that every faculty member teaches the subject / course as prescribed in the approved curriculum and syllabi.

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 entry stream).**

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 case, if a student fails to register in 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 is offered.

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 Faculty Advisor.

6.4 Flexibility to Add or Drop courses

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 to earn more than the total number of credits prescribed in the curriculum by opting for one- credit courses, self study electives or additional courses.

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. The total number of credits that a student can add or drop is limited to 8, subject to a maximum of 2 courses in a given Semester. In such cases, the attendance requirement as stated in Clause 7 is mandatory.

6.4.3 The student shall register Project work I in semester VII and Project work II in semester VIII only.

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 offered next.

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 such courses.

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

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 only once.

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 Semester Examination.

6.5.6 The student who fails in any continuous assessment courses (Laboratory/ Project work / Seminar or any other HSS/EEC courses) shall register for the same in the 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 Clause 6.5.5.

6.5.8 If a student fails to secure a pass in any theory courses (including elective) he/she is given a maximum of three arrear attempts to complete the courses. If the student still fails to secure a pass, he/she shall register for the same when offered next and repeat the course.

7. REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF A COURSE

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 the curriculum.

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 prescribed fee.

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 Clause 6.5).

7.5 If a student has shortage of attendance in all the registered courses, he/she would not be permitted to move to the higher semester and has to repeat the current semester in the subsequent year.

7.6 In the case of reappearance (Arrear) registration for a course, the attendance requirement as mentioned in Clauses 7.1 - 7.3 is not applicable. However, the student has to register for examination in that course by paying the prescribed fee.

7.7 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 of grades.

8. FACULTY ADVISOR

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. The Faculty Advisor also discusses with or informs the parents about the progress / performance of the students concerned.

The responsibilities of the faculty advisor shall be:

- To inform the students about the various facilities and activities available to enhance the student's curricular and co-curricular activities.
- To guide student enrollment and registration of the courses.
- To authorize the final registration of the courses at the beginning of each semester.
- To monitor the academic and general performance of the students including attendance and to counsel them accordingly.

9. COMMITTEES

9.1 Common Course Committee

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 Semester Examinations.

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 other students.

10. SYSTEM OF EXAMINATION

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 17. However, the final examination in the case of 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 laboratory including project work, shall be evaluated as per the Scheme of Assessment given in Clause 17.

10.3 The End Semester Examinations shall normally be conducted after satisfying the Clause 5.2.

10.4 For the End Semester examinations, both theory and 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 cum Evaluation committee of the Institute.

11. PASSING REQUIREMENTS AND PROVISIONS

11.1 The Passing requirement for a student in a course is determined based on the marks obtained both in Continuous Assessment and End Semester Examinations. A student who secures not less than 50% of total marks prescribed for the course [Continuous Assessment + End semester University Examinations] with a minimum of 45% of the marks prescribed for the end-semester University Examination, shall be declared to have passed the course and acquired the relevant number of credits.

11.1.1 If a student fails to secure a pass in a particular course, i.e., failing toobtain minimum marks, as stated above, it is mandatory that he/she shall 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'.

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 5 Grade Points (C Grade) in the course prescribed during the End Semester Examinations.

11.2 If a candidate fails in the seventh semester examinations of Project work I, he/she has to resubmit the Project Report within 30 days from the date of declaration of the results. If he / she fails in the End semester examination of Project work II, he/she shall resubmit the Project Report within 60 days from the date of declaration of the results. The resubmission of the project report and the subsequent viva-voce examination will be considered as reappearance with payment of exam fee. In case a student fails in the resubmission of a project report

and subsequent viva-voce examination, the student shall register for the course again, when offered next.

11.3 The passing requirement for the courses which are assessed only through continuous assessment (Laboratory and EEC courses except project work), shall be fixed as minimum 50% and the remaining grades are decided as per clause 12.4. If a candidate fails in EEC courses (Except Project work), he/she has to register and repeat the course within 30 days from the date of declaration of the results. In case a student fails to register within 30 days, he/she shall register for the course again, when offered next.

11.4 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	163	126
Agriculture Engineering	163	125
Automobile Engineering	161	124
Biomedical Engineering	163	124
Civil Engineering	163	125
Computer Science and Engineering	163	125
Electronics and Communication Engineering	163	122
Electrical and Electronics Engineering	162	123
Electronics and Instrumentation Engineering	161	122
Information Science and Engineering	163	122
Mechanical Engineering	161	122
Mechatronics	162	124
B.Tech. Programmes		
Artificial Intelligence and Data Science	161	123
Artificial Intelligence and Machine Learning	163	126
Biotechnology	163	125
Computer Science and Business Systems	163	119
Computer Technology	161	119
Fashion Technology	163	125
Food Technology	161	123

Information Technology	161	123
Textile Technology	162	124

11.5 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 Autonomous institutions to Bannari Amman Institution of Technology or rejoins from previous regulation to this regulation.

11.6 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 Clause 5.1.

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 17. Letter Grades (based on Credit Point and Grade Point) are awarded to the students based on the performance in the evaluation process.

12.2 Credit Point is the product of Grade Point and number of 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 12.4), while the Letter Grade is an index of the performance of a student in a said course.

12.3 Condition for Relative Grading

The minimum number of students for applying relative grading system is 30. If the students' strength is less than 30 then absolute grading system shall be followed with the grade range as specified below. The relative grading system shall not be applied for laboratory and continuous assessment courses.

O	A+	A	B+	B	C	U
91 - 100	81 - 90	71 - 80	61 - 70	56 - 60	50 - 55	< 50

12.4 The performance of a student will be reported using Letter Grades, each carrying certain points as detailed below: A student who earns a minimum of 5 grade points in a course is declared to have successfully passed the course.

Letter Grade	**Grade Points**
O (Outstanding)	10
A + (Excellent)	9
A (Very Good)	8
B + (Good)	7
B (Average)	6
C (Satisfactory)	5
U (Reappearance)	0
W (Withdrawal)	0
AB (Absent)	0
SA (Shortage of Attendance)	0

'U' ---Reappearance is required for that particular course

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

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

$$SGPA/CGPA = \frac{\sum_{1}^{n} C_i * g_i}{\sum_{1}^{n} C_i}$$

Where

C_i : Credit allotted to the course.

g_i : Grade Point secured corresponding to the course.

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

12.6 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 and 15).

12.7 For the non credit courses grades shall be indicated as given in the Clause 17 and shall not be counted for the computation of SGPA/CGPA.

For the Co-curricular activities such as NCC / NSS / NSO / YRC, a satisfactory / not satisfactory grading will appear in the mark sheet. Every student shall put in a minimum of 75% attendance in the training and attend the camp compulsorily. The training and camp shall be completed during the first year of the programme.However, for valid reasons, the Head of the Institution may permit a student to complete this requirement in the second year. A satisfactory grade in the above co- curricular activities is compulsory for the award of degree.

12.8 **Revaluation:** A student, who seeks the re-valuation of the answer script, is directed to apply through proper application to the Controller of Examinations in the prescribed format through the Head of the Department. 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 stated above.

12.9 Eligibility for the Award of Degree

A student shall be declared to be eligible for the award of the B.E. / B.Tech. Degree provided the student has

i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.

ii. Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the courses prescribed in all the 8 semesters within a maximum period of 7 years reckoned from the commencement of the first semester to which the candidate was admitted.

iii. Successfully completed the NCC / NSS / NSO / YRC / Extra-curricular/ Co-curricular requirements.

iv. No disciplinary action is pending against the student.

v. The award of Degree must have been approved by the Syndicate of the University.

12.10 Conduct of Special Examination

The special or make-up exams may be conducted for the students who missed the regular examination due to participation / representing the institute in various activities and the schedule may be included in the academic calendar. The special or make-up exams may be conducted after the completion of end-semester examinations and prior to starting of the next semester.

13. CLASSIFICATION OF THE DEGREE AWARDED

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 given below.

13.1 **First Class with Distinction**: A student who satisfies the following conditions shall be declared to have passed the examination in **First class with Distinction**:

- Should have passed the examination in all the courses of all the eight semesters (six semesters for lateral entry students) in the student's First Appearance within five years, which includes authorized break of study of one year. Withdrawal from examination (vide Clause 15) will not be considered as an appearance.
- Should have secured a CGPA of **not less than 8.50**
- Should **NOT** have been prevented from writing end semester examination due to lack of attendance in any of the courses.

13.2 **First Class**: A student who satisfies the following conditions shall be declared to have passed the examination in **First class**:

- Should have passed the examination in all the courses of all eight semesters (six semesters for lateral entry students) within five years, which includes one year of authorized break of study (if availed) or prevention from writing the End Semester Examination due to lack of attendance (if applicable).

- Should have secured a CGPA of **not less than 6.50**

13.3 Second Class: All other students (not covered in clauses 13.1 and 13.2) who qualify for the award of the degree shall be declared to have passed the examination in **Second Class.**

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 it is made within TEN working days before the commencement of the end semester examination in that course or courses and also recommended by the Head of the Department.

14.3 Notwithstanding the requirement of mandatory TEN working days' notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

14.4 If a student withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examination(s).

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

14.6 Withdrawal is permitted for the end semester examinations in the final semester, only if the period of study of the student concerned does not exceed 5 years as per clause 13.1 & 13.2.

15. AUTHORIZED BREAK OF STUDY FROM A PROGRAMME

15.1 A student is permitted to go on break of study for a fixed period of one year as a single break in the entire course of study.

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 / prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new Regulations shall apply to the Dean Academics in the prescribed format through the Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

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 Clause 13).

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 Clause 13).

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 in addition to the earlier authorized break of study.

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 any circumstances.

16. IMPLEMENTATION OF MINOR DEGREE/ HONOURS

The following guidelines shall be implemented for the B.E. / B. Tech. students who have been admitted from the academic year 2021-2022.

16.1 B.E. / B.Tech. Honours (specialization in the same discipline):

- The student should have earned additionally a minimum of 18 credits from a vertical of the same programme.
- Should have passed all the courses in the first attempt.
- Should have earned a minimum CGPA of 7.50.

16.2 B.E. / B.Tech. Honours

- The students should have earned additionally a minimum of 18 credits from more than one vertical of the same programme.
- Should have passed all the courses in the first attempt.
- Should have earned a minimum CGPA of 7.50.

16.3 B.E. / B.Tech. (minor in other specialisation)

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E/B.Tech. programmes or from any one of the following verticals

Vertical I: Fintech and Block Chain
Vertical II: Entrepreneurship Vertical
III: Public Administration Vertical IV:
Business Data Analytics
Vertical V: Environment and Sustainability

16.4 Students can earn maximum of 6 credits in online mode (SWAYAM platform), out of these 18 credits with the approval of the Departmental Consultative Committee constituted by the Head of the Department.

16.5 B.E./ B. Tech. (Hons) Specialization in the same discipline, B.E. / B.Tech. Honors and B.E. / B.Tech. Minor in other specialization degrees will be optional for students.

16.6 For categories 16.1 and 16.2, the students will be permitted to register for the courses from V Semester onwards provided the marks earned by the students until III semester should be of CGPA 7.50 and above and cleared all the courses in the first attempt.

16.7 For category 16.3, the students will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.

16.8 If a student decides not to opt for Honours, after completing a certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the grade sheet, however, they will not be considered for the calculation of CGPA.

16.9 If a student decides not to opt for Minor degree, after completing a certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the grade sheet, however, they will not be considered for calculation of CGPA.

16.10 Classification of the Degree Awarded

The conditions for First Class with Distinction, First Class, and Second Class are same as Clause except the following classification.

First Class: A student who satisfies the following conditions shall be declaredto have passed the examination in First class for the purpose of the 'Award of Degree', of B.E. / B.Tech. Honors (specialization in the same discipline) and
B.E. / B.Tech. Honors

- Should have secured a CGPA of not less than 7.50.

17. SCHEME OF ASSESSMENT

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

I	**THEORY COURSES**	**Marks**
	Continuous Assessment	**40**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (12)	
	Periodical Test II (12)	
	Innovative Practices (16)	
	End Semester Examination	**60**
	Total Marks	**100**

II	**THEORY COURSES WITH LAB COMPONENT**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (15)	
	Periodical Test II (15)	
	Innovative Practices (20)	
	(Laboratory Assessment & Report)	
	End Semester Examination (QP pattern as per (I))	**50**
	Total Marks	**100**

III	**LABORATORY COURSES**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Conduct of Experiment	
	i. Preparation (20)	
	ii. Experiment and Analysis of Results (20)	
	iii. Record (10)	
	Test – Cycle I (25)	
	Test – Cycle II (25)	
	Total Marks	**100**

IV	**PROJECT WORK I**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Literature Survey (5)	
	Identification of topic and Justification (5)	
	Work plan (10)	
	Review II	
	Approach & Results (15)	
	Conclusion (15)	

	End Semester Examination	
	Report[#] (20) *Presentation (20)* *Viva voce (10)*	**50**
	Total Marks	**100**
V	**PROJECT WORK II**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I *Progress (10)*	
	Review II *Approach & Results (10)*	
	Review III *Conclusion & Final Presentation (10)* *Report (15)* *Publication of Paper in Conferences / Journals (5)*	
	End Semester Examination	
	Presentation (30) *Viva voce (20)*	**50**
	Total Marks	**100**
VI	**LANGUAGE ELECTIVE (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test 1 *Listening (5)* *Speaking (10)* *Reading (5)* *Writing (5)*	**25**
	Test 2 *Listening (5)* *Speaking (10)* *Reading (5)* *Writing (5)*	**25**
	Oral Exam	**50**
	Total Marks	**100**
VII	**ONE-CREDIT COURSE (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**50**
	Quiz/ Assignment	**50**
	Total Marks	**100**

[#] *Reports / Record Note / Integrated Lab Manual to be retained for 1 year for Academic Audit, by respective Department*

VIII	**INDUSTRIAL TRAINING/ INTERNSHIP (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Assessment by Industry	**30**
	Viva-voce	**20**
	Presentation	**30**
	Case Study / Report	**20**
	Total Marks	**100**
IX	**SOFT SKILLS (CONTINUOUS ASSESSMENT ONLY)**	**Marks**
	Test I	**25**
	Test II	**25**
	Final Examination	**50**
	Total Marks	**100**
	Grades (Excellent / Good / 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)	
XI	**ENGINEERING GRAPHICS**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Exercise (Minimum 10 Exercises/Modelling)	**60**
	Model Examination	**40**
	Total Marks	**100**

Optional Test: *A student becomes eligible to appear for an 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), 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.*

18. FIELD / INDUSTRIAL VISIT / INTERNSHIP

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

19. 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. 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.

20. 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 stated thereof.

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.

21. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

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.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

I. Achieve successful career in Civil Engineering and related fields such as entrepreneurship, consultancy, government service and academia and engage in lifelong learning for professional growth.

II. Exhibit high level of technical expertise with good communication skills and team work to pursue higher study or research career in institutes of repute.

III. Demonstrate core competency in using modern tools and techniques with a good understanding of social, environmental and ethical issues for solving real-time problems in Civil Engineering.

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 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 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.

