M.E (Structural Engineering)

2021 Regulations, Curriculum & Syllabi

Stay Ahead

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

An Autonomous Institution Affiliated to Anna University - Chennai • Approved by AICTE • Accredited by NAAC with "A+" Grade

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BANNARI AMMAN INSTITUTE OF TECHNOLOGY
REGULATIONS 2021
(CHOICE BASED CREDIT SYSTEM)

Common to all M.E. / M.Tech. Degree Programmes

NOTE: *The regulations given hereunder are subject to amendments as may be decided by the Academic Council of the Institute 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. ELIGIBILITY FOR ADMISSION

(i) Candidates seeking admission to the First Semester of M.E./M.Tech. degree programmes will be required to satisfy the eligibility criteria for admission thereto prescribed by the Directorate of Technical Education, Chennai and Anna University, Chennai.

(ii) Students admitted under 'Full-Time' should be available in the departments during the entire duration of working hours (from morning to evening on a full-time basis) for the curricular, co-curricular and extra-curricular activities.

The full-time students should not attend any other full-time programme(s) / course(s) or take up any full-time job / part-time job during working hours in any institution or company during the period of the full-time programme. Violation of the above rules will result in the cancellation of admission to the PG programme.

2. DURATION OF THE PROGRAMME

(i) **Minimum Duration:** Master of Engineering (M.E.) / Master of Technology (M.Tech.) extends over a period of two years. The two academic years will be divided into four semesters, with two semesters per year.

(ii) **Maximum Duration**: A candidate shall complete all the passing requirements of M.E./M.Tech. programmes within a maximum period of 4 years / 8 semesters, these periods being reckoned from the commencement of the first semester to which the candidate was first admitted, regardless of the break-of-study availed.

3. BRANCHES OF STUDY

Following M.E./M.Tech. programmes are offered by the institute

M.E. Programmes

1. Communication Systems
2. Computer Science and Engineering

3. Embedded Systems
4. Industrial Automation and Robotics
5. Industrial Safety Engineering
6. Power Electronics and Drives
7. Software Engineering
8. Structural Engineering

M. Tech. Programme

9. Biotechnology

4. STRUCTURE OF PROGRAMMES

(i) **Curriculum:** Every post- graduate programme will have a curriculum with syllabi consisting of theory and practical courses that include

Program Core Courses (PCC) include the core courses relevant to the chosen specialisation.

Program Elective Courses (PEC) include the elective courses relevant to the chosen specialisation.

Research Methodology and IPR Course to understand the importance and the process of creation of patents through research.

Employability Enhancement Courses (EEC) include project work, practical courses, internship, mini project and industrial/practical training.

Audit Courses (AC) expose the students to Disaster Management, Yoga, English for Research Paper Writing, Value education, Pedagogy Studies, Stress Management, and Personality Development through Life Enlightenment Skills. Registration for any of these courses is optional to students.

(ii) **Project Work:** Every student, individually, shall undertake Dissertation Phase I during the third semester and Dissertation Phase II during the fourth semester under the supervision of a qualified faculty. The project work can be undertaken in an industrial / research organisation or institute in consultation with the faculty guide and the Head of the Department. In the case of project work at an industrial / research organisation, the same shall be jointly supervised by a faculty guide and an expert from the organisation. The student shall be instructed to meet the supervisor periodically and attend the review committee meetings to evaluate the progress.

(iii) **Elective Courses: Five Elective** courses are offered to the students admitted in various disciplines as prescribed in the curriculum to widen their knowledge in their specialisation area.

(iv) **Online Courses:** A Student may be permitted to credit online courses with the approval of a Departmental Consultative Committee constituted by the Head of the Department, subject to a maximum of six credits. Such students may be exempted

from attending the classes if such course(s) are offered in the semester. Summary of such online courses, taken by the students, along with the offering agency shall be presented to the Academic Council for information and further suggestions. However, the student needs to obtain certification from the agency offering the course to become eligible for writing or seeking exemption from the End Semester Examinations. In case of credits earned through online mode from the Institute / University, the credits may also be transferred directly after due approval from the Departmental Consultative Committee and the Controller of Examinations.

(v) **Industrial Training:** Every full-time student shall take up training in industry/research laboratories, under the supervision of a faculty guide during summer/winter vacation till the pre-final semester of the programme subject to the evaluation prescribed in Clause 15.

If industrial training/internship is not prescribed in the curriculum, the student may undergo industrial training/internship optionally, and the credits earned will be indicated in the Mark Sheet. If the student earns three credits in industrial training/internship, the student may drop one Program Elective in the III semester. In such cases, industrial training/internships need to be undergone continuously from one organisation only. However, if the number of credits earned is 1 or 2, these credits shall not be considered for the classification of the degree. The student is only allowed to undergo a maximum of 6 weeks of industrial training/internship during the entire duration of the study.

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

(vi) **Mini Project**: The students shall undertake a mini project individually in consultation with the respective faculty and Head of the Department, as specified in the curriculum. A student is expected to make a presentation about the mini-project during the final evaluation as given in Clause 15.

(vii) **Value Added / Certificate Courses:** Students can opt for any one of the value-added courses in II and III semesters, approved by the Academic Council. A separate certificate will be issued on successful completion of the course by the Controller of Examinations.

(viii) **Credit Assignment:** Each course is normally assigned a certain number of credits with 1 credit per lecture hour per week, 1 credit for 2 hours of practical per week, 1 credit for 1 hour of tutorial per week. The exact numbers of credits assigned to the different courses of various programmes are decided by the respective Board of Studies.

(ix) **Minimum Credits:** For the award of the degree, the student shall earn a minimum number of total credits as prescribed by the respective Board of Studies as given below:

S.No.	M.E./M. Tech. Programmes	Total Credits
1.	M.E. Communication Systems	68
2.	M.E. Computer Science and Engineering	68
3.	M.E. Embedded Systems	68
4.	M.E. Industrial Automation and Robotics	68
5.	M.E. Industrial Safety Engineering	68
6.	M.E. Power Electronics and Drives	68
7.	M.E. Software Engineering	68
8.	M.E. Structural Engineering	68
9.	M.Tech. Biotechnology	68

5. COURSE ENROLLMENT AND REGISTRATION

5.1 Each student, on admission, shall be assigned to a Faculty Advisor (vide Clause 7) who shall advise/counsel the student about the details of the academic programme and the choice of courses considering the student's academic background and career objectives.

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

5.3 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.

5.3.1 Each student on admission to the programme shall register for all the **courses prescribed in the curriculum** in the **first semester of study**.

5.3.2 The enrolment for all the courses of semester II will commence 10 working days prior to the last working day of the semester I. The student shall confirm the enrolment by registering for the courses within the first five working days after the commencement of semester II.

5.3.3 If a student wishes, the student may drop or add courses (vide Clause 5.5)

within **five** working days after the commencement of the semester concerned and complete the registration process duly authorised by the PG coordinator of the programme. In this case, if a student fails in a course, he/she may be permitted to register for the course in the subsequent semester or when it is offered.

5.3.4 A student who has passed all the courses prescribed in the curriculum for the award of the degree shall not be permitted to re-enrol to improve the student's marks in a course or the aggregate marks / CGPA.

5.4 Minimum Credits to Register for Project work

The Project work for M.E./M.Tech. consists of dissertation phase I and dissertation phase II. Dissertation phase I is to be undertaken during the III semester, and dissertation phase II, which is a continuation of phase I, is to be undertaken during the IV semester. Minimum 24 credits are required to be earned to enrol on dissertation phase I.

If a student fails to earn the requisite minimum credits, the student cannot enrol for dissertation phase I. In such a case, the student can enrol for the project work in a subsequent semester after earning the minimum credits specified.

5.5 Flexibility to Add or Drop courses

5.5.1 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 of the student's programme by opting for additional courses.

5.5.2 From the II to final semesters, the student has the option to register for additional courses or drop existing courses. The total number of credits that a student can add or drop is limited to 6, subject to a maximum of 2 courses. In such cases, the attendance requirement as stated in Clause 6 is mandatory.

The courses that a student registers in a particular semester may include:

i. Courses of the current semester and

ii. Courses dropped in the lower semesters.

The maximum number of credits that can be registered in a semester is 36. However, this does not include the number of Re-appearance (RA) and Withdrawal (W) courses registered by the student for the appearance of Examination.