PROGRAMME SPECIFIC OBJECTIVES (PSOs)

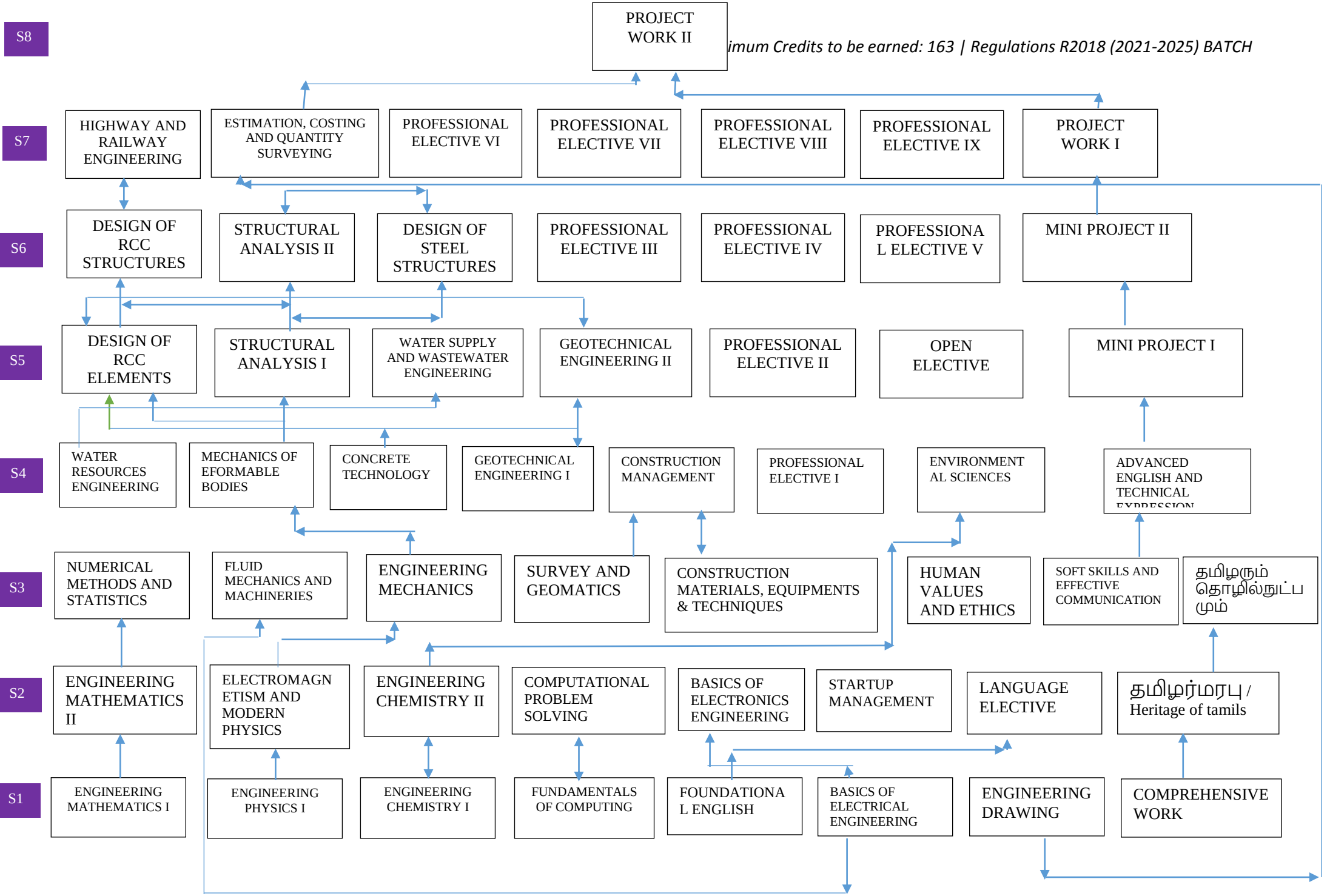
m) Apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.

n) Design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals

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

imum Credits to be earned: 163 | Regulations R2018 (2021-2025) BATCH



DEPARTMENT OF CIVIL ENGINEERING
R2018 (Revised) for the batch 2021- 2025
Minimum Credits to be earned: 163

I SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CA	ES	Total	
18CE101	ENGINEERING MATHEMATICS I	3	1	0	4	4	40	60	100	BS
18CE102	ENGINEERING PHYSICS I	2	0	2	3	4	50	50	100	BS
18CE103	ENGINEERING CHEMISTRY I	2	0	2	3	4	50	50	100	BS
18CE104	BASICS OF ELECTRICAL ENGINEERING	2	0	2	3	4	50	50	100	ES
18HS101	COMMUNICATIVE ENGLISH I	1	0	2	2	3	100	0	100	HSS
18CE105	ENGINEERING DRAWING	1	0	4	3	5	100	0	100	ES
Total		**11**	**1**	**12**	**18**	**24**				**-**

II SEMESTER

Code No.	Course	L	T	P	C	Hours /Week	Maximum Marks			Category
							CA	ES	Total	
18CE201	ENGINEERING MATHEMATICS II	3	1	0	4	4	40	60	100	BS
18CE202	ENGINEERING PHYSICS II	2	0	2	3	4	50	50	100	BS
18CE203	ENGINEERING CHEMISTRY II	2	0	2	3	4	50	50	100	BS
18CE204	ENGINEERING MECHANICS	3	0	0	3	3	50	50	100	ES
18CE205	FUNDAMENTALS OF CIVIL ENGINEERING	2	0	2	3	4	50	50	100	BS
	LANGUAGE ELECTIVES	1	0	2	2	3	100	0	100	HSS
18CE206	ENGINEERING PRACTICES LABORATORY	0	0	4	2	4	100	0	100	ES
Total		**13**	**1**	**12**	**20**	**26**				**-**

III SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18CE301	ENGINEERING MATHEMATICS III	3	1	0	4	4	40	60	100	BS
18CE302	MECHANICS OF DEFORMABLE BODIES	3	1	0	4	4	40	60	100	ES
18CE303	APPLIED GEOLOGY	3	0	0	3	3	40	60	100	ES
18CE304	SURVEY AND GEOMATICS	3	0	0	3	3	40	60	100	PC
18CE305	FLUID MECHANICS AND MACHINERIES	3	0	2	4	5	50	50	100	PC
18CE306	COMPUTER PROGRAMMING	2	0	2	3	4	50	50	100	ES
18CE307	COMPUTER AIDED BUILDING DRAWING LABORATORY	0	0	4	2	4	100	0	100	PC
18CE308	SURVEY LABORATORY	0	0	4	2	4	100	0	100	PC
18GE301	SOFT SKILLS - VERBAL ABILITY	0	0	2	-	2	100	0	100	EEC
Total		**17**	**2**	**14**	**25**	**33**				-

IV SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
18CE401	CONCRETE TECHNOLOGY	3	0	0	3	3	40	60	100	ES
18CE402	DESIGN OF RCC ELEMENTS	3	0	0	3	3	40	60	100	PC
18CE403	STRUCTURAL ANALYSIS I	3	1	0	4	4	40	60	100	PC
18CE404	SOIL MECHANICS	3	0	0	3	3	40	60	100	PC
18CE405	WATER RESOURCES ENGINEERING	3	0	0	3	3	40	60	100	ES
18CE406	CONSTRUCTION TECHNIQUES AND EQUIPMENTS	3	0	0	3	3	40	60	100	PC
18CE407	STRENGTH OF MATERIALS LABORATORY	0	0	4	2	4	100	0	100	PC
18CE408	GEOTECHNICAL ENGINEERING LABORATORY	0	0	4	2	4	100	0	100	PC
18HS001	ENVIRONMENTAL SCIENCE	2	0	0	-	2	100	0	100	HSS
18GE401	SOFT SKILLS – BUSINESS ENGLISH	0	0	2	-	2	100	0	100	EEC
Total		**20**	**1**	**10**	**23**	**31**				**-**

V SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CE501	STRUCTURAL ANALYSIS II	3	1	0	4	4	40	60	100	PC
21CE502	DESIGN OF RCC STRUCTURES	3	0	0	3	3	40	60	100	PC
21CE503	FOUNDATION ENGINEERING	3	0	0	3	3	40	60	100	PC
21CE504	IRRIGATION ENGINEERING	3	0	2	4	5	50	50	100	PC
	PROFESSIONAL ELECTIVE I	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE II	3	0	0	3	3	40	60	100	PE
21CE507	CONCRETE AND STRUCTURAL ANALYSIS LABORATORY	0	0	4	2	4	100	0	100	PC
21CE508	COMPUTER AIDED DESIGN AND DRAWING LABORATORY	0	0	4	2	4	100	0	100	PC
21GE501	SOFT SKILLS - APTITUDE I	0	0	2	-	2	100	0	100	EEC
Total		**18**	**1**	**12**	**24**	**31**				**-**

VI SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21HS002	HUMAN VALUES AND ETHICS	2	0	0	2	2	40	60	100	HSS
21CE602	DESIGN OF STEEL STRUCTURES	3	0	0	3	3	40	60	100	PC
21CE603	WATER SUPPLY AND WASTEWATER ENGINEERING	3	0	0	3	3	40	60	100	PC
	PROFESSIONAL ELECTIVE III	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE IV	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE V	3	0	0	3	3	40	60	100	PE
21CE607	COMPUTER AIDED PLANNING AND MANAGEMENT LABORATORY	0	0	4	2	4	100	0	100	PC
21CE608	ENVIRONMENTAL ENGINEERING LABORATORY	0	0	4	2	4	100	0	100	PC
21GE601	SOFT SKILLS - APTITUDE II	0	0	2	-	2	100	0	100	EEC
Total		**17**	**0**	**10**	**21**	**27**	**600**	**300**	**900**	

VII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CE701	ESTIMATION, COSTING AND QUANTITY SURVEYING	3	0	0	3	3	40	60	100	PC
21CE702	HIGHWAY AND RAILWAY ENGINEERING	3	0	0	3	3	40	60	100	PC
	PROFESSIONAL ELECTIVE VI	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE VII	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE VIII	3	0	0	3	3	40	60	100	PE
	PROFESSIONAL ELECTIVE IX	3	0	0	3	3	40	60	100	PE
21CE707	TRANSPORTATION ENGINEERINGLABORATORY	0	0	4	2	4	100	0	100	PC
21CE708	PROJECT WORK I	0	0	6	3	6	50	50	100	EEC
Total		**18**	**0**	**10**	**23**	**28**				**-**

VIII SEMESTER										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours /Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CE801	PROJECT WORK II	0	0	18	9	18	50	50	100	EEC
Total		**0**	**0**	**18**	**9**	**18**				**-**

ELECTIVES

LANGUAGE ELECTIVES

Code No.	Course	L	T	P	C	Hours/Week	Maximum Marks			Category
							CA	ES	Total	
18HS201	COMMUNICATIVE ENGLISH II	1	0	2	2	3	100	0	100	HS
18HSH01	HINDI	1	0	2	2	3	100	0	100	HSS
18HSG01	GERMAN	1	0	2	2	3	100	0	100	HSS
18HSJ01	JAPANESE	1	0	2	2	3	100	0	100	HSS
18HSC01	CHINESE	1	0	2	2	3	100	0	100	HSS
18HSF01	FRENCH	1	0	2	2	3	100	0	100	HSS
PHYSICS ELECTIVES										
18GE0P1	NANO MATERIALS SCIENCE	3	0	0	3	3	50	50	100	BS
18GE0P2	SEMI CONDUCTOR PHYSICS AND DEVICES	3	0	0	3	3	50	50	100	BS
18GE0P3	APPLIED LASER SCIENCE	3	0	0	3	3	50	50	100	BS
CHEMISTRY ELECTIVES										
18GE0C1	CORROSION SCIENCE AND ENGINEERING	3	0	0	3	3	50	50	100	BS
18GE0C2	ENERGY STORING DEVICES	3	0	0	3	3	50	50	100	BS
18GE0C3	POLYMER SCIENCE	3	0	0	3	3	50	50	100	BS
MATHEMATICS ELECTIVES										
18GE0M1	GRAPHTHEORY AND COMBINATORICS	3	0	0	3	3	50	50	100	BS
18GE0M2	ALGEBRA AND NUMBER THEORY	3	0	0	3	3	50	50	100	BS
18GE0M3	MATHEMATICAL FINANCE AND QUEUEING THEORY	3	0	0	3	3	50	50	100	BS
ENTREPRENEURSHIP ELECTIVES										
18GE0E1	ENTREPRENEURSHIP DEVELOPMENT I	3	0	0	3	3	50	50	100	PE
18GE0E2	ENTREPRENEURSHIP DEVELOPMENT II	3	0	0	3	3	50	50	100	PE

ELECTIVES										
VERTICAL I- MODERN STRUCTURES										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CE001	REPAIR AND REHABILITATION OF STRUCTURES	3	0	0	3	3	40	60	100	PE
21CE002	PRESTRESSED CONCRETE STRUCTURES	3	0	0	3	3	40	60	100	PE
21CE003	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE004	BRIDGE ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE005	TALL STRUCTURES	3	0	0	3	3	40	60	100	PE
21CE006	STRUCTURAL HEALTH MONITORING	3	0	0	3	3	40	60	100	PE
VERTICAL II- ADVANCED DESIGN										
21CE007	DESIGN OF TIMBER AND MASONRY ELEMENTS	3	0	0	3	3	40	60	100	PE
21CE008	ADVANCED RC DESIGN	3	0	0	3	3	40	60	100	PE
21CE009	ADVANCED STEEL DESIGN	3	0	0	3	3	40	60	100	PE
21CE010	INDUSTRIAL STRUCTURES	3	0	0	3	3	40	60	100	PE
21CE011	FINITE ELEMENT ANALYSIS	3	0	0	3	3	40	60	100	PE
21CE012	STEEL CONCRETE COMPOSITE STRUCTURES	3	0	0	3	3	40	60	100	PE
VERTICAL III- CONSTRUCTION TECHNIQUES AND PRACTICES										
21CE013	BUILDING SERVICES	3	0	0	3	3	40	60	100	PE
21CE014	CONCEPTUAL PLANNING AND BYE LAWS	3	0	0	3	3	40	60	100	PE
21CE015	COST EFFECTIVE CONSTRUCTION AND GREEN BUILDING	3	0	0	3	3	40	60	100	PE
21CE016	PREFABRICATED STRUCTURES AND PRE-ENGINEERED BUILDING	3	0	0	3	3	40	60	100	PE
21CE017	ENERGY EFFICIENT BUILDINGS	3	0	0	3	3	40	60	100	PE
21CE018	CONSTRUCTION MANAGEMENT AND SAFETY	3	0	0	3	3	40	60	100	PE
VERTICAL IV- GEOTECHNICAL APPLICATIONS										
21CE019	GROUND IMPROVEMENT TECHNIQUES	3	0	0	3	3	40	60	100	PE
21CE020	GEOENVIRONMENTAL ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE021	INTRODUCTION TO GEOTECHNICAL EARTHQUAKE	3	0	0	3	3	40	60	100	PE

	ENGINEERING									
21CE022	REINFORCED SOIL STRUCTURES	3	0	0	3	3	40	60	100	PE
21CE023	ROCK MECHANICS AND APPLICATIONS	3	0	0	3	3	40	60	100	PE
21CE024	EARTH RETAINING STRUCTURES	3	0	0	3	3	40	60	100	PE
VERTICAL V- TRANSPORTATION AND GEO-INFORMATICS										
21CE025	URBAN TRANSPORTATION PLANNING AND SYSTEMS	3	0	0	3	3	40	60	100	PE
21CE026	MASS TRANSPORTATION SYSTEMS	3	0	0	3	3	40	60	100	PE
21CE027	TRAFFIC ENGINEERING AND MANAGEMENT	3	0	0	3	3	40	60	100	PE
21CE028	TRANSPORTATION PLANNING AND SYSTEMS	3	0	0	3	3	40	60	100	PE
21CE029	TOTAL STATION AND GPS SURVEYING	3	0	0	3	3	40	60	100	PE
21CE030	REMOTE SENSING AND GIS	3	0	0	3	3	40	60	100	PE
VERTICAL VI- ENVIRONMENTAL ASPECTS										
21CE031	AIR POLLUTION CONTROL AND MANAGEMENT	3	0	0	3	3	40	60	100	PE
21CE032	SOLID WASTE MANAGEMENT	3	0	0	3	3	40	60	100	PE
21CE033	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3	3	40	60	100	PE
21CE034	ENERGY SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE035	INDUSTRIAL WASTE MANAGEMENT	3	0	0	3	3	40	60	100	PE
21CE036	HAZARDOUS WASTE MANAGEMENT	3	0	0	3	3	40	60	100	PE
VERTICAL VII- COMPUTER APPLICATION										
21CE037	APPLICATIONS OF NUMERICAL METHODS IN CIVIL ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE038	APPLICATION OF PYTHON FOR CIVIL ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE039	INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE040	APPLICATION OF MATLAB FOR CIVIL ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE041	APPLICATION OF R PROGRAMMING IN CIVIL ENGINEERING	3	0	0	3	3	40	60	100	PE
21CE042	RISK ASSESSMENT AND SAFETY MANAGEMENT	3	0	0	3	3	40	60	100	PE

MINOR DEGREE										
VERTICAL VI- ENVIRONMENTAL ASPECTS										
Code No.	**Course**	**L**	**T**	**P**	**C**	**Hours/Week**	**Maximum Marks**			**Category**
							CA	**ES**	**Total**	
21CEM01	AIR POLLUTION CONTROL AND MANAGEMENT	3	0	0	3	3	40	60	100	
21CEM02	SOLID WASTE MANAGEMENT	3	0	0	3	3	40	60	100	
21CEM03	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3	3	40	60	100	
21CEM04	ENERGY SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	
21CEM05	INDUSTRIAL WASTE MANAGEMENT	3	0	0	3	3	40	60	100	
21CEM06	HAZARDOUS WASTE MANAGEMENT	3	0	0	3	3	40	60	100	
Honours Degree										
VERTICAL VI- ENVIRONMENTAL ASPECTS										
21CEH01	AIR POLLUTION CONTROL AND MANAGEMENT	3	0	0	3	3	40	60	100	
21CEHO2	SOLID WASTE MANAGEMENT	3	0	0	3	3	40	60	100	
21CEH03	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3	3	40	60	100	
21CEH04	ENERGY SCIENCE AND ENGINEERING	3	0	0	3	3	40	60	100	
21CEH05	INDUSTRIAL WASTE MANAGEMENT	3	0	0	3	3	40	60	100	
21CEH06	HAZARDOUS WASTE MANAGEMENT	3	0	0	3	3	40	60	100	

18CE101 ENGINEERING MATHEMATICS I 3 1 0 4

Course Objectives

- Understand the concepts of vectors and for different matrices to describe the stability of the linear systems in engineering fields
- Exemplify the concepts of differentiation and integration to identify the area of 2D and 3D surfaces in engineering problems
- Explain the concepts of analytic functions in complex domain to predict the nature of different engineering systems

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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. Represent the different forms of coordinate system in complex plane and characteristics of linear systems by Eigen values and Eigenvectors
2. Analyse various types of functions and their differentiation techniques involved in engineering fields.
3. Analyze the reliability, safety analysis of engineering systems and design of engineering structures using higher order linear differential equations.
4. Execute the suitable integration technique to calculate the area and volume of different surfaces
5. Apply the concept of analytic function to estimate the integral in complex plane

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2													
2	1	2												
3	1	2												
4	1	2												
5	1	2												

UNIT I **9 Hours**

COMPLEX NUMBERS, VECTORS AND MATRICES

Complex plane, polar coordinates and polar form of complex numbers, powers and roots, fundamental theorem of algebra. Vector algebra in 2-D and 3-D space, dot product and cross product. Matrices : Eigen values and Eigen vectors, Properties of eigen values and eigen vectors.