5.6 Reappearance Registration

5.6.1 If a student fails in a theory course, the student shall do reappearance registration for that course in the subsequent semester or when it is offered next.

5.6.2 On registration, a student may attend the classes for the reappearance registration courses if the student wishes. However, the attendance requirement (vide Clause 6) is not compulsory for such courses.

5.6.3 The student who fails in any practical/mini project or any other EEC courses shall register for the same in the subsequent semester or when offered next and **repeat** the course. In this case, the student shall attend the classes, satisfy the attendance requirements (vide Clause 6) and earn continuous assessment marks.

5.6.4 The student who fails in dissertation phase I / II shall register for the same in the subsequent semester or when offered next and **repeat** the course. In this case, the student shall attend the classes, satisfy the attendance requirements (vide Clause 6), earn continuous assessment marks and appear for the end semester examinations. Reappearance registration is not available for such courses.

5.6.5 If a student is prevented from writing the end semester examination of a course due to lack of attendance, the student has to register for that course again, when offered next, attend the classes and fulfil the attendance requirements as per Clause 6.

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

A student who has fulfilled the following conditions (vide clause 6.1 and 6.2) shall be deemed to have satisfied the attendance requirements for appearing for the End Semester Examination of a particular course.

Each semester shall normally consist of 75 working days or 540 periods of each 50 minutes duration for the full-time mode of study.

6.1 Ideally, 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.

6.2 If a student secures attendance between 70% and 79% in any course in the current semester due to medical reasons (prolonged hospitalisation/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. Such certificates shall be forwarded to the Controller of Examinations for verification and permission to attend the examinations.

6.3 A student shall normally be permitted to appear for the end semester examination of a course if the student has satisfied the attendance requirements (vide Clause 6.1-6.2) and has registered for the examination in those courses of that semester by paying the prescribed fee.

6.4 A student who does not satisfy clauses 6.1 and 6.2 and secures less than 70% attendance in a course will not be permitted to write the end semester examination. The student has to register and repeat this course in the subsequent semester or when it is offered next (vide clause 5.6.4).

6.5 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 to improve grades/marks.

7. FACULTY ADVISOR

To help students plan their courses of study and for general advice on the academic programme, the Head of the Department of the students will attach a certain number of students to a teacher of the department, who shall function as a faculty advisor for those students throughout their period of study. The faculty advisor shall advise the students in registration and reappearance (Arrear) registration of courses, authorise the process, monitor their attendance and progress and counsel them periodically. If necessary, the faculty advisor may also discuss with or inform the parents about the progress/performance of the students concerned.

The responsibilities of the faculty advisor shall be:

i. To inform the students about the various facilities and activities available to enhance the student's curricular and co-curricular activities.

ii. To guide student enrolment and registration of the courses

iii. To authorise the final registration of the courses at the beginning of each semester.

iv. To monitor the academic and general performance of the students, including attendance, and to counsel them accordingly.

v. To collect and maintain the academic and co-curricular records of the students

8. COMMITTEES

8.1 Class Committee Meeting

i. For all the courses taught, prescribed in the curriculum, a class committee meeting shall be convened twice a semester, comprising faculty members handling all the courses and two student representatives from the class.

ii. One of the faculty members (not handling any courses to that class), nominated by the Head of the Department, shall coordinate the activities of

this Committee. During these meetings, the student members shall meaningfully interact and express their opinions and suggestions of all 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.

9. ASSESSMENT AND PASSING REQUIREMENTS

9.1 Assessment

The assessment will comprise continuous assessment and end semester examination, carrying marks as specified in the scheme (Clause 15). All assessments will be done on absolute marks basis. However, to report the performance of a student, letter grades and grade points will be awarded as per Clause 9.4.

9.2 End Semester Examinations

End semester examinations will normally be conducted as per the timetable circulated by the CoE's Office. A student will be permitted to appear for the end semester examination of a semester only if he/she completes the study of that semester satisfying the requirements given in Clause 5 and 6, and registers simultaneously for the examinations of the highest semester eligible and the courses, pertaining to that semester, that needs reappearance.

9.3 Employability Enhancement Courses

Every candidate shall submit reports on industrial training / mini-project, dissertation phase I and dissertation phase II on dates announced by the institute/department through the faculty guide to the head of the department. If a candidate fails to submit the reports of any of these courses not later than the specified date, he/she is deemed to have failed in it. The reports /papers shall be orally presented by the student before a team of experts consisting of an internal examiner, usually the supervisor, and an external examiner, appointed by the Controller of the Examination.

A candidate is permitted to register for dissertation phase II only after passing dissertation phase I. A candidate who fails in industrial training / mini-project, dissertation phase I or dissertation phase II shall register for redoing the same at the beginning of a subsequent semester.

9.4 Letter Grade and Grade Point

The letter grade and the grade point are awarded based on the percentage of total marks secured by a candidate in an individual course as detailed below:

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

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

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

After completion of the evaluation process, Semester Grade Point Average (SGPA) and Cumulative Grade Point Average 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.

9.5 A student can apply for revaluation of his/her semester examination answer paper in a theory course, within 3 working days from the declaration of results, along with prescribed application to the Controller of Examinations through the Head of Department. Revaluation is not permitted for laboratory courses, industrial training, and project works.

9.6 Passing a Course

A candidate who secures Grade Point 6 or more in any course of study will be declared to have passed that course, provided he/she secures a minimum of 50% of the total mark in the end semester examination of that course.

If a student fails to secure a pass in theory courses and laboratory courses in the current semester examination, he/she is allowed to write arrear examinations for the next three consecutive semesters, and their internal marks shall be carried over for the above mentioned period of three consecutive semesters.

In case if he/she has not completed all the courses of the semester I at the end of semester IV, he/she shall redo the semester I courses along with regular students. The same procedure shall be followed for the subsequent semesters of II, III and IV, subject to the maximum permissible period for this programme.

9.7 If a candidate fails in the end semester examinations of Phase 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 Phase II of M.E. / M.Tech., 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 the exam fee. If a student fails to resubmit the project report within the stipulated period and fails in the subsequent viva-voce examination, the student shall register for the course again in the subsequent semester.

10. REJOINING THE PROGRAMME

A candidate who has not completed the study of any of the semesters as per Clause 6 or who is allowed to rejoin the programme after the period of discontinuance or who on his/her own request is permitted to repeat the study of any semester (break of study), may join the semester which he/she is eligible or permitted to join, only at the time of its normal commencement for a regular batch of candidates and after obtaining the approval from the Director of Technical Education and Anna University, Chennai. In such a case, earlier continuous assessment in the repeated courses will be disregarded. However, no candidate will be allowed to enrol in more than one semester at any point of time.

11. QUALIFYING FOR THE AWARD OF THE DEGREE

A candidate will be declared to have qualified for the award of the M.E. / M.Tech. Degree provided:

i. He/she has completed the course requirements and has passed all the prescribed courses of study of the respective programme listed in Clause 3 within the duration specified in Clause 2.

ii. No disciplinary action is pending against the candidate.

12. CLASSIFICATION OF THE DEGREE AWARDED

12.1 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 four semesters in the student's First Appearance within two years (Three years in case of authorised break of study of one year (if availed)). Withdrawal from examination (vide Clause 13) 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.

12.2 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 four semesters within three years, including one year of authorised 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

12.3 Second Class:

All other students (not covered in clauses 12.1 and 12.2) who qualify for the award of the degree shall be declared to have passed the examination in the second class.

12.4 A student who is absent in the End Semester Examination in a course/project work after having registered for the same shall be considered to have appeared in that examination (except approved withdrawal from end semester examinations as per clause 13) for the purpose of classification.

13. WITHDRAWAL FROM EXAMINATION

13.1 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.

13.2 Withdrawal application shall be valid only if the student is eligible to write the examination as per Clause 6 and if such withdrawal request is made prior to the submission of marks of the continuous assessment of the course(s) with the recommendations from the Head of the Department.

13.3 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)

13.4 Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for first class with distinction or first class.

13.5 Withdrawal is permitted for the end semester examinations in the final semester only if the period of study the student concerned does not exceed 3 years for M.E. / M.Tech. as per clauses 12.1 and 12.2.

14. AUTHORISED BREAK OF STUDY FROM A PROGRAMME

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

14.2 A student who would like to avail the break of study, on account of short term employment / medical treatment / personal reasons) shall apply to the Head of the Institution through the concerned Head of the Department (application available with the Controller of Examinations), in any case, not later than the last date for registering for the semester.

14.3 The students permitted to re-join the programme after a break of study/prevention

due to lack of attendance shall be governed by the curriculum and regulations in force at the time of re-joining. A committee constituted by the Head of the Institution shall prescribe additional/equivalent courses, if any, from the regulation in force to bridge the requirement between the curriculum in force and the old curriculum.

14.4 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 2, irrespective of the period of break of study in order that he/ she may be eligible, for the award of the degree (vide Clause 11 and 12).

14.5 In case of any valid reasons for the extension of break-of-study, such 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 authorised break of study. Such extended break-of-study shall be counted for the purpose of classification of degree (vide clause 12).

14.6 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 enrolment. Such candidates are not entitled to seek readmission under any circumstances.

15. SCHEME OF ASSESSMENT

I	**THEORY COURSES**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Periodical Test I (15)	
	Periodical Test II (15)	
	Term Paper Report (10) & Presentation (10)	
	End Semester Examination	**50**
	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)	
	Lab Examination (10)	
	Viva-voce (10)	
	End Semester Examination	**50**
	(QP pattern as per (I))	
	Total Marks	**100**

III	**PRACTICAL COURSES**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Conduct of Experiment	
	i. Preparation (10)	
	ii. Experiment and Analysis of Results (20)	
	iii. Record (5)	
	Self-Learning Experiment (15)	
	Test - Cycle I (15)	
	Test - Cycle II (15)	
	Final Viva-voce (20)	
	Total Marks	**100**

IV	**DISSERTATION PHASE I**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Identification of topic and Justification (5)	
	Literature Survey (5)	
	Review II	
	Work plan & Approach (10)	
	Progress, Results and Discussion (10)	
	Review III	
	Conclusion (10)	
	Implementation & Applications (10)	

	End Semester Examination	
	Presentation (20)	**50**
	Report (10)	
	Viva Voce (20)	
	Total Marks	**100**

V	**DISSERTATION PHASE II**	**Marks**
	Continuous Assessment	**50**
	Distribution of marks for Continuous Assessment:	
	Review I	
	Work plan & Approach (10)	
	Review II	
	Progress (10)	
	Results and Discussion (10)	
	Review II	
	Conclusion (10)	
	Implementation & Applications *(10)*	
	End Semester Examination	
	Presentation (20)	**50**
	Report (10)	
	Viva Voce (20)	
	Total Marks	**100**

VI	**MINI PROJECT**	**Marks**
	Continuous Assessment	**100**
	Distribution of marks for Continuous Assessment:	
	Review I	**25**
	Review II	**25**
	Presentation & Viva voce	**50**
	Total Marks	**100**

VII	**INDUSTRIAL TRAINING / INTERNSHIP**	**Marks**
	Continuous Assessment	**100**
	Presentation	**30**
	Viva-voce	**30**
	Case study / Report	**40**
	Total Marks	**100**

VIII	**VALUE ADDED COURSES / CERTIFICATE COURSES (Continuous Assessment Only)**	**Marks**
	Test I	50
	Test II	50
	Grades: Excellent (>80) / Good (61≤Marks ≤ 80) / Satisfactory (50≤Marks ≤ 60))	

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

16. 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.

Vision of the Department

To educate the students to face the challenges pertaining to Civil Engineering by maintaining continuous sprit on creativity, innovation, safety and ethics

Mission of the Department

i. To prepare the students to learn beyond the syllabi and textbooks
ii. To train the students through periodical in-plant training and industrial visits
iii. To motivate the students to pursue higher education through competitive examinations
iv. To create a Centre of Excellence in the emerging areas of Civil Engineering
v. To give a broad education to the students on recent areas of development through interactions and camps

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

On successful completion of the two year ME degree programme quite a few years after graduation, our graduates will

I. Demonstrate necessary engineering and technical skills in applying the fundamental principles of Structural Engineering to solve complex real life issues related to analysis, design and maintenance of structures under various environmental conditions

II. Practice their profession with sound technical competency, leadership, communication, ethics and social responsibility for promoting sustainability in infrastructural development to feed the needs of global society

III. Explore themselves in the latest trends and innovations in Structural Engineering for life-long learning while performing quality research, consultancy works or professional jobs with a spirit of interdisciplinary teamwork

PROGRAMME OUTCOMES (POs)

Graduates will be able to:

PO1: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences.

PO2: Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety.

PO3: Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations.

PO4: Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society.

PO5: Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology.

PO6: Demonstrate management and business skills for undertaking civil engineering projects with an ability to engage in independent and lifelong learning.

MAPPING OF PEOs AND POs

POs / PEOs	1	2	3	4	5	6
I	X	X	X			X
II			X	X	X	X
III				X	X	X

M.E.STRUCTURAL ENGINEERING

Minimum credits to be earned: 68

First Semester								
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**	**Hours /Week**
		PEOs	**POs**					
21ST11	Research Methodology and IPR	III	5	2	0	0	2	2
21ST12	Structural Dynamics	I,II,III	1,2,3	3	0	0	3	3
21ST13	Advanced Reinforced Concrete Design	I,II.III	1,2,3	3	0	0	3	3
21ST14	Advanced Mechanics of Solids	I	1,2,3	3	0	0	3	3
	Program Elective I			3	0	0	3	3
21ST16	Structural Design Laboratory	I,II,III	1,2,3,5	0	0	4	2	4
21ST17	Advanced Concrete Laboratory	I,II,III	1,2,5	0	0	4	2	4
	Auditcourse1[1]			2	0	0	-	2
Total				**16**	**0**	**8**	**18**	**24**
Second Semester								
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**	**Hours /Week**
		PEOs	**POs**					
21ST21	Finite Element Analysis	I,II,III	1,2,3,5	3	0	0	3	3
21ST22	Advanced Steel Design	I,II,III	1,2,3	4	0	0	4	4
21ST23	Earthquake Resistant Design of Structures	I,II,III	2,3,4,5	3	0	0	3	3
	Program Elective II			3	0	0	3	3
	Program Elective III			3	0	0	3	3
21ST26	Numerical Analysis Laboratory	I,II,III	1,2,3,5	0	0	4	2	4
21ST27	Mini Project	I,II,III	3,4,5,6	0	0	4	2	4
	Audit course II[1]			2	0	0	-	2
Total				**18**	**0**	**8**	**20**	**26**

[1]Audit Course is optional

Third Semester								
Code No.	Course	Objectives & Outcomes		L	T	P	C	Hours /Week
		PEOs	POs					
	Program Elective IV			3	0	0	3	3
	Program Elective V			3	0	0	3	3
21ST33	Dissertation Phase I	I,II,III	1,2,3,4,5,6	0	0	20	10	20
Total				**6**	**0**	**20**	**16**	**26**

Fourth Semester								
Code No.	Course	Objectives & Outcomes		L	T	P	C	Hours /Week
		PEOs	POs					
21ST41	Dissertation Phase II	I,II,III	1,2,3,4,5,6	0	0	28	14	28
Total				**0**	**0**	**28**	**14**	**28**

List of Core Electives								
Code No.	Course	Objectives & Outcomes		L	T	P	C	Hours /Week
		PEOs	POs					
21ST51	Theory of Structural Stability	I,II,III	1,2,3	3	0	0	3	3
21ST52	Design of Steel-Concrete Composite Structures	I,II,III	2,3,5	3	0	0	3	3
21ST53	Design of Pre-stressed Concrete Structures	I,II,III	2,3,5	3	0	0	3	3
21ST54	Design of Bridges	I,II,III	1,2,3	3	0	0	3	3
21ST55	Prefabricated Structures	I,II,III	1,2,3	3	0	0	3	3
21ST56	Theory and Applications of Cement Composites	I,II,III	1,2,3,5	3	0	0	3	3
21ST57	Design of Industrial Structures	I,II,III	2,3,4,5	3	0	0	3	3
21ST58	Advanced Design of Foundations	I,II,III	1,2,5	3	0	0	3	3
21ST59	Structural Health Monitoring	I,II,III	1,4,5	3	0	0	3	3
21ST60	Theory of Plate and Shells	I,II,III	1,2,3	3	0	0	3	3
21ST61	Maintenance and Rehabilitation of Structures	I,II,III	1,4,5	3	0	0	3	3
21ST62	Design of Formwork	I,II,III	1,2,3	3	0	0	3	3
21ST63	Analysis and Design of Tall Buildings	I,II,III	1,2,3,5	3	0	0	3	3
21ST64	Soil Structure Interaction	I,II,III	1,2,5	3	0	0	3	3