UNIT II **9 Hours**

CALCULUS

Limits and Continuity of Functions: Limits of functions, types of limits, evaluation of limits, continuity of functions, properties of continuous functions. Derivatives: Derivatives, differentiability, rules and properties, differentiation of transcendental functions, higher order derivatives, implicit differentiation, and differentiation of hyperbolic functions. Integration: Anti-derivatives, Riemann

Sum, indefinite and definite integration, Mean Value Theorem for definite integral, Fundamental Theorem of Calculus

UNIT III **9 Hours**

INTEGRATION METHODS

Basic integration formulae for algebraic and transcendental functions. Integration by special devices: integration by parts, rationalizing substitution or trigonometric substitution, partial fractions, reduction formulas, improper integrals, convergence tests

UNIT IV **9 Hours**

APPLICATIONS OF DERIVATIVES AND INTEGRATIONS

Extreme values, points of inflection and curve sketching, Rolle s Theorem, Mean Value Theorem, optimization, indeterminate forms, L'Hopital's Rule.

Area between curves, volume of a general solid by slicing and cylindrical shell methods, volume of a solid of revolution, length of plane curves, area of a surface of revolution

UNIT V **9 Hours**

COMPLEX ANALYSIS

Analytic Functions- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method. Cauchy"s Integral Formula - Classification of Singularities - Cauchy"s Residue Theorem

Total: 60 Hours

Reference(s)

1. Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2001
2. Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.
3. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2016.
4. Anton H, Calculus with Analytic Geometry, 5th edition, John Wiley & Sons, 1995.
5. Ayres F Jr and Mendelson E, Schaum s Outline of Theory and Problems of Calculus, 4th edition, McGraw Hill, 1999

18CE102 ENGINEERING PHYSICS I **2 0 2 3**

Course Objectives

- Illustrate the Newtons laws of motion and wave motion with applications
- Understand the basic properties of electricity, magnetism and optics
- Differentiate the special theory of relativity and quantum physics from classical physics

Programme Outcomes (POs)

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

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

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

Course Outcomes (COs)

1. Illustrate the Newtons three laws of motion and apply the same to solve the real world problems involving elevator, atwood machine and acceleration of objects
2. Exemplify the physical characteristics of simple harmonic motion, wave motion and find the solutions for wave equations
3. Infer the fundamental laws, properties of electricity and magnetism and apply the same to electric and magnetic elements.
4. Apply the principles of physical and geometrical optics in the mirrors, lenses, microscopes and diffraction gratings
5. Outline the importance of special theory of relativity, quantum physics and analyse the wave and particle nature of matter

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1							2					
2	2								2					
3	2	1												
4	2	1							2					
5	2	1							2					

UNIT I **6 Hours**

MECHANICS

Newtons laws of motion: Concept of force and its nature - Newtons first law and inertial frames - definition of mass - Newtons second law-gravitational force and weight - Newtons third law. Applications of Newtons laws: particle in equilibrium, particle under net force - weighing a mass in an elevator, the atwood machine and acceleration of two objects connected by a cord

UNIT II **6 Hours**

OSCILLATIONS AND WAVES

Fundamentals of simple harmonic motion - energy of simple harmonic oscillator - spring mass system - time period of simple pendulum, compound pendulum and torsional pendulum - Damped oscillations.

Travelling wave motion - sinusoidal waves on strings - speed of a wave - reflection and transmission - rate of energy transfer in wave motion

UNIT III **6 Hours**

ELECTRICITY AND MAGNETISM

Point charges - electric fields - Gauss law and its applications - electric potential - capacitance - energy stored in a capacitor.

Concept and source of magnetic fields - Amperes theorem - determination of magnetic field due to different current distributions - Faradays law - self-induction and mutual induction - energy stored in an inductor

UNIT IV **6 Hours**

LIGHT AND OPTICS

Nature of light - laws of reflection and refraction - refractive index and Snells law - dispersion of light - total internal reflection - image formation: concave mirrors - convex mirrors - thin lenses - compound microscope - human eye.

Conditions of interference - Youngs double slit experiment - intensity distribution of interference - phase change due to reflection - diffraction-narrow slit diffraction - single slit and two slit - intensity distribution - diffraction grating - applications.

UNIT V **6 Hours**

MODERN PHYSICS

Special theory of relativity - simultaneity and time dilation - twin paradox - length contraction - relativistic mass variation - space time graph.

Black body radiation and Planck hypothesis - allowed energy levels - thermal radiation from different objects - photoelectric and Compton effect. Matter waves - de-Broglie hypothesis - wave nature of particles - Davission-Germer experiment

1 **5 Hours**

EXPERIMENT 1

Determination of resultant of system of concurrent coplanar forces-Parallelogram law of forces

2 **5 Hours**

EXPERIMENT 2

Determination of moment of inertia-Torsional pendulum

3 **5 Hours**

EXPERIMENT 3

Determination of wavelength of mercury spectral lines-spectrometer

4 **4 Hours**

EXPERIMENT 4

Determination of refractive index of solid and liquid-travelling microscope

5 **3 Hours**

EXPERIMENT 5

Determination of wavelength of laser-diffraction grating

6 **4 Hours**

EXPERIMENT 6

Determination of frequency of a tuning fork-MeldeÃ¢??s apparatus

7 **4 Hours**

EXPERIMENT 7

Thickness of a thin wire using interference of light-Air wedge method

Total: 60 Hours

Reference(s)

1. R A Serway and J W Jewitt, Physics for Scientists and Engineers, Thomson Brooks/Cole, 2011
2. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011
3. H C Verma, Concepts of Physics (Vol I & II), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017
4. H D Young and R A Freedman, Sears and Zemanskys University Physics with Modern Physics, Pearson education, 2016
5. R K Gaur and S L Gupta, Engineering Physics, Dhanpat Rai Publications, 2012

18CE103 ENGINEERING CHEMISTRY I 2 0 2 3

Course Objectives

- Understand the fundamentals of atomic and molecular chemistry for engineering applications
- Identify the quality parameters, estimation and discharge of impurities in water for domestic and industrial applications
- Interpret the principle involved during curing mechanism of cement

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Explain basic concepts of chemistry relating to chemical reactions and equilibrium conditions
2. Interpret the structural parameters and molecular properties of ceramic materials
3. Outline the important water quality parameters, their analysis and fundamentals of physico-chemical treatments
4. Analyze the various types of process involved in curing of construction materials
5. Compare the principles and procedures of various analytical instruments used for material characterization

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	2	1												
3	1	2											1	1
4	2	2												
5	2	1												

UNIT I **5 Hours**

CHEMICAL BONDING AND STRUCTURE OF MOLECULES

Atomic and molecular structures - Intermolecular forces: Ionic, dipolar and Van der Waals interactions. Classification of ionic structure: Zinc sulfide and sodium chloride system - VSEPR - Molecular orbital theory - Hybridization.

UNIT II **8 Hours**

STRUCTURE AND COMPOSITION OF MINERALS

Different ionic structures: AX, AX2, A2X, AmEnXp. Types of minerals: Rock salt - Rutile - Zinc blende - Antifluorite - Wurtzite - Nickelarsenide - Cadmiumiodide - Corundum - CsCl - Perovskite - Spinel (normal-inverse) - Illmenite - Olivine. Structure of Silicates.

UNIT III **6 Hours**

WATER TECHNOLOGY

Water quality parameters: pH, acidity, alkalinity, chlorides, hardness and dissolved gases - Water quality requirements for drinking, irrigation, concrete and industrial uses: WHO, BIS, EPA, ISO Standards - Concepts of titration and buffering. Types of hardness - Estimation of hardness by EDTA method. Types of alkalinity - Water softening methods: Ion exchange, reverse osmosis and electrodialysis. Chemistry of chlorination.

UNIT IV **6 Hours**

CURING MECHANISM OF CONSTRUCTION MATERIALS

Drying, firing cycles of following refractory materials: Silica bricks - Magnesite bricks - Dolomite - Forsterite - Chromite bricks - Carbon/graphite refractory - Insulating bricks. Classification of fireclays and fireclay bricks.

UNIT V **5 Hours**

INSTRUMENTAL METHODS

Principle and application of UV-Visible spectrophotometer (Estimation of iron, chromium, zinc copper and lead) - Colorimeter (Estimation of iron and copper) - Flame photometer (Estimation of sodium) - Atomic absorption spectrophotometer (Estimation procedure for any two elements) - Surface characterization techniques.

FURTHER READING

Application of nanotechnology in civil engineering. A review on degradation of quality of water in India over a decade. Construction of green buildings and its advances.

1 **6 Hours**

EXPERIMENT 1

Identification of ionic and covalent bonds by melting temperature variation

2 **4 Hours**

EXPERIMENT 2

Determination of conductivity of cesium chloride, zinc blende, glucose and sucrose

3 **6 Hours**

EXPERIMENT 3

Water quality of BIT campus (both river and bore well) with respect the hardness, alkalinity, TDS and pH

4 **6 Hours**

EXPERIMENT 4

Estimation of Magnesium in dolomites and limestones by volumetric method

5 **4 Hours**

EXPERIMENT 5

Estimation of iron (thiocyanate method) in the given solution by spectrophotometric method

6 **4 Hours**

EXPERIMENT 6

Estimation of chloride by argentometric method

Total: 60 Hours

Reference(s)

1. Peter Atkins, Physical Chemistry, Oxford University press, 2014.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, Vishal publishing company, 2017.
3. Jain and Jain, Engineering Chemistry, 16th Edition, DhanpatRai Publishing Company, New Delhi, 2013.
4. Carter, C. Barry, Norton, M. Gran, Ceramic materials: Science and Engineering, Springer, 2013.
5. Douglas A. Skoog, Donald M. West, F. James, Fundamentals of analytical chemistry, Brooks/cole, 2014.
6. W. D. Kingery, Harvey Kent Bowen, Donald Robert Uhlmann, Introduction to ceramics, Wiley Interscience Publication, John Wiley & Sons, 2010

18CE104 BASICS OF ELECTRICAL ENGINEERING 2 0 2 3

Course Objectives

- To understand the basic concepts of electric circuits and wiring
- To illustrate the construction and operation of various electrical machines and renewable energy sources.
- To learn the fundamentals of electrical safety measures.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. 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. Apply the fundamental laws to electric circuits and measure the electrical quantities
2. Apply the laws of magnetism for the operation of Diesel generator and Induction motor
3. Illustrate the concept of electrical wiring for household and industrial purposes
4. Analyze the different energy strategies for green building
5. Analyze the performance characteristics of electrical safety equipments

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		1										
2	1	2		1										
3	1	1												
4	1	2												
5	1	2		1										

UNIT I **6 Hours**

INTRODUCTION TO ELECTRICITY

Concept of basic Electricity- Single phase & three phase circuits-Measurement of electrical quantities like Voltage, Current, Resistance, Impedance, power factor and energy.

UNIT II **6 Hours**

ELECTRICAL MACHINES

Generator- operation &different parts of Diesel Generator (DG) set, applications-Motor-construction, operation of single phase & three phase Induction Motor, applications.

UNIT III **6 Hours**

ELECTRICAL WIRING

Types of wires,switches-Wiring layout for house with light, fan & power socket, Staircase wiring-Types of Lamps-applications-Single Line Diagram of Distribution system

UNIT IV **6 Hours**

GREEN BUILDING CONCEPTS

Renewable Energy Basics-Solar Photovoltaic generation-Building Energy analysis-Energy Conservation & Management

UNIT V **6 Hours**

ELECTRICAL SAFETY AND MAINTENANCE

IE Standards for electrical safety-Fuses-types, ratings-MCB-working, ELCB-Lightning Arrester-Earthing-Concepts & types

1 **4 Hours**

EXPERIMENT 1

Connect a 60W Lamp with switch across the supply of 230V and measure the actual current, voltage and power for the circuit.

2 **4 Hours**

EXPERIMENT 2

Demonstrate an electrical circuit for dim bright application using a lamp.

3 **4 Hours**

EXPERIMENT 3

Develop the wiring circuit for single phase pump motor with necessary protection circuits.

4 **4 Hours**

EXPERIMENT 4

Develop a circuit to control two lamps using Staircase wiring.

5 **6 Hours**

EXPERIMENT 5

Demonstrate the fluorescent lamp wiring.

6 **4 Hours**

EXPERIMENT 6

Calculate the energy consumption of electrical appliances such as LED, CFL and Ceiling fan using energy meter.

7 **4 Hours**

EXPERIMENT 7

Calculate the fuse ratings of iron box and heater.

Total: 60 Hours

Reference(s)

1. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Smarjith Ghosh, 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. Muthusubramanian & Salivahanan, Basic Electrical and Electronics Engineering and Communication Engineering, Seventh Edition, Tata MCGraw Hill Education Private Limited, 2011.
5. Charles. J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, Inc., New Jersey, 2008

18CE105 ENGINEERING DRAWING 1 0 4 3

Course Objectives

- To provide knowledge on fundamentals of engineering drawings and conic sections.
- To impart skill on developing projections of points and lines.
- To familiarize about projection of planes and simple solids.
- To provide knowledge on section of solids and development of surfaces of simple solids.
- To impart skill on conversion of orthographic to isometric projections and vice versa.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Create an engineering drawing as per industrial standard
2. Construct orthographic projections of points and lines.
3. Create projection of planes and simple solids
4. Develop section of solids and surfaces.
5. Demonstrate the conversion of orthographic to isometric and vice versa.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3								1	3				2
2	2								1	3				1
3	2								1	3				2
4	3								1	3				2
5	3								1	3			1	

UNIT I **3 Hours**

FUNDAMENTALS OF ENGINEERING DRAWINGS

Definition, standards, drawing tools, drawing sheets, scales, line and its types. Practices on lettering, numbering, dimensioningof drawings. Construction of conic sections-ellipse, parabola and hyperbola using eccentricity method.

UNIT II **3 Hours**

PROJECTION OF POINTS AND STRAIGHT LINES

Principles of projection, Projection of points in four quadrants, first angle projection of straight lines - perpendicularto one plane, parallel and inclined to both planes.