21ST65	Experimental Stress Analysis and Techniques	I,II,III	1,3,5	3	0	0	3	3
List of Audit courses I & II								
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**	**Hours /Week**
		PEOs	**POs**					
21XE01	English for Research Paper Writing	II,III	5,6	2	0	0	-	2
21XE02	Cost Management of Engineering Projects	I,III	3,5,6	2	0	0	-	2
21XE03	Stress Management	II,III	3,5,6	2	0	0	-	2
21XE04	Disaster Management	III	5,6	2	0	0	-	2
21XE05	Value Education	II,III	5,6	2	0	0	-	2
21XE06	Pedagogy Studies	I,III	1,2,5,6	2	0	0	-	2
21XE07	Business Analytics	II,III	5,6	2	0	0	-	2

21ST11 RESEARCH METHODOLOGY AND IPR 2 0 0 2

Course Objectives

- To impart knowledge on sampling methods, data collection methods and on statistical analysis of data
- To familiarize the research methods and the preparation of reports

Programme Outcomes (POs)

- a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
- e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Identify various methods and techniques related to the research process
2. Infer the laws and theories of research methods
3. Analyse the data by different approaches
4. Indicate the steps and methods for writing thesis report
5. Understand the procedure and guidelines for filing the patent

UNIT I **6 Hours**

OBJECTIVES AND TYPES OF RESEARCH

Motivation and objectives - Research methods vs. Methodology - Types of research - Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical- Research Formulation - Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem - Literature review- Primary and secondary sources - reviews, treatise, monographs - patents - web as a source - searching the web - Critical literature review - Identifying gap areas from literature review- Development of working hypothesis.

UNIT II **6 Hours**

RESEARCH DESIGN AND METHODS

Research design - Basic Principles - Need of research design - Features of good design - Important concepts relating to research design- Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models. Developing a research plan - Exploration, Description, Diagnosis, Experimentation. Determining experimental and sample designs.

UNIT III **6 Hours**

DATA COLLECTION METHODS AND STATISTICAL ANALYSIS

Data Analysis - Factor Analysis - Cluster Analysis - Discriminant Analysis - Multiple Regression and Correlation - Canonical Correlation - Application of Statistical (SPSS) Software Package in Research. Data Analysis - Factor Analysis - Cluster Analysis - Discriminant Analysis - Multiple Regression and Correlation - Canonical Correlation - Application of Statistical (SPSS) Software Package in Research.

UNIT IV **6 Hours**

REPORTING AND THESIS WRITING

Structure and components of scientific reports - Types of report - Technical reports and thesis - Significance - Different steps in the preparation - Layout, structure and Language of typical reports - Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation - Planning - Preparation - Practice - Making presentation - Use of visual aids - Importance of effective communication.

UNIT V **6 Hours**

INTELLECTUAL PROPERTY RIGHTS

Patents - Designs, Trade and Copyright - Process of patenting and Development: technological Research - Innovation - Patenting - Development - International Scenario: International corporation on Intellectual Property - Procedure for grants and patents - Patenting under PCT.

Total: 30 Hours

Reference(s)

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. C. R. Kothari, Research Methodology, Methods and Techniques, New Age International, 2008
3. R. Pannerselvam, Research Methodology, Prentice Hall India, New Delhi, 2008
4. Ranjit Kumar, Research Methodology: A Step by Step Guide for Beginners, SAGE Publications,2014
5. Donald R. Cooper and Ramela S. Schindler, Business Research Methods, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2000
6. C.R.Kothari, Research Methodology, Wishva Prakashan, New Delhi, 2001

21ST12 STRUCTURAL DYNAMICS 3 0 0 3

Course Objectives

- To expose the students, the principles and methods of dynamic analysis of structures.
- To prepare them for designing the structures for wind, earthquake and other dynamic loads.

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Outline the principle involved in structural dynamics
2. Determine the two degree of freedom and multi degree of freedom under the forced and free vibration with iteration methods and its applications
3. Evaluate Fourier series expression loading by Duhamels Integral, vibration analysis by Rayleigh Ritz method and Earthquake response analysis of Multi DOF system

4. Describe the vibration of springs for free flexural and free longitudinal vibration of simply supported beam and other end conditions with finite element method
5. Compute damping and vibration parameter in MDOF system with Direct integration method, central difference method, Wilson method and New mark

UNIT I **9 Hours**

PRINCIPLES OF STRUCTURAL DYNAMICS

Overview of Structural Dynamics - Degree of freedom, Simple harmonic motion, Newtons second law of motion, D-Alemberts principle, Energy method, Equation of motion for SDOF system, Damped and un-damped free vibration and forced vibration, Logarithmic decrement, Effects of Damping.

UNIT II **9 Hours**

MULTI DEGREE OF FREEDOM SYSTEMS

Dynamics of Multi-Degree of Freedom Systems - Lagrange"s equations-equations of motion for MDOF Systems-Algebraic eigenvalue problem and free vibration analysis; Undamped and damped normal modes; Mode superposition techniques- Applications; Mode-truncation and correction for the missing mass.

UNIT III **9 Hours**

RESPONSE TO GENERAL DYNAMIC LOADING

Fourier series expression for loading (blast or earthquake) - Duhamel"s integral, vibration analysis by Rayleigh"s method, Rayleigh - Ritz method - Earthquake response analysis of Multi - DOF systems subjected to earthquake ground motion -Idealization of multi- storeyed frames.

UNIT IV **9 Hours**

DYNAMIC RESPONSE OF CONTINUOUS SYSTEMS

Vibration of springs -Free longitudinal vibration of a bar -Free flexural vibration of simply supported beams and beams with other end conditions -Vibration analysis using finite element method for beams and frames.

UNIT V **9 Hours**

DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE

Introduction -Damping in MDOF systems - Nonlinear MDOF systems -Direct integration methods -The central difference method -Wilson method -New mark"s method -measurement of damping and vibration techniques - Application of structural dynamics in the design of block and frame foundations.

Total: 45 Hours

Reference(s)

1. Roy R.Craig, Jr, Andrew J. Kurdila, "Fundamentals of Structural Dynamics", John Wiley& Sons. 2011.
2. S. Chandrasekaran and Gaurav. 2017. Analysis and design of structures under special loads including fire-resistant design, Springer, Singapore
3. S. Chandrasekaran, Federico Carannante, Giorgio Serino. 2009. Design aids of RC structures under Seismic loads, CRC Press, Florida.
4. Mario Paz, Structural dynamics, CBS Publishers 1987.

5. Anil K. Chopra, Dynamics of structures: Theory and applications to earthquake Engineering, PHI Ltd., 1997.
6. Manickaselvam, V.K., "Elementary Structural Dynamics", Dhanapat R ai& Sons, 2001.

21ST13 ADVANCED REINFORCED CONCRETE DESIGN

3 0 0 3

Course Objectives

- To enhance the confidence level of students to design the special structural elements as per Indian standard code of practices.
- To impart knowledge on the limit state design of RC Structural components
- To impart knowledge on the limit state design of RC Structural components

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Design of RC beam for serviceability conditions and design of column as per IS 456
2. Design and detailing of special RC elements
3. Analysis of RC slab using yield line theory and design of flat slab and grid floor
4. Design of RC walls and concepts of ductile detailing
5. Evaluate the RC section with moment redistribution and ultimate load analysis

UNIT I **9 Hours**

LIMIT STATE DESIGN OF BEAMS AND COLUMNS

Design of beam Section subjected to the combined action of bending moment, transverse shear and torsion. Parameters considered in limit state of serviceability - Calculation of deflections in beams under working loads - Calculation of crack width in beams. Design of columns subjected to axial, uniaxial and biaxial moment using interaction charts.

UNIT II **9 Hours**

DESIGN OF SPECIAL R.C. ELEMENTS

Design and detailing of Deep beams - Corbels - Spandrel beams - Continuous beams. Approximate analysis and design of beams circular in plan - Design of curved beams

UNIT III **9 Hours**

DESIGN OF SLABS AND YIELD LINE THEORY

Yield line theory of slabs - Virtual work method - Equilibrium methods - Hillerborg method of design - Design of flat slabs - Design of grid floors as per IS456-2000

UNIT IV **9 Hours**

DESIGN OF R.C WALL AND DUCTILE DETAILINGÃ‚Â

Design of RC walls - Shear walls. Concepts of ductility- Factors influencing ductility - Design principles and codal provisions.

UNIT V **9 Hours**

ULTIMATE LOAD ANALYSIS AND INELASTIC BEHAVIOR

Whitney""s theory - Ultimate load analysis - Moment redistribution and moment rotation characteristics of a R.C. section - Plastic hinges check for rotation capacity of sections. Concept of moment - rotation curves. Design and detailing of multi-storey building using manual and software analysis instead of ultimate load analysis and inelastic behaviour.

Total: 45 Hours

Reference(s)

1. S. Unnikrishna Pillai and DevadasMenon, Reinforced Concrete Design, Tata McGraw Hill Education, 2011
2. P.C. Varghese, Advanced Reinforced Concrete Design, Prentice Hall International Edition, 2006
3. N. Krishnaraju, Advanced Reinforced Concrete Design, CBS Publishers and Distributors, 2000
4. R. Park and T. Paulay, Reinforced Concrete Structures, John Wiley Sons, 2008
5. Gambhir, M.L. Design of Reinforced Concrete Structures, Prentice Hall of India, 2012
6. S.N. Sinha, Handbook of Reinforced Concrete Design, Tata McGraw Hill Education, 2004

21ST14 ADVANCED MECHANICS OF SOLIDS 3 0 0 3

Course Objectives

- To understand the concept of 3D stress-strain analysis and its applications to simple problems
- To give an exposure on the plastic behavior of materials

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Analyze the stress and strain for two and three dimensional structures
2. Discriminate the Equilibrium equations in terms of displacements - compatibility equations for different degree of polynomial
3. Examine the displacements for symmetrical stress distribution and Bending of a curved bar
4. Evaluate the torsional moment of shafts of circular and noncircular and various elements
5. Analyse the structure by theories of failures and calculate stress distribution of elasto-plastic problems of beams

UNIT I **9 Hours**

ANALYSIS OF STRESS AND STRAIN

Analysis of stress (two and three dimension)- Body force, surface force - Uniform state of stress - Principal stresses - stress transformation laws - Differential equations of equilibrium. Analysis of strain (two and three dimension) Strain displacement relations - state of strain at a point - strain transformation - principal strain - principle of superposition. Stress - strain relations- Compatibility equations - generalized Hookes law: Anisotropic elasticity, Isotropic Elasticity, Orthotropic materials - Lames constants

UNIT II **9 Hours**

TWO DIMENSIONAL PROBLEMS IN CARTESIAN COORDINATES

Methods of formulation of elasticity problems - Equilibrium equations in terms of displacements - compatibility equations - Boundary value problems. Plane stress and Plane strain problems - Airy''s stress function - polynomials Direct method of determining Airy''s polynomial stress function - solution of Biharmonic equation - St. Venants principle- two dimensional problems in Cartesian Coordinates- bending of a cantilever loaded at end

UNIT III **9 Hours**

TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES

Equilibrium equations in polar coordinates - Conversion of cylindrical polar to rectangular Cartesian equation- stress distribution symmetrical about an axis - pure bending of curved bars - strain components in polar coordinates - displacements for symmetrical stress distribution - Rotating Disc - Bending of a curved bar by force at the end - Effect of circular hole on stress distribution - Forces on wedges

UNIT IV **9 Hours**

TORSION OF PRISMATIC BARS

General solutions of the problem by displacement (St. Venant''s warping function) and force (Prandtl''s stress function) approaches - Membrane Analogy-Torsion of shafts of circular and non-circular (elliptic, triangular and rectangular) cross sectional shapes. Torsion of thin rectangular section - Torsion of thin walled single and multi-celled sections.

UNIT V **9 Hours**

INTRODUCTION TO PLASTICITY

Introduction to stress-strain curve - Rate of loading- Visco elastic material - Ideal plastic body - criterion of yielding -Theories of failure - yield surface - Flow rule (plastic stress- strain relation) Prandtl Reuss equations - Plastic work - Plastic potential - uniqueness of stress distribution - Elastoplastic problems of beams in bending- thick hollow spheres and cylinders subjected to internal pressure - General relations - plastic torsion - Nadai''s sand heap analogy.

Total: 45 Hours

Reference(s)

1. S. Timoshenko and J. N. Goodier, Theory of Elasticity, McGraw Hill Book Co., 2007
2. Sadhu Singh, Theory of Elasticity, Khanna Publishers, New Delhi, 2005
3. Sadhu Singh, Theory of Plasticity, Khanna Publishers, New Delhi, 2008
4. P. C. Chow and N. J. Pagano, Elasticity, Tensor, Dyadic and Engg. Approaches, D.Vannostrard Co., New York, 1992
5. L. S. Srinath, Advanced mechanics of solids, Tata McGraw Hill Publishing Company Ltd, 2006
6. T. Chakrabarthy, Theory of Plasticity, McGraw Hill Book Co., New Delhi, 2006

21ST16 STRUCTURAL DESIGN LABORATORY 0 0 4 2

Course Objectives

- To train the students in the application of computer software for the analysis and design of structures
- To train the students in the application of programming for the analysis and design of structures

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. The students will be able to develop computer programs for the analysis of structures and design of RC structural components.
2. Students will be able to use computer software packages for the analysis and design of structures

1 **7 Hours**

EXPERIMENT 1

Computer Aided Analysis and Design of a 2D steel truss.

2 **7 Hours**

EXPERIMENT 2

Computer Aided Analysis and Design of a 3D steel truss.

3 **10 Hours**

EXPERIMENT 3

Computer Aided Analysis and Design of Symmetrical Building Frames (Gravity Load, Earthquake load and wind load)

4 **12 Hours**

EXPERIMENT 4

Computer Aided Analysis and Design of Unsymmetrical Building Frames (Gravity Load, Earthquake load and wind load)

5 **12 Hours**

EXPERIMENT 5

Computer Aided Analysis and Design of Water tanks

6 **12 Hours**

EXPERIMENT 6

Computer Aided Analysis and Design of Overhead water tanks

Total: 60 Hours

21ST17 ADVANCED CONCRETE LABORATORY 0 0 4 2

Course Objectives

- To impart training to student on concrete mix design and determination of properties of concrete in fresh and hardened states
- To impart training on NDT Testing of concrete
- To study the strength and behavior of RC Beams
- To study the behavior of model structural components subjected to vibration

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Design the concrete mix for field requirements
2. Demonstrate the properties of concrete in fresh and hardened state
3. Characteristic behavior of self-compacting concrete and steel frame by using various methods

1 **6 Hours**

EXPERIMENT 1

Mix design for high strength concrete and properties of fresh concrete (Design the high strength)

2 **6 Hours**

EXPERIMENT 2

Tests on mechanical properties of hardened concrete

3 **6 Hours**

EXPERIMENT 3

Tests on durability of concrete

4 **7 Hours**

EXPERIMENT 4

Method of manufacture and test on self-compacting concrete

5 **7 Hours**

EXPERIMENT 5
Method of manufacture and test on self-curing concrete

6 **7 Hours**

EXPERIMENT 6
Effect of different types of curing on strength of concrete

7 **7 Hours**

EXPERIMENT 7
Casting and testing of simply supported reinforced concrete beam for strength and deflection behavior

8 **7 Hours**

EXPERIMENT 8
Non-destructive testing of concrete using
i. Rebound hammer
ii. Ultra sonic pulse velocity method

9 **7 Hours**

EXPERIMENT 9
Tests on the behavior of model frames under vibration

Total: 60 Hours

21ST21 FINITE ELEMENT ANALYSIS 3 0 0 3

Course Objectives

- To educate the students to analyse by flexibility and stiffness method pin jointed trusses, continuous beams, grids and rigid jointed frames.
- To educate the students with the available latest software packages used practically for analysis of structures

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations
d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Predict the displacement, stress and strain of elements after idealizing by finite element method
2. Analyse the internal forces for beams, frames and trusses subjected to different boundary conditions by discretizing the members into small elements.
3. Analyse 2-D for complex geometry problems.
4. Apply the finite element method to form the stiffness matrix for plates and shells.
5. Identify the appropriate mesh shape and size for reliable results

UNIT I **9 Hours**

INTRODUCTION TO FINITE ELEMENT ANALYSIS

Introduction: Basic concepts of finite element analysis - Steps involved in finite element analysis - one, two and three dimensional elements - Shape functions - Convergence Requirements - Energy Principles and Method of Weighted Residuals: Variational principles - Rayleigh Ritz method - Method of collocation - Sub domain method - Galerkin''s method - Method of least squares.