UNIT III **3 Hours**

PROJECTION OF PLANES AND SOLIDS

Projection of simple planes and projection of simple solids parallel, perpendicular and inclined to one plane using change of position method

UNIT IV **3 Hours**

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES

Section of Solids-Simple position with cutting plane parallel, perpendicular and inclined to one plane. Development of surfaces - simple and truncated solids.

UNIT V **3 Hours**

ORTHOGRAPHIC AND ISOMETRIC PROJECTION

Orthographic and isometric projection of components used in engineering applications

1 **4 Hours**

EXPERIMENT 1

Lettering and Dimensioning

2 **6 Hours**

EXPERIMENT 2

Conic sections ellipse, parabola, hyperbola

3 **4 Hours**

EXPERIMENT 3

Projections of Points

4 **6 Hours**

EXPERIMENT 4

Projections of Lines

5 **6 Hours**

EXPERIMENT 5

Projections of Planes

6 **6 Hours**

EXPERIMENT 6

Projections of Solids

7 **5 Hours**

EXPERIMENT 7

Projections of Sections

8 **5 Hours**

EXPERIMENT 8

Development of surfaces

9 **6 Hours**

EXPERIMENT 9

Orthographic projections

10 **6 Hours**

EXPERIMENT 10

Isometric Projections

11 **6 Hours**

EXPERIMENT 11

Creating solids model

Total: 75 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.

18CE201 ENGINEERING MATHEMATICS II 3 1 0 4

Course Objectives

- Understand the concepts of partial derivatives and multiple integrals to define the area, volume and extreme values of various surfaces in engineering fields.
- Classify the sequences and series in linear systems is convergent or divergent
- Formulate the real time engineering problem into mathematical model using ordinary differential equation and solve it by appropriate method

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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. Illustrate the various parameters in partial differentiation and characterize the maxima and minima functions for signals and systems.
2. Apply multiple integral concepts to calculate the area and volume by appropriate vector integral theorems
3. Analyse the properties of analytic functions.
4. Construct first order differential equations from real time phenomena and solve it by suitable method
5. Execute the appropriate method to solve the second order differential equations.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1												
2	2	2												
3	2	1												
4	2	1												
5	2	1												

UNIT I **9 Hours**

PARTIAL DIFFERENTIATION

Functions of several variables, plotting of 2-variable functions, introduction to cylindrical and spherical coordinates, chain rule, total differential, gradient, directional derivatives, normal lines and tangent planes, extreme of functions of two variables, applications

UNIT II **9 Hours**

MULTIPLE INTEGRALS

Double integrals, regions of integrations, triple integrals, applications (Cartesian coordinates only- Greens theorem and Gauss Divergence theorem).

UNIT III **9 Hours**

SEQUENCES AND SERIES

Sequences and series, convergence and divergence of series, absolute convergence, conditional convergence, test for convergence and divergence. Power series for functions, interval of convergence, Taylor and Maclaurin series, Taylors Theorem with remainder

UNIT IV **9 Hours**

FIRST ORDER DIFFERENTIAL EQUATIONS

Separable differential equations, homogeneous differential equations, exact differential equations, integrating factor, Bernoullis equation, applications.

UNIT V **9 Hours**

SECOND ORDER DIFFERENTIAL EQUATIONS

Second order homogeneous and non-homogeneous equations with constant coefficients, variation of parameters, method of undetermined coefficients, series solutions of differential equations, applications.

Total: 60 Hours

Reference(s)

1. Finney RL, Weir MD and Giordano FR, Thomas Calculus, 10th edition, Addison-Wesley, 2001
2. Smith RT and Minton RB, Calculus, 2nd Edition, McGraw Hill, 2002.Kreysgiz E, Advanced Engineering Mathematics, 8th edition, John Wiley & Sons, 1999.
3. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
4. Peter V. O Neil , Advanced Engineering Mathematics, Seventh Edition , Cengage Learning India Private Limited, 2012
5. Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India, 2014.

18CE202 ENGINEERING PHYSICS II 2 0 2 3

Course Objectives

- To understand the laws of kinematics to infer the objects moving in rectilinear and circular motion
- To apply the properties of matter to represent the strength of the materials and interpret the heat transfer mechanisms in various materials
- To analyze the concepts of ultrasonics and non destructive testing methods to detect the flaws in engineering materials

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Course Outcomes (COs)

1. Infer the laws of kinematics to interpret the rectilinear and circular motion of objects moving in one and two dimensions.
2. Identify the properties of materials to represent their strength in structure and design of engineering materials.
3. Use thermodynamic laws to infer the thermal expansion of solids and explain the thermodynamic processes.
4. Outline the properties and types of sound waves to rectify the factors affecting the acoustics of buildings
5. Compare the three types of non destructive testing methods to detect the flaws in engineering materials.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2	2	2							2					
3	2	2							2					
4	2	2							2					
5	2	2												

UNIT I **6 Hours**

DYNAMICS

Kinematics: motion in one dimension - instantaneous speed, velocity and acceleration - freely falling objects. Motion in two dimensions: constant acceleration - projectile motion. Circular motion: particle in uniform and non-uniform circular motion - motion in the accelerated frames - motion in the presence of resistive forces.

UNIT II **6 Hours**

PROPERTIES OF MATTER

Elasticity: elastic and plastic materials - Hookes law - elastic behavior of a material - stress-strain diagram - factors affecting elasticity - modulii of elasticity - Poisson""s ratio and its significance. Viscosity: coefficient of viscosity - Reynolds number - streamline and turbulent flow of a liquid. Poiseuilles Method: viscosity of a liquid.

UNIT III **6 Hours**

HEAT AND THERMODYNAMICS

Temperature and the zeroth law of thermodynamics - thermometer and temperature scale -thermal expansion of solids - anomalous properties of water - first law of thermodynamics - heat and internal energy - specific heat and calorimetry - latent heat - applications of first law of thermodynamics: isothermal and adiabatic processes - second law of thermodynamics - entropy.

UNIT IV **6 Hours**

ACOUSTICS AND ULTRASONICS

Classification of sound waves - absorption coefficient - sound absorbing materials - reverberation - Sabines formula (qualitative) - factors affecting acoustics of buildings and their remedies. Properties of ultrasonic waves - generation of ultrasonic waves: magnetostriction oscillator - piezo electric oscillator. Determination of velocity of ultrasonic waves by acoustic grating method - applications.

UNIT V **6 Hours**

NON-DESTRUCTIVE TESTING

Introduction - steps involved in NDT process - X-ray radiography: displacement method - merits and demerits - applications. Liquid penetrant method: mechanism - advantages - disadvantages - applications. Ultrasonic flaw detector: block diagram - construction - working. Applications of NDT.

1 **5 Hours**

EXPERIMENT 1

Determination of thermal conductivity of a bad conductor Lees disc method

2 **5 Hours**

EXPERIMENT 2

Band gap determination of a given semiconductor

3 **5 Hours**

EXPERIMENT 3

Determination of coefficient of viscosity of the given liquid Poiseuilles method.

4 **5 Hours**

EXPERIMENT 4

Ultrasonic interferometer: wavelength and velocity determination of ultrasonic waves.

5 **5 Hours**

EXPERIMENT 5

Determination of frequency of vibrating rod using Meldes apparatus.

6 **5 Hours**

EXPERIMENT 6

Determination of youngs modulus of a given beam Non-uniform bending method.

Total: 60 Hours

Reference(s)

1. Halliday and Resnick, Fundamentals of Physics, John Wiley and Sons, Inc, 2011
2. Raymond A. Serway John W. Jewett, Jr. Physics for Scientists and Engineers with Modern Physics, Seventh Edition, Thomson Learning, Inc. 2008.
3. Brij Lal, N Subrahmanyam and P S Hemne, Heat Thermodynamics and Statistical Physics, S. Chand Publisher, 2008.
4. V Rajendran and A Marikani, Applied Physics for Engineers, Tata McGraw-Hill Publishing Company, New Delhi, 2002
5. H C Verma, Concepts of Physics (Vol I), Bharathi Bhawan Publishers & Distributors, New Delhi, 2017.
6. P K Palanisamy, Engineering Physics, SCI Tech Publications, PVT Ltd, New Delhi, 2017

18CE203 ENGINEERING CHEMISTRY II 2 0 2 3

Course Objectives

- Classify composite materials based on its properties
- Interpret the properties steel and carbon nanomaterials
- Analyze the various types of organic and inorganic coating
- Interpret qualitatively the mechanism of corrosion and explain the methods of corrosion control
- Analyze the various types of organic and inorganic coating

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Differentiate plastic and non-plastic materials based on its forms and properties
2. Identify properties while changing composition of steels and carbon nanomaterials
3. Classify of various types of electrode to measure the physico-chemical parameters
4. Outline the forms of deterioration of construction materials
5. Illustrate the characteristics of protective coatings

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	2	1												
3	1	2												
4	2	2											1	1
5	2	1												

UNIT I **6 Hours**

NON PLASTIC AND PLASTIC MATERIALS

Polymorphic forms and transformations of SiO_2. Different natural forms of SiO_2 of industrial importance - Properties and uses.

Clay: Classification of clay - Composition, Particle shape, Size, Plasticity, CEC, Occurrences, Important properties and uses of China Clay, Fire Clay, Bentonites.

UNIT II **6 Hours**

STEEL AND CARBON NANO MATERIALS

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.

Nano Materials - Carbon nanotubes: Single and multiwall - Fullerenes, graphene C60 buckyball - Synthesis, properties and applications.

UNIT III **6 Hours**

ELECTROCHEMICAL INSTRUMENTATION

Electrochemical and electrolytic cells. Metal-metal insoluble salt electrode and redox electrode. Reference electrodes: Calomel electrode silver chloride electrode, Glass electrode - measurement of pH using glass electrode - Redox potentiometry - Potentiometric titration.

UNIT IV **7 Hours**

DETERIORATION OF CONSTRUCTION MATERIAL

Chemical corrosion - Types of oxide layers- Electrochemical corrosion - Mechanism. Galvanic corrosion and differential aeration corrosion - Factors influencing corrosion rate: Nature of metal and environment. Corrosion control methods: Sacrificial anode and impressed current cathodic protection.

UNIT V **5 Hours**

PROTECTIVE COATINGS

Classification - Metallic coating - Hot dipping. Electroplating diffusion coating.

Paint: Characteristics of paints - Constituents - Drying process. Varnishes - characteristics of good varnishes - Constituents. Enamels and lacquers.

FURTHER READING

Fire proof paint, Natural Corrosion inhibitors, Electrochemistry of batteries

1 **6 Hours**

EXPERIMENT 1

Estimation of iron and calcium in fired clay by volumetric method

2 **4 Hours**

EXPERIMENT 2

Estimation of copper content in brass by volumetric method

3 **4 Hours**

EXPERIMENT 3

Estimation of amount of acids (HCl and CH3COOH) in the given solution by conductometric titration

4 **6 Hours**

EXPERIMENT 4

Measurement of rate of corrosion on mild steel in aerated / neutral / acidic / alkaline medium by weight loss method

5 **4 Hours**

EXPERIMENT 5

Estimation of dye obtained from paint by spectrophotometric method

6 **2 Hours**

EXPERIMENT 6

Determination of strength of acidity in the given solution by pH measurement

7 **4 Hours**

EXPERIMENT 7

Estimation of iron in the given sample by potentiometric method using calomel electrode

Total: 60 Hours

Reference(s)

1. Jain and Jain, Engineering Chemistry, 16th Edition, DhanpatRai Publishing Company, New Delhi, 2013.
2. S. Vairam, Engineering Chemistry, John Wiley & sons, 2014.
3. Clive H. Hare, Protective Coatings: Fundamentals of Chemistry and Composition, Technology Publishing Company, 1994.
4. Abel Banov, Paints and Coatings Handbook, Structures Publishing Company, 1973.
5. Anthony E. Hughes, Johannes M.C. Mol, Mikhail L. Zheludkevich, Rudolph G. Buchheit, Active Protective Coatings: New-Generation Coatings for Metals, springer, 2015.
6. Fritz Aldinger, Volker A. Weberruss, Advanced Ceramics and Future Materials, Wiley VCH verlag, 2010

18CE204 ENGINEERING MECHANICS 3 0 0 3

Course Objectives

- To introduce coplanar and space forces and the conditions for the equilibrium of particles and rigid bodies.
- To develop capacity to predict the effect of force
- To understand the different primitive and user defined data types.

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Compute the resultant force for various force systems using laws of mechanics.
2. Apply the equations of statics to determine the unknown reactions in plane and space
3. Compute the unknown frictional forces using free body diagram of particles and rigid bodies
4. Evaluate the sectional properties of surfaces and solids
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	PSO1	PSO2
1	1													
2	1	2												
3	1	3												
4	1		1											
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 of coplanar 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**

CENTRE OF GRAVITY AND MOMENT OF INERTIA

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

Equilibrium of Multiply Connected Rigid Bodies - Friction Offered by Thrust Bearing - Screw jack - 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: 45 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 Jaan Kiusalaas, 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

18CE205 FUNDAMENTALS OF CIVIL ENGINEERING 2 0 2 3

Course Objectives

- Gain knowledge about the properties and uses of various materials for constructions
- Recognize the necessity for composite materials like concrete, RCC
- Understand the building components

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c. 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. 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Understand the scope and importance of civil engineering.
2. Understand the composition, properties and classification of building materials.
3. Analyze the properties of timber, and other building materials used in construction.
4. Explain the various building components and their functions.
5. Differentiate the types of masonry and also enumerate the functions of super-structure.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3		1		2									1
2	1		3		2									
3	1			2	3								1	
4	2		3		1									
5	2		1		3								2	

UNIT I **9 Hours**

SCOPE OF CIVIL ENGINEERING

Scope of Civil Engineering- Functions of a Civil Engineer - Types of Building: Residential- Commercial- Industrial & Institutional buildings- Site selection- Units & Unit conversions- Room dimensions as per NBC.

UNIT II **9 Hours**

PRIMARY BUILDING MATERIALS

Bricks: Manufacturing of bricks-Types- Characteristics of Bricks. Stone: Characteristics of Stones- Coarse aggregate- Characteristics of good building stone. Concrete: Definition-Cement-Types- Manufacturing of cement. Fine aggregate- M-sand- Manufacturing of M-Sand. Water- Water standards for construction purpose. Steel: Properties- Grade- Cold formed steel- Hot rolled steel- Sections.

UNIT III **9 Hours**

OTHER BUILDING MATERIALS

Timber: Types of Timber - Seasoning of Timber- Applications. PVC, UPVC, Aluminium, Glass & Stainless steel types- Applications in construction. Paints: Composition of oil paints- Purpose of paints- Applications. Enamels- Varnishes- Plaster of Paris- Purpose- Applications.

UNIT IV **9 Hours**

BUILDING COMPONENTS (SUB-STRUCTURE)

Components of Building- Sub structures- Foundation and its Types- Construction sequence in Building- Design sequence in Building- Ground level- Basement- Plinth level- Sill level- Lintel level- Roof level- Parapet level.

UNIT V **9 Hours**

BUILDING COMPONENTS (SUPER-STRUCTURE)

Super-structure - Walls: Types of Stone masonry and Brick masonry walls- Brick bonds- Slab- Beam- Column- Roof- Floor- Door- Windows- Lintel- Parapet.

1 **2 Hours**

EXPERIMENT 1

Fineness test on Cement as per BIS

2 **2 Hours**

EXPERIMENT 2

Consistency test on cement

3 **4 Hours**

EXPERIMENT 3

Initial and final setting time test on cement

4 **3 Hours**

EXPERIMENT 4

Soundness test on cement

5 **4 Hours**

EXPERIMENT 5

Compressive strength test on cement mortar

Total: 60 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., New Delhi,2006
6. E. Keith Blankenbaker, "Construction and Building Technology", 1st Edition, 2009

18CE206 ENGINEERING PRACTICES LABORATORY 0 0 4 2

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 suitable tools

Programme Outcomes (POs)

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

Course Outcomes (COs)

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

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2													
2	1													
3	2													
4	1													
5	2													

1 **2 Hours**

EXPERIMENT 1

Forming of simple object in sheet metal using suitable tools (Example: Brick mould / Cube mould)

2 **4 Hours**

EXPERIMENT 2

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

3 **2 Hours**

EXPERIMENT 3

Making a simple component using carpentry power tools. (Example: Door ,window frames].