UNIT II **9 Hours**

FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL ELEMENT

Continuity requirement -Truss/rod/shaft, beam bending- Locking in shear deformable beam elements and solution -Modeling of framed structures- Skewed boundary conditions; constraint equations- Rules for monotonic convergence of the finite element solution

UNIT III **9 Hours**

FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL ELEMENTS

Plane Stress and Plane Strain Problems Constant Strain Triangle Element stiffness matrix Higher Order Triangular Elements Comparison of different methods Rectangular Element Serendipity family Lagrangian family Hermitian family - Isoparametric Elements and Axisymmetric Elements Sub Iso-super parametric elements Shape functions mapping Linear Isoparametric quadrilateral Simple problems

UNIT IV **9 Hours**

FINITE ELEMENT ANALYSIS OF THREE DIMENSIONAL ELEMENTS, PLATES AND SHELLS

Axisymmetric stress analysis Three Dimensional Elements Tetrahedron element family Hexahedron element family ZIB8 and ZIB20 elements Comparison.Plate Bending Problems: Basic concepts - Derivation of element stiffness matrix - Four noded, eight noded rectangular and iso-parametric element - BFS element - Effect of shear deformation in plates - Introduction to finite strip method - Application to folded plates. Shell elements: Concepts of shell elements - Degenerated shell elements - Derivation of stiffness matrix for degenerated shell elements.

UNIT V **9 Hours**

APPLICATIONS IN STRUCTURAL ENGINEERING

Consistent mass matrix; Lumping procedures; Algebraic eigen value problem; Time-marching schemes; Adequacy of the finite element mesh, Applications in analysis of deep beams, corbels.

Total: 45 Hours

Reference(s)

1. S. Rajasekaran, Computational methods of Structural mechanics, Prentice Hall, 2006
2. O. C. Zienkiewinz, The Finite Element Method Vol. 1 & 2, TMH, New York, 2002
3. Daryl L Logan, A First Course in the Finite Element Method, Cengage Learning, 2012
4. K. J. Bathe, Finite Element Procedure, Prentice Hall of India, and New Delhi, 2007

21ST22 ADVANCED STEEL DESIGN 4 0 0 4

Course Objectives

- To impart knowledge in the design of bolted and welded connections.
- To impart knowledge in the design of industrial structures, transmission towers and light gauge Section.
- To impart knowledge on the plastic analysis and design of hyper static steel structures.

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Design the bolted and welded connections at the junctions.
2. Analyze include all different loads acting on structure and design the multistoried industrial building.
3. Compute the internal forces and design the special steel structural elements.
4. Analyze the cold formed steel sections and design by effective width method
5. Identify the plastic hinge location and design members by plastic hinge mechanism

UNIT I **12 Hours**

DESIGN OF STRUCTURAL ELEMENTS AND CONNECTIONS

Design of high strength function grip bolts -Design of bolted connections at the junctions of beams and columns in frames -Design of un-stiffened & stiffened seat connections -Welded connections -eccentric connections -Beam end connections -Direct web fillet welded connections -Direct Web Butt welded connection -Double plate web connection -Double angle web connection -Un-stiffened and stiffened seat connection -Moment resistant connection -T stub connections.

UNIT II **12 Hours**

INDUSTRIAL BUILDING

Industrial building frames -wind load analysis - Calculation of wind load and its combination - Framing Roof Bracing - Analysis of Trussed bents - Design example - Design of rigid joints knee for gable frames - Structure of Multi-storeyed Buildings - Design of plate girder - Design of column base plate - Design of pre engineering building and connection details

UNIT III **12 Hours**

ANALYSIS AND DESIGN OF SPECIAL STRUCTURES

Design of steel bunkers and silos -Janssen"s theory - Airy"s theory -design parameters-design criteria. Design and detailing of self-supporting and guyed steel chimneys. Transmission line towers. Types of towers and design of foundation -tower configuration, Load analysis and design of members

UNIT IV **12 Hours**

LIGHT GAUGE SECTIONS

Concepts -Design of cold formed sections -effective width -stiffened sections -multiple stiffened sections -design of light gauge beams and columns - Torsion & Flexural buckling -composite decks

UNIT V **12 Hours**

PLASTIC ANALYSIS AND DESIGN

Concept of plastic analysis -Theory of plastic bending -Plastic hinge - Redistribution of moments - Failure mechanisms -plastic analysis and design of fixed beams, continuous beams and portal frames by mechanism method.

Total: 60 Hours

Reference(s)

1. N. Subramanian, Steel Structures Design and Practice, Oxford University Press 2011.
2. S. K. Duggal, Limit State Design of Steel Structures, McGraw Hill, 2014.
3. IS 800 - 2007, General Construction in Steel - Code of Practice (Third revision).
4. IS 811 - 1987, Specification for cold formed light gauge structural steel sections
5. IS 9178 (Part 1) - 1989, Design and construction of steel chimney code of practice.
6. IS 9178 (Part 2) - 1979, Criteria for design of steel bins for storage of bulk materials.

21ST23 EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

3 0 0 3

Course Objectives

- To study the analysis and design of earthquake resistant structures
- To understand the concept of providing ductility to structures for making it earthquake resistant

Programme Outcomes (POs)

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations
d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Interpret the performance and response of the structure during an earthquake
2. Attribute the design philosophies on strength and serviceability factors by considering the building irregularity
3. Analyze the structures subjected to earthquake loading by different methods
4. Design the RCC structures as earthquake resistant based upon the strong column weak beam concept
5. Design the various elements of steel structures as earthquake resistant

UNIT I **9 Hours**

EARTHQUAKE AND GROUND MOTION

Seismic performance of structures and structural components during earthquakes - Ground motion parameters - Response spectrum - design spectrum

UNIT II **9 Hours**

SEISMIC DESIGN PHILOSOPHY

Concept of strength, over strength and ductility - Concept of equal displacement and equal energy principles - Capacity design - Seismic design consideration in buildings with irregularities - Seismic resistance methods - Floating foundation - Shock absorption

UNIT III **9 Hours**

SEISMIC ANALYSIS OF BUILDINGS

Equivalent static analysis - Response spectrum analysis - Mode superposition method - Time history analysis - Modelling concept of reinforced concrete building

UNIT IV **9 Hours**

SEISMIC DESIGN OF BUILDING COMPONENTS

Seismic resistant properties of reinforced concrete - Seismic behavior and design of linear reinforced concrete Elements - Seismic behavior of planar reinforced concrete elements - IS1893(PART-I) - 2002

UNIT V **9 Hours**

SEISMIC PROVISIONS FOR STRUCTURAL STEEL BUILDINGS

Materials, connections joints and fasteners- Columns, ordinary, intermediate and special moment resisting Frame - Concentrically and eccentrically braced frames

Total: 45 Hours

Reference(s)

1. S.K.Duggal, Earthquake Resistant Design of Structures, Oxford, Second Edition, 2013
2. Aggarwal P, Earthquake Resistant Design of Structures, Prentice Hall India Learning Private Limited, 2006
3. Bruce A Bolt, Earthquakes, W H Freeman and Company, New York, 2004.
4. Mohiuddin Ali Khan, Earthquake-Resistant Structures: Design, Build and Retrofit, Elsevier Science & Technology, 2012.
5. C. A. Brebbia, Earthquake Resistant Engineering Structures VIII,WIT Press, 2011.
6. Paulay,T and Priestley, M.J.N., Seismic Design of Reinforced Concrete and Masonry buildings, John Wiley and Sons, 1992.

21ST26 NUMERICAL ANALYSIS LABORATORY 0 0 4 2

Course Objectives

- To train the students in the application of computer software's for the analysis and design of structures
- To train the students in the application of programming for the analysis and design of structures

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations
d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology
f. Demonstrate management and business skills for undertaking civil engineering projects with an ability to engage in independent and lifelong learning

Course Outcomes (COs)

1. The students will be able to develop computer programs for the analysis of structures and design of RC structural components.
2. Students will be able to use computer software packages for the analysis and design of structures

1 **8 Hours**

EXPERIMENT 1
Finite Element Analysis of Singly reinforced beams

2 **8 Hours**

EXPERIMENT 2
Finite Element Analysis of Doubly reinforced beams

3 **8 Hours**

EXPERIMENT 3
Finite Element Analysis of Rectangular Columns

4 **8 Hours**

EXPERIMENT 4
Finite Element Analysis of Deep Beams

5 **9 Hours**

EXPERIMENT 5
Finite Element Analysis of 2D steel truss.

6 **9 Hours**

EXPERIMENT 6

Finite Element Analysis of 3D steel truss.

7 **10 Hours**

EXPERIMENT 7

Finite Element Analysis of Multi-storeyed building frame.

Total: 60 Hours

21ST27 MINI PROJECT 0 0 4 2

Course Objectives

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society

e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

f. Demonstrate management and business skills for undertaking civil engineering projects with an ability to engage in independent and lifelong learning

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

Total:60 Hours

21ST33 DISSERTATION PHASE I 0 0 20 10

Course Objectives

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society

e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

f. Demonstrate management and business skills for undertaking civil engineering projects with an ability to engage in independent and lifelong learning

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

Total: 150 Hours

21ST41 DISSERTATION PHASE II 0 0 28 14

Course Objectives

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society

e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

f. Demonstrate management and business skills for undertaking civil engineering projects with an ability to engage in independent and lifelong learning

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

Total: 210 Hours

21ST51 THEORY OF STRUCTURAL STABILITY 3 0 0 3

Course Objectives

- To understand the behavior of structures based on the concept of strength and stability
- To impart Knowledge in phenomenon of buckling and its effects on structural components

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Identify the type of equilibrium and failure pattern in structures
2. Compute the critical load of columns at different end conditions by various methods
3. Compare the beam/column joint in structure by various methods
4. Find the lateral buckling behavior of various elements by differential equations
5. Show the failure pattern in thin and thick plates

UNIT I **9 Hours**

FUNDAMENTAL CONCEPTS OF STABILITY

Criterion for design of structures: Strength, stability and stiffness-Concepts of stability- Methods of Neutral Equilibrium

UNIT II **9 Hours**

BUCKLING OF COLUMNS

Governing differential equations - Higher order differential equations -Analysis for various boundary conditions - Behavior of imperfect column - initially bent column - eccentrically loaded column - Energy method - Rayleigh Ritz, Galerkin methods - Effect of shear on buckling - Large deflection analysis of columns

UNIT III **9 Hours**

BUCKLING OF BEAM-COLUMN

Buckling of beam column - Derivation of stability function for standard cases of beam columns: Beam - columns with concentrated lateral loads - distributed loads - effect of axial loads on bending stiffness. Buckling of frames: Mode of buckling- Single storey frames with sway and no sway; Buckling analysis of frames with various methods: Slope deflection and Stiffness methods.

UNIT IV **9 Hours**

BUCKLING OF FRAMES

Introduction-modes of buckling-critical load using various methods Neutral equilibrium-slope deflection equations, matrix method.

UNIT V **9 Hours**

STABILITY OF PLATES

Differential equation of plate buckling-critical load on plates with various boundary condition-energy method-finite difference method.

Total: 45 Hours

Reference(s)

1. Timoshenko and Gere. Theory of elastic stability, McGraw Hill Book Company, 1981
2. AlexandarChajes, Principles of Structural Stability Theory, Prentice Hall, New Jersey, 1980
3. Iyenger, N.G.R. Structural Stability of columns and plates, Affiliated East west press Pvt Ltd., 1990
4. Chajes,"principle of structures stability theory",prentice hall,1974.
5. Gambhir, "stability Analysis and design of structure"springer,new york,2004
6. Simister G J and Hodges DH," Fundamental of structure stability",2006

21ST52 DESIGN OF STEEL-CONCRETE COMPOSITE STRUCTURES

3 0 0 3

Course Objectives

- To develop an understanding of the behavior and design procedure of steel - concrete composite elements and structures.
- To give an exposure on case studies related to steel-concrete composite construction

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Identify the different types of steel-concrete composite structure

2. Design the composite beam and column
3. Apply the studs in Roofs and Slabs and predict the cracking pattern
4. Analyze the various bridges and design the economical one
5. Discuss about historical Steel concrete composite construction and seismic behavior of the structures

UNIT I **9 Hours**

INTRODUCTION

Introduction to steel - concrete composite construction - Advantages - Theory of composite structures- Introduction to steel - Concrete - Steel sandwich construction.

UNIT II **9 Hours**

DESIGN OF COMPOSITE BEAMS AND SLABS

Behavior of composite beams - Effective concrete slab - Design of composite beams including shear connector - Behavior and design of composite columns and composite slab

UNIT III **9 Hours**

COMPOSITE TRUSSES

Introduction - Stud shear connectors - Design consideration: Preliminary design, detailed analysis, and design - Design of studs - Partial shear - Concrete cracking - Practical considerations - Cost implications - Design problems

UNIT IV **9 Hours**

COMPOSITE BRIDGES

Introduction - design of composite bridge deck - Composite box girder bridges - Behavior of composite box girder bridges - Design concepts

UNIT V **9 Hours**

GENERAL

Case studies on steel - Concrete composite construction -Seismic behavior of composite structures - Failure of Steel-Concrete composite components/Structure.

Total: 45 Hours

Reference(s)

1. N. Krishna Raju, "Design of Bridges", Oxford & IBH Publishing Company Pvt. Ltd, NewDelhi. Fourth edition 2015.
2. R. P. Johnson, Composite Structures of Steel and Concrete, Blackwell Scientific Publications, UK, 1994.
3. D.J. Oehlers and M.A. Bradford, "Composite Steel and Concrete Structural Members", Fundamental behaviour, pergamon press, Oxford,1995.
4. G. W. Owens and P. Knowels, Steel Designers Manual, Steel Concrete Institute (UK), OxfordBlackwell Scientific Publications, 1992.
5. INSDAG Hand book on Composite Construction - Institute for Steel Development and Growth Publishers, Calcutta

21ST53 DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

3 0 0 3

Course Objectives

- Interpret the Basic concept of pre-stressed concrete, materials, methods and factors influencing pre- stress.
- Implement the basic assumptions of elastic analysis and design pre-stressed flexural and shear members.
- Predict the stresses due to long term and short term deflection and design a pre-stressed member accordingly.
- Determine the stresses in composite structures and find out how partial pre-stressing is done.

Programme Outcomes (POs)

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Analyse the stresses in pre-stressed concrete member due to prestressing force and its variation due to losses
2. Design the layout of cables for Type I and Type II beams based on calculation of moment of resistance
3. Compute the deflections and anchorage zone stresses
4. Implement the methods for achieving continuity in beams
5. Evaluate the design of circular prestressing and the uses of non pre-stressed reinforcement

UNIT I **9 Hours**

INTRODUCTION

Basic principles of Prestressing - Classification and types - Advantages over ordinary reinforced concrete - Materials - high strength concrete and high tensile steel - Methods of Prestressing - Freyssinet, MagnelBlaton, Lee Mc Call and Killick anchorage systems - Analysis of sections for stresses by stress concept, strength concept and load balancing concept - Losses of pre-stress

UNIT II **9 Hours**

DESIGN FOR FLEXURE AND SHEAR

Basic assumptions for calculating flexural stresses - Permissible stresses in steel and concrete as per I.S.1343 Code - Design of sections of Type I, Type II and type III post - tensioned and pre -tensioned beams - Check for strength limit state based on I.S.1343 Code - Layout of cables in post-tensioned beams - Location of wires in pre-tensioned beams - Design for shear based on I.S.1343 Code.