4 **2 Hours**

EXPERIMENT 4

Prepare a "V" (or) Half round (or) Square joint from the given mild Steel flat.

5 **4 Hours**

EXPERIMENT 5

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.

6 **3 Hours**

EXPERIMENT 6

Prepare a green sand mould using solid pattern/split pattern

7 **3 Hours**

EXPERIMENT 7

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.

8 **3 Hours**

EXPERIMENT 8

Dismantling and assembly of Centrifugal Monoblock / Gear Pump / Gear box.

9 **3 Hours**

EXPERIMENT 9

Dismantling and assembly of two stroke and four stroke petrol engine.

10 **4 Hours**

EXPERIMENT 10

Mini Project (Fabrication of Small Components).

Total: 30 Hours

18CE301 ENGINEERING MATHEMATICS III 3 1 0 4

Course Objectives

- Develop the knowledge of periodic and non periodic functions and their representations using Fourier analysis
- Understand the Laplace Transform to solve real world problems
- Predict the changes in the manufacturing process using the concepts of statistics

Programme Outcomes (POs)

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

b. 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. Use the properties of periodic and non-periodic vibrations with the help of Fourier analysis in civil engineering.
2. Formulate a function in frequency domain for which the function defined in time domain through the techniques of Laplace transforms
3. Compute the position of a particle that depends on more than one parameter, using partial differential equations
4. Predict the outcome of civil engineering problem using the concepts of probability and its distributions
5. Justify and validate the mathematical model for a civil engineering problems with the help of hypothesis testing

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2													
2	1													
3	1													
4		2												
5		2												

UNIT I **10 Hours**

FOURIER ANALYSIS

Review of Fourier series for periodic functions. Orthogonal functions. The Euler coefficients. Fourier transforms. Properties of Fourier transform. Applications of Fourier series and transform analysis.

UNIT II **9 Hours**

LAPLACE TRANSFORM

Properties and theorems of Laplace transform. Shifting theorems.Convolution.Applications to ordinary differential equations.Applications to linear system analysis.

UNIT III **11 Hours**

PARTIAL DIFFERENTIAL EQUATION

Introduction to partial differential equations.One-dimensional wave equation.Method of separation of variables.D'Alemberts solution of the wave equation.Heat equation.Laplace equation. Telegraph equations. Laplace transform method of solution.

UNIT IV **8 Hours**

PROBABILITY THEORY

Probability.Random variables, probability densities and distributions, mean and variance of a distribution.Conditional probability.Bayes theorem.Binomial, Poisson and normal distributions.

UNIT V **7 Hours**

MATHEMATICAL STATISTICS

Sample mean and variance.Sampling distributions.Statistical estimation of parameters, confidence intervals. Testing of hypotheses, one-sample and two-sample inferences. Applications to statistical quality control and reliability analysis.

Total: 60 Hours

Reference(s)

1. Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2016.
2. Johnson Richard A. and BhaltacharyyaGouri K., Statistics, Principles and Methods, 3rd Edition, John Wiley, 1996.
3. O'Neil Peter V., Advanced Engineering Mathematics, 4th Edition, PWS-Kent, 1995
4. James Glyn, Advanced Modern Engineering Mathematics, Addison-Wesley, 1993.
5. Milton J. S. and Arnold Jesse C., Introduction to Probability and Statistics: Principles and Applications for Engineering and The Computing Sciences, McGraw Hill Inc, 3rd Edition, 1995.

18CE302 MECHANICS OF DEFORMABLE BODIES 3 1 0 4

Course Objectives

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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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. Compute the simple stress and strain for one and two dimensional elements
2. Evaluate Principal stress,strain and analyze thin cylinders
3. Determine and plot shear force and bending moment diagram for statically determinate beams
4. Evaluate the slope and deflection of statically determinate beams using different methods.
5. Identify the buckling and stability of columns subjected to axial load, and compute the uniaxial and biaxial bending moments

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2												
2	1	2												
3	1	2												
4	1	3												
5	1	3												

UNIT I **9 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

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 -Two dimensional 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 **11 Hours**

BENDING AND STRESSES IN BEAMS

Shear force and bending moment for cantilever, simply supported and over hanging beams for any type of loading - Relationship between rate of loading, shear force and bending moment- Theory of

simple bending -Assumptions -Analysis for bending stresses -Load carrying capacity of beams - Flitched beams - Stresses in solid and hollow circular shafts

UNIT IV **9 Hours**

DEFLECTION OF STATICALLY DETERMINATE BEAMS

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

UNIT V **8 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 line formula

FOR FURTHER READING

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

Total: 60 Hours

Reference(s)

1. S. Rajput, Strength of Materials, S. Chand & Co., 2014
2. R. K. Bansal, A Textbook ofStrength of Materials, Laxmi Publications,6th Edition 2015
3. S. M. A. Kazimi, Solid Mechanics, Tata McGraw 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

18CE303 APPLIED GEOLOGY 3 0 0 3

Course Objectives

- To provide basic knowledge on earth sciences and their applications in civil engineering
- To provide essential knowledge on classification of rocks and their uses in civil engineering constructions
- Apply the knowledge of application of geological investigation in projects such as dams,tunnels,bridges, and roads

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. Describe the interior and exterior structure of earth.
2. Discuss the crystal structure, mineral types and properties
3. Understand the formation of rocks and its properties
4. Identify subsurface information and groundwater potential sites through geophysical investigations
5. Apply geological principles for mitigation of natural hazards and select sites for dams and tunnels

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1											
2	2	2	2											
3	1		2	3										
4	1			2	3									
5	1	1	1											

UNIT I **8 Hours**

GENERAL GEOLOGY

Geological time scale- Branches and scope of geology- Importance of geology from Civil Engineering point of view- Earth-surface features and internal structure- Weathering of Rocks-types

UNIT II **9 Hours**

MINERALOGY

Role of study of physical properties of minerals in the identification of minerals-Significance of physical properties of following common rock forming minerals: Feldsper, Quartz, Olivine, Augite, Hornblende, Muscovite, Biotite, Garnet, Talc and Calcite- Study of other common economics minerals such as Pyrite, Hematite , Magnetite, Chrorite , Galena , Graphite, Magnesite, and Bauxite

UNIT III **9 Hours**

PETROLOGY

Formation and classification of rocks - Igneous, Sedimentary and metamorphic rocks, their texture and structures, properties of granite, pegmatite, dolerite, gabbro, charnockite, basalt, sandstone, conglomerate, breccia, limestone, shale, laterite, schist, gneiss, quartzite, marble, khondalite and slate- Drilling Techniques, Core Recovery, RQD, Engineering Properties of Rocks

UNIT IV **9 Hours**

STRUCTURAL GEOLOGY

Outcrop, Strike and dip, types and classifications of folds, faults, joints, unconformities- Subsurface Investigations: Geophysical methods - Electrical Resistivity and Seismic refraction methods

UNIT V **10 Hours**

DAMS AND TUNNELS

Types of dams- Requirements of dam sites- preliminary and detailed geological investigations for a dam site- Purpose of tunneling, geological considerations for tunneling -Case histories of dam failures and their causes- Geology of the major dam sites of India- Factors affecting the seepage and leakage of reservoir and the remedial measures

Total: 45 Hours

Reference(s)

1. Engineering Geology by N. Chennakesavulu, McMillan, India Ltd. 2005 ISBN13:978.0230-63870-9
2. Parbin Singh. A Text book of Engineering and General Geology, Katson publishing house, Ludhiana 2009.
3. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
4. Principles of Engineering Geology by K.V.G.K. Gokhale, B.S publications ISBN-13: 978-8178002187

18CE304 SURVEY AND GEOMATICS 3 0 0 3

Course Objectives

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying and Astronomical surveying.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. The use of various surveying instruments and mapping
2. Measuring Horizontal angle and vertical angle using different instruments
3. Methods of Leveling and setting Levels with different instruments
4. Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
5. Concept and principle of modern surveying.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2				2								2	1
2	2	3		2	1									
3	2	2			2									
4	2				2									
5	2													

UNIT I **9 Hours**

FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELING

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Types of Compass - Basic Principles- Bearing - Types - True Bearing - Magnetic Bearing - Levelling - Principles and theory of Levelling - Datum - Bench Marks - Temporary and Permanent Adjustments- Methods of Levelling- Booking - Reduction - Sources of errors in Levelling - Curvature and refraction.

UNIT II **9 Hours**

THEODOLITE AND TACHEOMETRIC SURVEYING

Horizontal and vertical angle measurements - Temporary and permanent adjustments - Heights and distances - Tacheometry surveying - Contour - Contouring - Characteristics of contours - Methods of contouring - Tacheometric contouring - Contour gradient - Uses of contour plan and map

UNIT III **9 Hours**

CONTROL SURVEYING AND ADJUSTMENT

Horizontal and vertical control - Methods - specifications - triangulation- baseline - satellite stations - reduction to centre- trigonometrical levelling - single and reciprocal observations - traversing - Gales table. - Errors Sources - precautions and corrections - classification of errors - true and most probable values - weighed observations - principle of least squares - normal equation

UNIT IV **9 Hours**

ADVANCED TOPICS IN SURVEYING

Hydrographic Surveying - Tides - MSL - Sounding methods - - Engineering project surveys- requirements and specifications, various stages of survey work Setting out of works- simple circular curves.

UNIT V **9 Hours**

GEOMATICS

Total Station : Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station GPS Surveying : Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers - data processing.

Total: 45 Hours

Reference(s)

1. Kanetkar.T.P and Kulkarni.S.V, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2014
2. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, 7th Edition,McGraw Hill, 2001.
4. Bannister and S. Raymond, Surveying, 7th Edition, Longman 2004.
5. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014

18CE305 FLUID MECHANICS AND MACHINERIES 3 0 2 4

Course Objectives

- To introduce the basic concepts of fluid statics, kinematics and dynamics
- To enable students to solve practical problems involving fluid statics, fluid flow, turbines and pumps

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. Explain the fundamental properties of fluids and methods of pressure measurement in fluid statics
2. Infer fundamentals of fluid kinematics and dynamics and their applications in hydraulic experiments
3. Identify factors affecting flow through pipes to estimate head loss and conditions for choosing boundary conditions
4. Assess the performance of a model by dimensional analysis and similitude
5. Compute the efficiency and performance of pumps and turbines

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	3	2	1		3									
3	3	2	1		3									
4	2	3	1											
5	2	3	1		3									

UNIT I **9 Hours**

FLUID PROPERTIES AND FLUID STATICS

Fluid properties - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension. Fluid statics- Hydrostatic law - Pascal's law - Pressure measurement - Buoyancy and meta-centre

UNIT II **9 Hours**

FLUID KINEMATICS AND FLUID DYNAMICS

Classification of fluid flow - Reynolds Transport Theorem - Velocity and acceleration - Continuity equation - Stream line, Streak line, Path line, Velocity Potential and Stream function.

Dynamics: Euler's equations of motion - Bernoulli's theorem and proof - Application of Bernoulli's equation - Pitot tube, Orifice meter, Venturi meter

UNIT III **9 Hours**

FLOW THROUGH PIPES AND BOUNDARY LAYER

Development of laminar and turbulent flows in circular pipes - Hagen-Poiseuille equation - Darcy-Weisbach equation - Major and minor losses - Empirical formulae for friction loss - Equivalent pipe - Water hammer and cavitation - Pipe network analysis - Hardy cross method - Boundary layer concept - Displacement and momentum thickness

UNIT IV **9 Hours**

DIMENSIONAL ANALYSIS, SIMILITUDE AND MODEL ANALYSIS

Dimensional homogeneity - Dimensionless numbers - Methods of dimensional analysis - Rayleigh's method - Buckingham's pi theorem - Method of selecting repeating variables - Types of similarities - Hydraulic similitude - Model analysis - Types of models - Similarity laws.

UNIT V **9 Hours**

PUMPS AND TURBINES

Impulse-momentum principle - Impact of jet - Velocity triangle - Types of pumps - Properties of centrifugal pump - Pump characteristics - Specific speed, NPSH, slip - Reciprocating pump - Indicator diagram - Classification of turbines - Efficiency of turbines.

1 **4 Hours**

EXPERIMENT 1

Determination of Co-efficient of discharge of Orifice meter, Venturi meter.

2 **3 Hours**

EXPERIMENT 2

Determination of Co-efficient of Impact Jet.

3 **3 Hours**

EXPERIMENT 3

Determination of friction factor in a piping system.

4 **3 Hours**

EXPERIMENT 4

Study on Performance Characteristics of Centrifugal pump and Reciprocating pump

5 **3 Hours**

EXPERIMENT 5

Study on performance characteristics of Pelton Wheel Turbine.

6 **3 Hours**

EXPERIMENT 6

Study on performance characteristics of Francis Turbine.

7 **2 Hours**

EXPERIMENT 7

Study on performance characteristics of Kaplan Turbine.

8 **2 Hours**

EXPERIMENT 8

Demonstrate the Bernoulli equation concept learnt in theory and their limitations

9 **3 Hours**

EXPERIMENT 9

Experimental study on stability of floating bodies.

10 **4 Hours**

EXPERIMENT 10

INNOVATIVE PRACTICE

Total: 75 Hours

Reference(s)

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010 ISBN-10: 9780195699630
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House ISBN-10: 8190089374 ISBN-13: 9788190089371
3. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications, New Delhi, 2005. (Revised Ninth Edition) ISBN-10: 8131808157 ISBN-13: 9788131808153
4. Yunus A. Cengal and John M. Cimbala, Fluid Mechanics - Fundamentals and Applications (In SI Units), McGraw Hill International Book Co., 2004. ISBN-10: 0073380326, ISBN-13: 978-0073380322
5. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill. ISBN-10: 9780070154414, ISBN-13: 0070154414
6. Fluid Mechanics, Frank M. White, McGraw Hill Education, 8th Edition, 2015, ISBN-10: 0073398276, ISBN-13: 978-0073398273

18CE306 COMPUTER PROGRAMMING 2 0 2 3

Course Objectives

- Study the basic components and operations of a computer
- Use office automation tools
- Write and develop programs using C language constructs

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
e. 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. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
l. 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. Identify the basic hardware components and Install and configure Windows and Linux operating systems
2. Install and work with office automation software
3. Implement C programs using operators, type conversion and input-output functions.
4. Apply decision making and looping statements in writing C programs.
5. Develop C programs using the concepts of Arrays and strings.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1				3							2		
2	1				3				2					
3	1				3				2					
4	1				2							3		
5	1				3				2					

UNIT I **6 Hours**

INTRODUCTION TO COMPUTER

Components of a computer - Input - Output devices - Installation - Number systems - Operating systems - types of operating Systems - RAM-ROM - Internet and E-mail

UNIT II **5 Hours**

OFFICE AUTOMATION

Word Processing - Features - Understanding spread sheet - applications - Making presentations - Use of stand alone and open source software for creating word, excel and powerpoint presentations

UNIT III **5 Hours**

C INTRODUCTION

Problem Solving Techniques - C Primitives: Introduction to C- Planning and writing a C program- - Compiling and executing the C program - Operators and Expressions - Type Conversion Formatted I/O functions.

UNIT IV **7 Hours**

CONTROL STATEMENTS

Decision Making and Branching - Statement - Decision Making and Looping Jump Statements

UNIT V **7 Hours**

ARRAYS AND STRINGS

Arrays- one dimensional array - two-dimensional arrays - multi dimensional arrays. Strings - String handling functions.

FOR FURTHER READING

File handling using C

1 **2 Hours**

EXPERIMENT 1

a) Study of desktop computer, motherboard and its interfacing components.
b) Install and configure computer drivers and system components.

2 **2 Hours**

EXPERIMENT 2

Disk formatting, partitioning and Disk operating system commands

3 **2 Hours**

EXPERIMENT 3

a) Install, upgrade and configure Windows/Linux operating systems.
b) Installation of Dual OS using Virtual Machine

4 **2 Hours**

EXPERIMENT 4

a)Installation Antivirus and configure the antivirus.
b)Installation of printer and scanner software.

5 **2 Hours**

EXPERIMENT 5

a) Create an advertisement page in Word
b) Create a Mail Merge Letter and a macro for inserting a picture and formatting the text in Word
c) Create an Excel sheet and include all basic formatting options
d) Create a PPT incorporating the major formatting options and animations

6 **4 Hours**

EXPERIMENT 6

Write and execute basic programs in C illustrating operators and expressions

7 **4 Hours**

EXPERIMENT 7

Write and Execute programs in C to illustrate the concept of control structures

8 **3 Hours**

EXPERIMENT 8

Write and Execute programs in C to illustrate the concept of arrays

9 **3 Hours**

EXPERIMENT 9

Write and Execute programs in C to illustrate the concept of strings

10 **6 Hours**

EXPERIMENT 10

Develop a small application of your choice using C

Total: 60 Hours

Reference(s)

1. ITL Educational Solutions Limited, Introduction to Information Technology, Pearson Education, India, 2006.
2. Behrouz A.Forouzan and Richard F. Gilberg, Computer Science: A Structure program approach using C, Cengage learning-2009.
3. Herbert Schildt, C- The complete Reference, McGraw Hill, 2010.

18CE307 COMPUTER AIDED BUILDING DRAWING LABORATORY

0 0 4 2

Course Objectives

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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
e. 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.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
l. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.

Course Outcomes (COs)

1. Understand the various basic commands used for drafting and know the types of coordinate systems.
2. Draw the brick bond models using basic drawing and modify commands
3. Prepare the site plan by manual and computer aided drawing; arrange the components of building to satisfy the functional and orientation aspect.
4. Sketch the detailed drawings of plan,elevation and section of a single storey residential building and list the schedule of joineries.
5. Create a model of a building with rendering effects using Revit.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1				1							1		
2	2				2			1	1					
3	3				3			1	1					
4	1				2							1	1	
5	1				1			1	1					

1 **10 Hours**

EXPERIMENT 1

Simple drawing using basic draw commands and coordinate system

2 **10 Hours**

EXPERIMENT 2

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

3 **10 Hours**

EXPERIMENT 3

Plan of a single storeyed residential building

4 **10 Hours**

EXPERIMENT 4

Elevation and cross section of a single storeyed residential building

5 **10 Hours**

EXPERIMENT 5

Plan, elevation and cross section of an industrial building

6 **10 Hours**

EXPERIMENT 6

Draw the Plan and elevation of residential building with rendering effects using Revit

Total: 60 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
3. Shah. M.G, Kale. C.M and Patki. S.Y, "Building Drawing", Tata McGraw Hill Book Co., 2004
4. CloisE.Kicklighter., "Architecture, Residential Drawing and Design", The Good Heart - Willcox Company Inc., 2000
5. Donald E. Hepler and Paul I. Wallach., "Architecture, Drafting and Design", Tata McGraw Hill Book Co., New Delhi, 1998.

18CE308 SURVEY LABORATORY 0 0 4 2

Course Objectives

- To determine the relative position of any objects or points of the earth.
- To develop methods through the knowledge of modern science and the technology and use them in the field.
- To prepare a map or plan to represent an area on a horizontal plan.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. use conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling
2. apply the procedures involved in field work and to work as a surveying team
3. take accurate measurements, field booking, plotting and adjustment of errors can be understood
4. To prepare a topographical map which shows the hills, valleys, rivers, villages, towns, forests, etc. of a country.
5. To prepare a geological map showing areas including underground resources.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1			1									
2		2			1									
3		2	1	1	1									
4		2	1	2	2									
5		1	1	1	1									

1 **6 Hours**

EXPERIMENT 1

Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset

2 **6 Hours**

EXPERIMENT 2

Setting out works - Foundation marking using tapes single Room and Double Room Compass Survey

3 **6 Hours**

EXPERIMENT 3

Levelling - Longitudinal and cross-section and plotting

4 **6 Hours**

EXPERIMENT 4

Fly levelling using Dumpy level and tilting level

5 **6 Hours**

EXPERIMENT 5

Measurements of horizontal angles by reiteration and repetition and vertical angles using theodolite

6 **6 Hours**

EXPERIMENT 6

Fixing gradient for a pipe line

7 **8 Hours**

EXPERIMENT 7

Contouring - Block Contouring for non uniform terrain

8 **8 Hours**

EXPERIMENT 8

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

9 **8 Hours**

EXPERIMENT 9

Determination of distance and difference in elevation between two inaccessible points using Total station

Total: 60 Hours

Reference(s)

1. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
2. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014

18CE401 CONCRETE TECHNOLOGY 3 0 0 3

Course Objectives

- To impart a sound technical knowledge on the ingredients of conventional and special concrete.
- To impart basic knowledge on the properties of fresh and hardened concrete.
- To provide basic understanding on the usage of different admixture in enhancing the specific requirements of the concrete.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

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 using IS code
3. Evaluate the hardened concrete properties
4. Examine the concrete properties based on the addition of admixtures
5. Identify the suitable special concrete based on the field requirement.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											2
2	1	2	3											2
3	1	3			2								2	
4	1	2	3										2	
5	1	2	3											2

UNIT I **9 Hours**

INGREDIENTS OF CONCRETE

Cement: Composition and properties of cement- different types of cements - Hydration of cement - Structure of hydrated cement -Tests on physical properties of cement Consistency-Setting Time - Soundness-Strength. Aggregates: Classification; Size shape -Tests on aggregates - standard specifications and requirements - Bulking of sand - Sieve Analysis-Fineness modulus-interpretation of gradation charts - Quality of water for mixing and curing.

UNIT II **9 Hours**

FRESH CONCRETE

Mix Proportioning of Concrete: General Principles - Mix Design of Concrete: IS Method - Particle Packing Density, Rheology - Production process - Batching and Mixing - RMC - Transporting - pumping - Workability - Slump - Vee bee - Compaction factor - Factors affecting workability- Segregation and bleeding - Methods of compaction and curing.

UNIT III **9 Hours**

HARDENED CONCRETE

Compressive strength - fracture mechanism - role of paste aggregate bond - effect of aggregate properties - effect of air entrainment, degree of compaction - effect of curing - factors affecting test compressive strength results - tensile strength - modulus of rupture - split tensile strength - Elastic Modulus, Poison's Ratio, Fatigue, Impact and abrasion- Creep - mechanism - factors influencing-effects - shrinkage mechanism - types- factors affecting - effect - thermal expansion -Introduction to durability - relation between durability and permeability - common degradation processes

UNIT IV **9 Hours**

MINERAL AND CHEMICAL ADMIXTURES

Mineral admixtures - Fly ash, blast furnace slag, silica fume, and metakaolin - their production, properties, and effects on concrete properties; other reactive and inert mineral additives - chemical admixtures - role of chemical admixtures - water reducing agents - plasticizers, super plasticizers, hyper plasticizers - retarders - accelerators - Air entraining agents - Viscosity modifying agents - corrosion inhibitors - water proofing admixtures - anti-shrinkage admixtures

UNIT V **9 Hours**

SPECIAL CONCRETE

Special concrete properties & applications of high strength concrete - Self compaction concrete - fiber reinforced concrete - heavy and light weight concrete - High volume fly ash concrete - Geopolymer concrete - recycled aggregate concrete - Slurry Infiltrated Fiber Concrete - Sulfur concrete - Pervious concrete - Refractory Concrete - Air entrained concrete - polymer concrete - coloured concrete - Shotcrete - Ferrocement concrete

SELF STUDY

Prestressed concrete - Precast concrete - Vacuum concrete - Mass concrete, Cellular concrete, Bendable concrete, light transmitting concrete.

Total: 45 Hours

Reference(s)

1. Neville, A.M. and Brooks, J.J.," CONCRETE TECHNOLOGY", ELBS .1990.
2. P.Kumar Mehta and Paulo J.M. Monteiro, Concrete - Micro structure, Properties and Materials, Indian Concrete Institute, Chennai,1997
3. M.S.Shetty, Concrete Technology, S.Chand and Co., Ltd., NewDelhi, 2003

4. A.R.Santhakumar, Concrete Technology, Oxford University Press, New Delhi, 2007
5. M.L.Gambhir, Concrete Technology, Tata Mc Graw Hill Publishing Co., Ltd., New Delhi, 2007

18CE402 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 of practice
- To underline and discuss basic principles of mechanics regarding the design of reinforced concrete systems and elements

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Illustrate the design principles of working stress method for beam
2. Design a types slab based on based on the limiting condition and the staircase
3. Design of beam for various sections subjected to flexure as per the limit state method.
4. Design of beam for shear and Evaluate the beam section for deflection and crack
5. Design of column subjected to axial, uniaxial and biaxial moment.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											1
2	2	3	1											1
3	2	3	1											1
4	2	3	1											1
5	2	3	1											1

UNIT I **9 Hours**

WORKING STRESS METHOD

Aims of design - Method of design - Working stress method - Assumptions - Stress strain behavior of steel and concrete - Stress block parameters - Design of singly and doubly reinforced rectangular sections by working stress method.

UNIT II **9 Hours**

LIMIT STATE DESIGN OF SLAB AND STAIRCASE

Limit state method - Principles - Partial safety factor - Design of RC rectangular one and two way slabs subjected to uniformly distributed load by limit state method -Introduction to flat slab - Types of stairs - Design of stairs spanning horizontally - Design of doglegged stair.

UNIT III **9 Hours**

LIMIT STATE DESIGN OF BEAMS FOR FLEXURE

Stress block parameters - Neutral axis-Balanced-Under Reinforced-Over Reinforced Sections - Design of singly reinforced rectangular section - Design of doubly reinforced rectangular section - Design of flanged (T & L) beams.

UNIT IV **9 Hours**

LIMIT STATE DESIGN OF BEAMS FOR SHEAR

Shear forces in beam - Types of shear resistance - Design of vertical stirrups - Design of Bent-up bars - Development length - Design of beams for flexure, shear and torsion (Combined effect) Parameters considered in limit state of serviceability - Check for deflection and crack width.

UNIT V **9 Hours**

LIMIT STATE DESIGN OF COLUMNS

Types of columns - Provisions of IS-456 code for the design of columns - Design of short columns subjected to axial load, uniaxial and biaxial bending moment. Design of long column subjected to axial load

Total: 45 Hours

Reference(s)

1. B. C. Punmia, A. K. Jain, Limit State Design of Reinforced Concrete, Laxmi Publications,Revised edition (2016)
2. S. Unnikrishna Pillai and DevedasMenon, Reinforced Concrete Design, McGraw Hill Education; 3 edition 2017
3. S. N. Sinha, Reinforced Concrete Design, McGraw Hill Education (India) Private Limited; 3 edition (New Delhi), April 9, 2014.
4. N. Krishna Raju, Advanced Reinforced Concrete Design (IS : 456-2000), CBS; 3rd edition (2016) 2016
5. P. C. Varghese, Limit State Design of Reinforced Concrete, PHI Learning Pvt. Ltd., New Delhi, 2008
6. IS 456:2000 Plain and reinforced concrete-Code of Practice

18CE403 STRUCTURAL ANALYSIS I 3 1 0 4

Course Objectives

- To impart knowledge on the different methods of analysis of statically indeterminate structures
- To impart knowledge on moving loads and influence line diagrams
- To provide a thorough understanding on arches and influence line diagram
- At the end of the course students will be conversant with classical method of analysis.

Programme Outcomes (POs)

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

m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.

Course Outcomes (COs)

1. Compute the member forces and deflection of determinate and indeterminate structures
2. Analyse the bending moment and shear force for beam, sway and non-sway frame by slope deflection method.
3. Analyse the bending moment and shear force for beam, sway and non-sway frame by moment distribution method.
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 moving load.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		1											2	
2		2											2	
3		2											1	
4		2											1	
5		3											1	

UNIT I **9 Hours**

DEFLECTION OF DETERMINATE STRUCTURES

Determination of Static and Kinematic Indeterminacy 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.

FRAMED ANALYSIS

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: 60 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 , Vikas Publishing House (p) ltd ,2009

18CE404 SOIL MECHANICS 3 0 0 3

Course Objectives

- To make the students gain adequate knowledge on soil formation and characteristics
- To make them know the significance of the soil properties

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Classify the soil based on index properties and understand the compaction process
2. Determine the stress distribution and the permeability of soils
3. Evaluate the vertical stress due to external loads and consolidation settlement of clayey soils
4. Compute the shear strength parameters of soils under different drainage conditions
5. Analyze the stability of slopes and provide slope protection methods

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2		3										1
2	3	3												1
3	3	3												1
4	3	3		3										1
5	3	2	1	2									1	1

UNIT I **10 Hours**

SOIL CLASSIFICATION

Soil formation and nature of soils - Phase diagrams - Basic definitions and inter-relationships - Index Properties of soils - Classification based on BIS. Compaction - Factors affecting compaction - Laboratory & Field Compaction methods.

UNIT II **10 Hours**

EFFECTIVE STRESS

Soil water - Various forms - Static pressure in water - Total - Neutral and effective stress distribution in soils - Liquefaction & quicksand conditions. Flow of water through soils - Darcy"s law;

Assumptions and validity - Permeability - Coefficient of permeability - Factors affecting permeability - Permeability of stratified deposits of soils - Laboratory tests - Seepage analysis.

UNIT III **10 Hours**

STRESS DISTRIBUTION

Boussinesqs and Wester Guard"s theories of stresses due to concentrated loads - Circular, Rectangular load - Strip load -New Mark"s chart. 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 **8 Hours**

SHEAR STRENGTH OF SOILS

Shear strength - Factors affecting shear strength of soils- Mohr - Coulomb theory - Measurement of shear strength parameters - Direct shear - Unconfined compression - Triaxial - Drained and un-drained conditions - Vane shear tests.

UNIT V **7 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

Total: 45 Hours

Text Book(s)

1. B. N. D. Narasinga Rao, 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.

Reference(s)

1. Alam Singh, Soil Engineering in Theory and Practice, Asia Publishing House, Bombay, 2ndEdition, 2009.
2. Braja M. Das, Principles of Geotechnical Engineering, Thomson Brooks/Cole, Australia, 8th Edition, 2015.
3. Karl Terzaghi, Soil Mechanics in Engineering Practice, 3rd edition, John Wiley & Sons, Inc, 1995.
4. IS Codes: IS 1498: 1970, IS 2810: 1979, IS 2809: 1972, IS 2720 : Part 1 to Part 41

18CE405 WATER RESOURCES ENGINEERING 3 0 0 3

Course Objectives

- To impart knowledge on spatial and temporal distribution of water available in any region
- To disseminate the knowledge on hydrologic estimates for river and reservoir management
- To emphasize the need for water resources planning and management

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Infer the fundamentals of hydrological parameters and need for water conservation
2. Assess the variations in distribution of rainfall, runoff, infiltration and evapo transpiration
3. Demonstrate development and applications of hydrographs and frequency analysis from stream flow data
4. Attribute strategies for sustainable reservoir operation and flood control using reliability, economic analysis and flood routing techniques
5. Identify methods of groundwater assessment and extraction including factors affecting groundwater yield

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	3	2	1											
3	1	3	2											
4	2	3											1	2
5	3	2											2	

UNIT I **9 Hours**

INTRODUCTION

Climate and weather- meteorological and hydrological parameters - hydrologic cycle - water-budget equation - water resources survey - consumptive and non-consumptive water use - water scarcity and its impacts - water resources planning - watershed management - national water policy.

UNIT II **9 Hours**

FUNDAMENTALS OF HYDROLOGY

Types of precipitation - measurement of rainfall - rain-gauge density - estimates of missing data and adjustment of records - optimum rain-gauge network design - intensity-duration and depth-area-duration relations - frequency analysis of rainfall data - losses from precipitation - interception and depression storage - estimation of evaporation and transpiration - measurement of infiltration - infiltrationindices - effective rainfall - estimation of runoff.

UNIT III **9 Hours**

STREAM FLOW ANALYSIS

Components of stream flow - stream gauging - stage-discharge rating curve - selection of site for stream gauging station - hydrograph analysis - hydrograph separation - unit hydrograph-S-curve hydrograph -unithydrograph of different deviations - synthetic unit hydrograph - methods for peak discharge estimation - frequency analysis of stream flow data- Role of rivers.

UNIT IV **9 Hours**

RESERVOIR PLANNING AND MANAGEMENT

Single purpose and multipurpose reservoir - determination of storage capacity and yield - strategies for reservoir operation - reservoir reliability - reservoir sedimentation and desilting - reservoir flood routing -Muskingum channel routing - methods of flood control - flood forecasting and warning - economic analysis of water resources projects.

UNIT V **9 Hours**

GROUNDWATER HYDROLOGY

Types of geologic formations and aquifers - aquifer properties - Darcy's law - transmissibility - well hydraulics - steady state flow equations for confined and unconfined aquifers - Dupuit's assumptions - specific capacity - cavity wells - yield of a well - pumping test and recuperation test - construction of open wells and bore wells - well shrouding and well development.

Total: 45 Hours

Reference(s)

1. Berndtsson, P. N. Chadramouli,C.S.P.Ojha, R. Fluid Mechanics and Machinery,Oxford University Press,ISBN-10: 9780195699630,2010.
2. K Subramanya, Engineering Hydrology,4th Edition, Tata McGraw Hill, New Delhi, ISBN: 1259029972, 2017.
3. VenTeChow, D.R. Maidment and L.W. Mays, Applied Hydrology, 1st Edition, McGraw Hill, New York,ISBN: 0071001743,1998.
4. K.N. Duggal, J.P. Soni, Elements of Water Resources Engineering, New Age International Pvt Ltd Publishers, New Delhi, ISBN: 8122408079, 2008.
5. P. Jaya Rami Reddy, A Textbook of Hydrology,3rd Edition, Tata McGraw Hill, New Delhi, 2016, ISBN:9380856040, 2016.
6. H. M. Ragunath, Hydrology: Principles, analysis, and design, Wiley Eastern Limited, New Delhi,ISBN: 0470200367,1985

18CE406 CONSTRUCTION TECHNIQUES AND EQUIPMENTS

3 0 0 3

Course Objectives

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

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Generalize the aspects involved in concrete technology
2. Identify the suitable site and techniques involved in good construction practices
3. Apply appropriate techniques used for sub structure construction
4. Identify and apply different techniques for super structure construction
5. Identify the different construction equipments for various applications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2									3		2	3
2	2	1									3		1	2
3	3	2									1		2	1
4	1	3									2		1	2
5	1	2	1			1					3		2	

UNIT I **9 Hours**

CONCRETE TECHNOLOGY

Cements - Grade of cements - concrete chemicals and Applications - Grade of concrete - manufacturing of concrete -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-destructive testing

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.

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, tunnelling.

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.Construction Equipment and Management,Khanna Publishers New Delhi, 2002
3. Deodhar, S.V.Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2012
4. Dr. Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company, NewDelhi, 1983
5. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004

18CE407 STRENGTH OF MATERIALS LABORATORY 0 0 4 2

Course Objectives

- To make the students understand the behaviour of materials under various loading conditions, viz., tension, compression, torsion and bending
- To know the impact strength and the hardness number of the given material

Programme Outcomes (POs)

b. 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 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. 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. 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. 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.

Course Outcomes (COs)

1. Evaluate Young Modulus, torsional strength, impact strength, hardness numbers and tensile strength of given specimens
2. Find the compressive strength of wood and brick
3. Find stiffness of open coiled and close coiled springs

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1			1		2									
2		1			2	1								
3			1	2										

1 **4 Hours**

EXPERIMENT 1

Tension test on mild steel rod

2 **4 Hours**

EXPERIMENT 2

Torsion test on mild steel rod

3 **6 Hours**

EXPERIMENT 3

Compression test on brick and wood

4 **6 Hours**

EXPERIMENT 4

Tests on open coil helical springs

5 **6 Hours**

EXPERIMENT 5

Tests on closed coil helical springs

6 **8 Hours**

EXPERIMENT 6

Izod and Charpy impact tests

7 **6 Hours**

EXPERIMENT 7

Determination of Rockwell Hardness Number

8 **6 Hours**

EXPERIMENT 8

Determination of Brinell Hardness Number

9 **6 Hours**

EXPERIMENT 9

Shear test on mild steel rod

10 **8 Hours**

EXPERIMENT 10

Static bending test on metal beam

Total: 60 Hours

18CE408 GEOTECHNICAL ENGINEERING LABORATORY

0 0 4 2

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 seepage characteristics
- To determine the safe bearing capacity of soil at a given site using the knowledge of the fundamental properties of soils

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Classify the given soil sample
2. Determine the index properties of the given soil sample
3. Determine the shear strength characteristics of given soil sample
4. Determine the permeability and swelling characteristics of given soil sample
5. Determine the CBR value of given soil sample

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1			1											
2		1	2	1										
3			1	2									2	2
4	-	1												1
5	1	-												1

1 **2 Hours**

GRAIN SIZE DISTRIBUTION

Sieve analysis and Hydrometer analysis

2 **4 Hours**

SPECIFIC GRAVITY

Specific gravity of soil grains

3 **6 Hours**

ATTERBERG LIMITS TEST

a) Liquid limit
b) Plastic limit
c) Shrinkage limit

4 **8 Hours**

STANDARD PROCTOR TEST

Determination of moisture - Density relationship using Standard Proctor test

5 **8 Hours**

PERMEABILITY DETERMINATION

Constant head and falling head methods

6 **8 Hours**

DETERMINATION OF SHEAR STRENGTH PARAMETERS

a) Direct shear test on cohesionless soil
b) Unconfined compression test on cohesive soil
c) Triaxial compression test
d) Vane shear test

7 **6 Hours**

ONE DIMENSIONAL CONSOLIDATION TEST

Determination of co-efficient of consolidation only

8 **6 Hours**

SWELL TEST

Differential free swell and swell pressure tests

9 **6 Hours**

FIELD DENSITY TEST

Core cutter and sand replacement methods

10 **6 Hours**

CBR TEST

Estimation of CBR value for pavement design at a given site

Total: 60 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

21CE501 STRUCTURAL ANALYSIS II 3 1 0 4

Course Objectives

- To impart a thorough knowledge about the matrix methods of structural analysis
- To impart knowledge on moving loads and influence line diagrams
- To impart knowledge on finite element analysis and tension co-efficient method
- To introduce plastic analysis of structures

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.

Course Outcomes (COs)

1. Analyze and construct influence line for the trusses and symmetrical arches
2. Analyze the internal forces in the Cables and Suspension bridges.
3. Compute the forces for continuous beams, frames and trusses using flexibility method.
4. Determine the displacement for continuous beams, frames and trusses using stiffness method.
5. Analyze beams, frames and trusses by Kani's method and mechanism method.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2											2	
2		1	2										2	
3	1	2											2	
4	1	2											1	
5	2	3											1	

UNIT I **9 Hours**

INFLUENCE LINES FOR FORCES IN PLANE TRUSSES AND 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 and UDL- Muller Breslau principle

UNIT II **9 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 **9 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 **9 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 **9 Hours**

MISCELLANEOUS TOPICS

Analysis of continuous beams, indeterminate frames and trusses with maximum two degrees of static indeterminacy by Kani's method. Plastic analysis of structures - Assumptions - Moment redistribution - Analysis of fixed and continuous beams and portal frames by mechanism method.

Total: 60 Hours

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, Vikas Publishing House (p) ltd ,2009
3. Vaidyanathan.R, Perumal.P, Comprehensive Structural Analysis, 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 Computional structural mechanics, Prentice Hall of India , New Delhi ,2008

21CE502 DESIGN OF RCC STRUCTURES 3 0 0 3

Course Objectives

- To impart knowledge on the basic design philosophy of R.C.C structures
- To make students be familiar about the codal provisions for the design of R.C.C structures

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Design various types of foundation.
2. Identify the suitable retaining wall and design cantilever, counter fort retaining wall.
3. Design various types of liquid storage structures as per Indian standard codal provision.
4. Design deck slab and T beam bridges by evaluating the critical load
5. Illustrate the need of prefabricated structures and its behaviour

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		3											
2	1	2	3											1
3	1	2	3											1
4	1		3											1
5	1	2	3										1	

UNIT I **9 Hours**

FOUNDATIONS

Design of Isolated footings: square and rectangular footing Design of isolated footing subjected to uniaxial and biaxial moments. Design of Combined footings: rectangular and trapezoidal shape - Principles of design of mat foundation.

UNIT II **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.Introduction to Gabion wall

UNIT III **9 Hours**

DESIGN OF WATER TANK

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 water tanks

UNIT IV **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

UNIT V **9 Hours**

PREFABRICATED STRUCTURES

Need for prefabrication - Principles - Materials - Modular coordination -Standarization - Systems - Production -Transportation -Erection. Behaviour of structural components
-Construction of roof and floor slabs - Wall panels -Columns-Connection detail

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 Arun kumar Jain, Limit State Design of Reinforced Concrete, Laxmi Publications (P) Ltd., New Delhi, 2015.
3. Unnikrishna Pillai and Devedas Menon, Reinforced Concrete Design, Tata Mc Graw 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 of Practice

21CE503 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 & earth retaining structures

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.

Course Outcomes (COs)

1. Conduct site investigation and prepare the report 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	PSO1	PSO2
1	3	3	1			1							1	
2	3	3	1	2									1	
3	3	3	1										1	
4	3	3	1			1							1	
5	3	3	1										1	

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 **9 Hours**

FOOTINGS AND RAFT

Contact pressure distribution below footings - Types and uses of shallow footings - Proportioning of Isolated and Combined footings - Strap footings - Principles of design of mat foundation.

UNIT IV **9 Hours**

PILE FOUNDATION

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) - Interpretation with in situ 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 **8 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 conditions

Total: 45 Hours

Reference(s)

1. B. N. D. Narasinga Rao, 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. Donald P. Coduto, Foundation Design Principles & Practices, 2nd Edition, Prentice-Hall of India, 2001
4. Braja M. Das, Principles of Geotechnical Engineering, Thomson Brooks/Cole, Australia, 8th Edition, 2015.
5. B.M. Das, Principles of Foundation Engineering, 8th Edition, Cengage Learning, 2015
6. P.C.Varghese, Foundation Engineering, Prentice-Hall of India Private Ltd, New Delhi, 2006

21CE504 IRRIGATION ENGINEERING 3 0 2 4

Course Objectives

- To impart basic knowledge on the types and methods of irrigation
- To outline the design aspects of hydraulic structures in canal regulation
- To illustrate the need of irrigation scheduling and water management

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Estimate the water requirement to prepare the irrigation schedule for crops
2. Identify the suitability of surface and subsurface irrigation methods
3. Design irrigation canals and head regulatory structures
4. Select suitability of impounding structures and suitable spillways
5. Analyse 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	PSO1	PSO2
1	1	2											1	1
2	1	2					1						2	2
3	2	1	3										1	2
4	1	3	2										3	3
5	1	2	2										2	2

UNIT I **9 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 **9 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 **9 Hours**

IRRIGATION CANALS AND HEAD WORKS

Classification of canals - principles of design - silt theories - design of lined canal - lining, alignment and maintenance of canals - design of surplus weir - design of tank sluice with tower head - design of canal drops and regulators - types of cross - drainage works

UNIT IV **9 Hours**

IMPOUNDING STRUCTURES

Types of impounding structures - forces acting on gravity dams - analysis of gravity dams - types of earth dams - causes of failure - seepage analysis and control - types and functions of spillways and energy dissipaters

UNIT V **9 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

1 **5 Hours**

EXPERIMENT 1

Design and Drawing of Surplus weir

2 **5 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 **4 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

Total: 75 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, Dhanpat Rai Publishing Company (P) Ltd, 2001

21CE507 CONCRETE AND STRUCTURAL ANALYSIS LABORATORY

0 0 4 2

Course Objectives

- To impart basic knowledge on the preliminary tests of the concrete ingredients.
- To provide knowledge on the tests to be conducted on fresh and hardened concrete
- To impart knowledge on the analysis of the different type of structures

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
d. 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. 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.

Course Outcomes (COs)

1. Determine the prescribed limits of ingredients as per IS standards for concrete making.
2. Demonstrate the workability property of freshly made concrete.
3. Compute the strength property of concrete by conducting destructive and non-destructive tests.
4. Determine the deflection and behavior of structures under various end conditions
5. Evaluate the modulus of elasticity of the concrete.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1			3	2								2	
2	1			2		3							2	
3				1	3	2							1	
4				2	1	3								
5	1			3	2									

1 **8 Hours**

EXPERIMENT 1

Physical tests on cement - Fineness, Standard consistency, Initial and final setting time and soundness test

2 **8 Hours**

EXPERIMENT 2

Tests on aggregate - Sieve analysis on fine and coarse aggregate, Specific gravity, Bulk density of fine and coarse aggregate and bulking of fine aggregate, Elongation index and Flakiness index,

Aggregate Impact value,
Crushing value, abrasion value

3 **8 Hours**

EXPERIMENT 3

Tests on fresh concrete - Slump test, Compaction factor, Vee bee test

4 **8 Hours**

EXPERIMENT 4

Tests on hardened concrete - Cube Compressive strength, Split tensile strength of cylinder and modulus of rupture

5 **8 Hours**

EXPERIMENT 5

To experimentally determine the deflection of pin connected truss

6 **8 Hours**

EXPERIMENT 6

To study the behaviour of struts and columns with various end conditions

7 **8 Hours**

EXPERIMENT 7

To experimentally determine the horizontal thrust in a three hinged arch for a given system of loads

8 **4 Hours**

EXPERIMENT 8

To plot the stress strain curve for concrete.

Total: 60 Hours

Reference(s)

1. P.D.Kulkarni, Text book of Concrete Technology, New Age International (P) Ltd. 2007
2. M.S.Shetty, Concrete Technology, S.Chand and Co., Ltd., NewDelhi, 2003
3. IS: 10262:2009 Concrete Mix Proportioning - Guidelines
4. IS: 2386 PART I & IV AGGREGATE SHAPE TEST
5. Madan Mohan Das, Structural Analysis, PHI Learning (P) Ltd.2011
6. Dr.R.Vaidyanathan and Dr.P.Perumal, Structural Analysis Volume II, Laxmi Publications (P) Ltd. 2016

21CE508 COMPUTER AIDED DESIGN AND DRAWING LABORATORY

0 0 4 2

Course Objectives

- To impart fundamental knowledge on Design and Detailing of structural components
- To impart a thorough knowledge on the computer aided analysis and design of structural components.
- To enhance the capability of the students to draw the plan, elevation and sectional view of various structural elements using softwares

Programme Outcomes (POs)

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

Course Outcomes (COs)

1. Analyse, Design and Detailing of RCC building components (slabs, beams and columns).
2. Design and Detailing of Isolated footings using IS456:2000.
3. Design and Detailing of elevated circular water tanks, retaining walls.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	3											
2	1	2	3											
3	2	1	3											

1 **10 Hours**

EXPERIMENT 1

Analyse,design and detailing of Framed RCC building components (Slab, Beam and column) using software.

2 **10 Hours**

EXPERIMENT 2

Design and detailing of Isolated footings

3 **10 Hours**

EXPERIMENT 3

Design and detailing of Rectangular water tank

4 **10 Hours**

EXPERIMENT 4

Design and detailing of Elevated circular water tank

5 **10 Hours**

EXPERIMENT 5

Design and detailing of Cantilever retaining wall

6 **10 Hours**

EXPERIMENT 6

Design and detailing of Counterfort retaining wall

Total: 60 Hours

Reference(s)

1. krishnaraju, structural design and drawing, universities press, 2016
2. S.N.Sinha, reinforced concrete design, Tata Mcgraw hill education, 2018

21CE602 DESIGN OF STEEL STRUCTURES 3 0 0 3

Course Objectives

- To impart knowledge on Limit State Design Methods for steel Structures
- To impart knowledge on the codal provisions for the design of steel structures
- To impart knowledge on the design of connections, tension members, compression members, beams and roof trusses

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Calculate the strength of connections and design the bolted and welded connections.
2. Determine the strength of tension member and Design tension members, Splices & Lug angles.
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, Plate Girders, Roof trusses & Gantry girders
5. Execute Steel structure erection and also analyse the failures of structures.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1											
2	3	2	1											
3	3	2	1											
4	3	2	1											2
5	1	1	1										2	

UNIT I **9 Hours**

INTRODUCTION

Steel structures - Properties of steel - Working stress and Limit state design philosophy - Analysis and Design Methods - Structural steel sections - Types of connections - Design of bolted and welded connections - simple connections - Eccentric connections - Frame connections - Design of gusset plate connections - combined stresses - Prying action.

UNIT II **9 Hours**

TENSION MEMBERS

Introduction to Tension Members - behaviour of tension members - Plates under tension - Angles under tension - Design of tension members - Design of tension splices - Design of Lug Angles.

UNIT III **9 Hours**

COMPRESSION MEMBERS

Introduction to types of compression members - Theory of column - Design of Compression Members - Axially loaded columns - Design of lacings and battens - Design of column base: Slab Base - Gusseted Base.

UNIT IV **9 Hours**

FLEXURAL MEMEBERS

Introduction to Flexural Members, Beams, Beams with web openings, Plate Girders, Gantry Girders - Design of laterally supported and unsupported beams - Roof Trusses - Wind load on pitched roof trusses.

UNIT V **9 Hours**

CONSTRUCTION AND CASE STUDIES

Introduction - fabrication procedure - Sequence of Operation - Welded connections - Methods of welding - Defects in welds - Quality control in fabrication and erection - learning from failures: case studies - need for forensic studies - Tacoma Narrows Bridge - Millennium Bridge at London - Cleddau Bridge, Milford Haven, (UK) - Hyatt Regency Walkway Collapses

Total: 45 Hours

Reference(s)

1. N. Subramanian, Design of Steel Structures, Oxford University Press 2015.
2. S. K. Duggal, Limit State Design of Steel Structures, Tata , Mc Graw Hill Education Pvt Ltd, New Delhi, 2014.
3. S.S.Bhavakatti, Design of Steel Structures, IK publications, New Delhi, Third Edition 2017.
4. IS 800 - 2007, General Construction in Steel - Code of Practice, BIS, New Delhi
5. IS 875 (part 3) - 2015, Wind loads on Buildings and Structures, BIS, New Delhi
6. http://www.steel-insdag.org/TM_Contents.asp

21CE603 WATER SUPPLY AND WASTE WATER ENGINEERING 3 0 0 3

Course Objectives

- To impart knowledge on the quality and quantity of water.
- To select suitable method of water treatment and to find the capacity of water treatment plant.
- To deliver the knowledge on various systems of collection and treatment of municipal wastewater.
- To emphasize the need for sewage treatment and to impart training to design the various treatment units

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Estimate the quantity of water and analyse its quality parameters.
2. Design the coagulation, flocculation and sedimentation tanks including intake structures.
3. Design the filtration and disinfection units and select the typical distribution layout.
4. Estimate the quantity of sewage and analyse its characteristics to design sewers including storm water flow.
5. Design the various sewage treatment units including sludge disposal.

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	1										1	2
2	2	2	2										1	2
3	2	3	2										1	2
4	2	2	2										1	2
5	2	2	3										1	2

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 - Physical - chemical and microbiological examinations - Water borne diseases - BIS & WHO water standards

UNIT II **8 Hours**

SOURCE, CONVEYANCE AND TREATMENT OF WATER

Intake structures - Different types of intakes - Factors for selection and location of intakes - pipes - Design for the economical diameter of the rising main - Nomograms - 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 - Coagulation and Flocculation- Dosages - Chemical feeding - Flash mixing -Flocculators - Design of sedimentation tanks.

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- Design of Sewers - Sewer Materials - Non Silting and Non Scouring Velocities - Gradient- Empirical formulae. Manholes - Water seal system. Sewage farming, sewage sickness.

UNIT V **10 Hours**

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 - Concepts of Aerobic and Anaerobic activity - 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.

Total: 45 Hours

Reference(s)

1. Garg, S.K., Environmental Engineering Vol.I, Water Supply Engineering, Khanna Publishers, New Delhi, 2014.
2. Garg, S.K.,Environmental Engineering Vol.II, Sewage Disposal and Air Pollution Engineering, Khanna Publishers, New Delhi, 2014.
3. Birdie, G.S. and Birdie, J.S., Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, New Delhi, 1992.
4. Metcalf and Eddy., 1991.Waste water Engineering, Treatment, Disposal and Reuse, 3rd Edition, Tata McGraw Hill, New Delhi.
5. CPHEEO, 1980. Manual for water supply and treatment, Central Public Health and Environment Engineering Organization, Government of India, New Delhi.
6. CPHEEO, 1980. Manual for waste water collection and treatment, Central Public Health and Environment Engineering
7. Organization, Government of India, New Delhi.

21CE607 COMPUTER AIDED PLANNING AND MANAGEMENT LABORATORY

0 0 4 2

Course Objectives

- To impart knowledge on different concepts of construction planning, scheduling and controlling using primavera software.

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. 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.
k. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. List the basic tools of project management using software
2. Identify the bar chart of residential building for given task
3. Design the Activity and workers requirement for foundation
4. Explain the network for pumping station and analyse using critical path method
5. Exemplify the optimization resource in multi storied building construction using software

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2		3									1	2
2	2	3		1							1		2	3
3	1	3		2									2	1
4	1	2		3									1	2
5	2	1		3									2	3

1 **6 Hours**

EXPERIMENT 1

Basics concept of project management tools

2 **6 Hours**

EXPERIMENT 2

Draw the bar chart of residential building for given construction task

3 **6 Hours**

EXPERIMENT 3

Design the housing unit project extract from workers requirement for crash program

4 **6 Hours**

EXPERIMENT 4

Design the Activity and workers requirement for foundation

5 **6 Hours**

EXPERIMENT 5

Draw the commercial buildings for work- breakdown structure

6 **6 Hours**

EXPERIMENT 6

Design the network for pumping station and analyse using critical path method

7 **6 Hours**

EXPERIMENT 7

Determine the activity based on floating method for small scale project

8 **6 Hours**

EXPERIMENT 8

Estimate the expected activity duration in PERT network

9 **6 Hours**

EXPERIMENT 9

Determine the standard deviation in normal distribution for a project

10 **6 Hours**

EXPERIMENT 10

Design of optimization resource in multi storied building construction using software

Total: 60 Hours

Reference(s)

1. CADD Center manual, "Project planning and management by using MS Project" ,CADD Centre Training Services Pvt, 2010
2. Sengupta .B, Guha .H, construction management and planning, Tata Mcgraw Hill,New Delhi,2007
3. Sharma .S.C, "Construction engineering and management" ,Khanna Publishers,Delhi,2008.
4. Kumar Neeraj Jha, construction project management", Dorling Kindersley, New Delhi.2013.

21CE608 ENVIRONMENTAL ENGINEERING LABORATORY **0 0 4 2**

Course Objectives

- To provide basic knowledge on the various methods of analysis of water and waste water
- To emphasize the need for water and wastewater treatment

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d. 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.
j. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Determine the important quality parameters of drinking water
2. Analyze wastewater for its various strength characteristics.
3. Conclude the quality of drinking water/strength of wastewater with respect to I.S. limits and specifications

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2								2			2	3
2	2	2		3						2			2	3
3	1	2		3						2			2	3

1 **6 Hours**

EXPERIMENT 1

Determination of Acidity and Alkalinity in the given water/wastewater sample.

2 **8 Hours**

EXPERIMENT 2

Estimation of Hardness and Chlorides in the given water and wastewater sample.

3 **8 Hours**

EXPERIMENT 3

Analysis of Sulphates and Nitrates in the given sample.

4 **8 Hours**

EXPERIMENT 4

Estimation of available chlorine in Bleaching powder and chlorine demand for the given sample.

5 **6 Hours**

EXPERIMENT 5

Determination of pH, Turbidity and Colour for the given sample.

6 **8 Hours**

EXPERIMENT 6

Determination of optimum coagulant dosage for the given sample.

7 **8 Hours**

EXPERIMENT 7

Estimation of Dissolved Oxygen and Bio Chemical Oxygen Demand for the given water/wastewater sample.

8 **8 Hours**

EXPERIMENT 8

Determination of Chemical Oxygen Demand and Solids(Total and Dissolved - organic and inorganic solids) for the given water/wastewater sample.

Total: 60 Hours

Reference(s)

1. Garg, S.K., Environmental Engineering (Vol.I), Water Supply Engineering, Khanna Publishers, New Delhi, 2014.
2. Garg, S.K., Environmental Engineering (Vol.II),Sewage Disposal and Air Pollution Engineering, Khanna Publishers, New Delhi, 2014.
3. APHA,AWWA, WEF. Standard Methods for the Examination of water and Wastewater, 22nd Edition, Washington: American Public Health Association; 2012

21CE701 ESTIMATION COSTING AND QUANTITY SURVEYING

3 0 0 3

Course Objectives

- To impart fundamental knowledge on investigation of the site and selection of suitable foundation
- To make the students understand the methods of estimating the cost of buildings
- To know about the rate analysis and bill preparations
- To study about the specification writing
- To understand the valuation of land and buildings

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.

Course Outcomes (COs)

1. Perform rate analysis of materials of construction
2. Apply different types of estimates in different situations
3. Carry out analysis of rates and bill preparation at different locations
4. Demonstrate the concepts of specification writing
5. Estimate the total cost of construction and plan of building and Carry out valuation of assets

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3											
2	3	3	3	2										
3	3	3		2		1								
4	3			3	1								1	
5		3		3				3						

UNIT I **9 Hours**

BASICS OF ESTIMATION

General items of work in Building - Earthwork - Cement Concrete work - R.C.C. work - Stonework - Brickwork - Wood work - Ironwork - Flooring - Finishing work Standard units- Principles of working out quantities for detailed and abstract estimates - An approximate method of Estimating - Detailed Estimates of Buildings.

UNIT II **9 Hours**

COST ESTIMATION OF QUANTITIES OF MATERIALS

Earthwork excavation - Sand filling - Lime concrete - Cement concrete - R.C.C work - Cement mortar - Brickwork - Reinforced brickwork - Stone masonry - Plastering - Painting - Flooring - White and colour washing - Distempering - Varnishing - Woodwork - Centering - Shuttering and formwork for R.C.C works - AC sheet roofing, etc.

UNIT III **9 Hours**

ESTIMATION OF BUILDINGS

Load bearing and framed structures - Calculation of quantities of brickwork, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof - Estimating of a septic tank, soak pit - Sanitary and water supply installations - Water supply pipeline - Sewer line - Tube well - Open well - Estimate of bituminous and cement concrete roads.

UNIT IV **9 Hours**

SPECIFICATION AND TENDERS

Data - Schedule of rates - Analysis of rates - Specifications - sources - Preparation of detailed and general specifications - Tenders -Tamilnadu Tender Transparency Act - e-tender - Preparation of Tender Notice and Document - Contracts - Types of contracts - Drafting of contract documents - Arbitration and legal requirements.

UNIT V **9 Hours**

VALUATION

Valuation: Purpose of valuation, types of property- Depreciation, Sinking fund, Leasehold and freehold property, obsolescence, Gross income, Outgoing and Net income, Capitalized value and year"s purchase - Rental method of valuations - Typical problems - GST Rate for Construction and Building Materials - GST on Building.

FOR FURTHER READING

Special Foundations - Foundation on expansive soils -Reinforced earth

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, 2011.
2. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2004
3. Gurcharan Singh and Jagdish Singh "A Text Book of Estimating, Costing and Valuation", Standard Publishers Distributors, Delhi, 1998
4. K. S. Randwala and K.K. Rangwala "Elements of Estimating and Costing", Chavotar Publishing House, India, 1995

21CE702 HIGHWAY AND RAILWAY 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 railway planning, design and construction

Programme Outcomes (POs)

a. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Identify the concepts of highway alignment and the highway proposal
2. Design various cross sectional elements of highway and construction of flexible and rigid pavements as per the standards of Indian Road Congress (IRC)
3. Analyse the construction and maintenance of highways
4. Identify the basic components of railway track.
5. Characterize the techniques used in construction and maintenance of railway track

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1											
2	3	2	1											2
3	1	3	2										1	
4	1	3	1											
5	2	1												2

UNIT I **9 Hours**

HIGHWAY PLANNING AND ALIGNMENT

Introduction to highway - 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 [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), [Problems in SSD and OSD] - Geometric design of hill roads [IRC Standards Only] - Design principles of flexible and rigid pavements (IRC Recommendations - Problems)

UNIT III **9 Hours**

HIGHWAY CONSTRUCTION AND MAINTENANCE

Construction of WBM, 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 - Types of defects in flexible pavements and rigid pavements - Overlays - - Benkelman beam method - Roadside development and Arboriculture.

UNIT IV **9 Hours**

RAILWAY PLANNING AND DESIGN

Introduction - Engineering survey for track alignment- Permanent Way - Components and functions of each component - Gauges in railway tracks - Coning of wheels- Creeps and kinks - Geometric design of railway tracks -Gradient - Super-Elevation - Widening of gauges in curves

UNIT V **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 - Track Modernization - Automated maintenance and upgrading.

FOR FURTHER READING

Highway Development in India - Classification and cross section of urban and rural roads (IRC)- 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) Railways for Urban area - LRT & MRTS - Mono Rail - Metro Rail

Total: 45 Hours

Reference(s)

1. S. K. Khanna ,C. E. G. Justo, A.Veeraraghavan, Highway Engineering, Nem Chand and Bros., Roorkee, 2015 (tenth edition) ISBN 978-81-85240-80-0
2. K. P. Subramaniam, Highway, Railway, Airport and Harbour Engineering, Scitech Publications, Chennai, 2011, ISBN-13: 978-8183712712
3. IRC 37 - 2012, Guidelines for the Design of Flexible Pavements
4. S. C. Saxena and S. P. Arora, Railway Engineering, Dhanapat Rai Publications Pvt. Ltd., New Delhi, 2010.
5. S. K. Khanna and C. E. G. Justo, Highway Material Testing Manual, Nem Chand and Bros., Roorkee, 2009
6. L. R. Kadiyali, Principles and Practice of Highway Engineering, Khanna Publishers Ltd., New Delhi, 2017.ISBN No. 978-81-7409-220-X

21CE707 TRANSPORTATION ENGINEERING LABORATORY

0 0 4 2

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. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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.
m. Gradates will be able to apply technical skills and modern engineering tools with critical thinking and innovations for solving civil engineering problems.
n. Gradates will be able to design sustainable and smart infrastructure in the context of environmental, economical, and societal requirements and serve the community as ethical and responsible professionals.

Course Outcomes (COs)

1. Acquisition of skills in selecting the best highway alignment and the highway proposal
2. Planning of various highway cross sectional elements
3. Design flexible and rigid pavements as per IRC codes
4. Prepare Environmental Impact Assessment for any highway project
5. Better assessment of the proposals because of the cost-benefit analysis knowledge

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1		2	1										
2	1	1	2	3									1	
3	1		3	2										2
4	1		3	1										
5	1	2	1	3										

1 **3 Hours**

EXPERIMENT 1

Shape test on aggregates

2 **3 Hours**

EXPERIMENT 2

Aggregate Impact value

3 **3 Hours**

EXPERIMENT 3
Aggregate abrasion value test

4 **3 Hours**

EXPERIMENT 4
Aggregate Crushing value test

5 **3 Hours**

EXPERIMENT 5
Specific Gravity of Bitumen

6 **3 Hours**

EXPERIMENT 6
Penetration test for bitumen

7 **3 Hours**

EXPERIMENT 7
Ductility test for Bitumen

8 **3 Hours**

EXPERIMENT 8
Flash and fire point test

9 **3 Hours**

EXPERIMENT 9
Softening point test for Bitumen

10 **3 Hours**

EXPERIMENT 10
Viscosity test for Bitumen

Total: 30 Hours

Reference(s)

1. S. K. Khanna and C. E. G. Justo, Highway Material Testing Manual, Nem Chand and Bros. Roorkee, 2002
2. IS: 2386 PART -1 Aggregate Shape test
3. IS: 2386 PART -4 Aggregate Impact value
4. IS: 1203-1978 Penetration test
5. IRC Recommendations for aggregate and bitumen

21CE708 PROJECT WORK I 0 0 6 3

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. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. 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. 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
5. Prepare report and present the oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		1	1			2	1							
2	1	1	2	3		1					1	1		
3			1	1	2			1			1	2		
4		1		1	1	3	1	2	2					
5									1		2	1		

21CE801 PROJECT WORK II **0 0 18 9**

Course Objectives

- To develop knowledge to formulate a real world problem and project 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. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. 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 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. 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. 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. 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. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k. 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. 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
5. Prepare report and present the oral demonstrations

Articulation Matrix

CO No	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1		1	2			1	2							
2	1	2	3	2		2					1	2		
3			1	2	2			2			2	2		
4		1		2	1	2	1	2	2					
5									1		1	2		