UNIT III **9 Hours**

DEFLECTION AND DESIGN OF ANCHORAGE ZONE

Factors influencing deflections - Short term deflections of uncracked members - Prediction of long term deflections due to creep and shrinkage - Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post - tensioned beams by Magnel"s method, Guyon"s method and I.S.1343 code - Design of anchorage zone reinforcement.

UNIT IV **9 Hours**

COMPOSITE BEAMS

Types of R.C.C. - P.S.C composite beams - Analysis and design of composite beams and Continuous Beams - Methods of achieving Continuity in continuous beams - Analysis for secondary moments - Concordant cable and linear transformation - Calculation of stresses - Principles of design.

UNIT V **9 Hours**

MISCELLANEOUS STRUCTURES

Design of tanks, pipes, sleepers, tension and compression members - Use of non-pre-stressed reinforcement - Definition, methods of achieving, merits and demerits of partial Prestressing.

Total: 45 Hours

Reference(s)

1. Krishna Raju, N., "Pre-stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi, 2008.
2. Lin, T.Y. and Ned.H.Burns, "Design of Pre-stressed Concrete Structures", John Wiley & Sons, New York, 2009.
3. Rajagopalan, N., "Pre-stressed Concrete", Narosa Publishing House, New Delhi,2008
4. Arthur H.Nilson,"Design of Pre-stressed Concrete", John Wiley & Sons Inc, New York, 2004.
5. Dayaratnam, P., "Pre-stressed Concrete Structures", Oxford and IBH, New Delhi, 1982.
6. Sinha, N.C.and Roy, S.K., "Fundamentals of Pre-stressed Concrete", S.Chand&Co.,Ltd.,

3 0 0 3

21ST54 DESIGN OF BRIDGES

Course Objectives

- To emphasize the importance of maintenance and inspection of structures
- To impart fundamental knowledge on various repairing strategies

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Classify and design different types short span RC bridges
2. Design long span RC bridges
3. Compare the loads acting on bridge, then classify the steel girders, suspension bridge and cable stayed bridges
4. Design a pre-stressed concrete bridge structures
5. Identify and design suitable support structures for bridges

UNIT I **9 Hours**

GENERAL INTRODUCTION AND SHORT SPAN R.C BRIDGE

Types of bridges and loading standards-Choice of type-I.R.C. specifications for road bridges-Design of RCC solid slab bridges-analysis and design of slab culverts, Tee beam and slab bridges

UNIT II **9 Hours**

LONG SPAN R.C BRIDGES

Design principles of continuous girder bridges, box girder bridges, and balanced cantilever bridges-Arch bridges-Box culverts-Segmental bridges

UNIT III **9 Hours**

STEEL BRIDGE

General- Railway loadings- Dynamic effect-Railway culvert with steel beams-Design of Plate Girder Bridges and Steel Trussed bridges - Design principles of cable stayed and suspension bridges

UNIT IV **9 Hours**

PRESTRESSED CONCRETE BRIDGE

Introduction - Design of Post - tensioned pre-stressed Concrete Slab Bridge deck - Design of Post - tensioned pre-stressed Concrete Tee beam and Slab Bridge deck

UNIT V **9 Hours**

BEARINGS AND SUB STRUCTURE

Bearings - Types of bearings - Design of bearings - Design of Piers and abutments - Foundations: Types of bridge foundations - Design of Pile Foundation and Well foundation - Caisson Foundation

Total: 45 Hours

Reference(s)

1. N. Krishna Raju, Design of Bridges, Oxford & IBH Publishing Company Pvt. Ltd, New Delhi. Fourth edition 2015
2. T.R. Jagadeesh and M.A. Jayaram., "Design of Bridge Structures", Prentice Hall of India Pvt.Ltd. Second edition 2014
3. S.Ponnuswamy, Bridge Engineering, Tata McGraw-Hill Publishing Company Limited, New Delhi, Second edition 2008
4. D. Johnson Victor, Essentials of Bridge Engineering, Oxford and IBH Publishing Co., New Delhi, Sixth Edition, 2014
5. Raina V.K. "Concrete Bridge Practice", Tata McGraw Hill Publishing Company, New Delhi, 2007
6. IRC: 6:2017, IRC:18(2000),IRC:21(2000)

21ST55 PREFABRICATED STRUCTURES 3 0 0 3

Course Objectives

- To impart Knowledge on prefabricated elements and the technologies used in fabrication and erection
- To give an exposure on the applications of Pre - Engineered Buildings in construction.

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Apply the basic principles to compare monolithic construction and prefabrication
2. Classify the types of prefabricated elements
3. Identify the production and hoisting technology for prefabricated structures
4. Design the prefabricated elements
5. Identify the advantages of - Pre Engineered Buildings

UNIT I **9 Hours**

GENERAL PRINCIPLES OF FABRICATION

Comparison with monolithic construction - Types of prefabrication - site and plant fabrication Economy of prefabrication - Modular coordination - Standardization - Planning for Components of prefabricated structures - Disuniting of structures - Handling and erection stresses - Elimination of erection stresses- Beams, columns - Symmetrical frames.

UNIT II **9 Hours**

PREFABRICATED ELEMENTS

Roof and Floor panels, ribbed floor panel - Wall panels - Footings, Staircase slab - Joints for different structural connections - Effective sealing of joints for water proofing - Provisions for non-structural fastenings - Expansion joints in precast construction

UNIT III **9 Hours**

PRODUCTION AND HOISTING TECHNOLOGY

Choice of production setup - Manufacturing methods - Stationary and mobile production - Planning of production setup - Storage of precast elements - Dimensional tolerances - Acceleration of concrete hardening. Equipment for hoisting and erection - Techniques for erection of different type of members like Beams, Slabs, Wall panels and Columns - Vacuum lifting

UNIT IV **9 Hours**

APPLICATIONS

Designing and detailing of precast unit for factory structures - Purlins, Principal rafters, roof trusses, lattice girders, gable frames - Single span single storeyed frames - Single storeyed buildings: slabs, beams and columns, Application of pre-stressed concrete in prefabrication.

UNIT V **9 Hours**

PRE-ENGINEERED BUILDINGS

Introduction - Advantages - Pre Engineered Buildings Vs Conventional Steel Buildings-Design procedure of Pre Engineered Buildings (PEB) Applications

Total: 45 Hours

Reference(s)

1. L. Mokk, Prefabricated Concrete for Industrial and Public Structures, Publishing House of theHungarian Academy of Sciences, Budapest, 2007
2. T. Koncz, Manual of Precast Concrete Construction, Vol.I, II, III & IV, Berlin, 1971
3. B. Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam, London, New York, 1998.
4. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland BetorVerlag, 2009
5. Hass, A.M. Precast concrete design and Applications, Applied Science Publishers, 1983.

21ST56 THEORY AND APPLICATIONS OF CEMENT COMPOSITES

3 0 0 3

Course Objectives

- To introduce basic concepts related to Composite Materials such as Ferro cement, SIFCON and Fiber Reinforced. Concrete
- To study materials as Per Orthotropic and Anisotropic Behavior.
- To study the Strain Constants Using Theories Applicable to Composite Materials.
- To learn the Design of Structural elements made of Cement Composites.

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Understand stress-strain behavior and formulate constitutive behavior of composite materials.
2. Understand the classification of materials based on orthotropic and anisotropic behavior.
3. Estimate elastic constants using theories applicable to composite materials.
4. Analyze and Design structural elements made of cement composites as ferro cement, SIFCON and fiber reinforced concrete.
5. Identify alternative materials for cement composites instead of traditional materials.

UNIT I **9 Hours**

PROPERTIES OF COMPOSITES

Classification and Characteristics of Composite Materials - Stress-Strain Relations - Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

UNIT II **9 Hours**

MECHANICAL BEHAVIOR

Mechanics of Materials Approach to Stiffness - Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness - Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

UNIT III **9 Hours**

CEMENT COMPOSITES

Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fiber Reinforced Concrete – Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

UNIT IV **9 Hours**

MECHANICAL PROPERTIES OF CEMENT COMPOSITES

Behavior of Ferro-cement and Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact - Durability and Corrosion of cement composites.

UNIT V **9 Hours**

STRUCTURAL AND NON-STRUCTURAL APPLICATIONS

FRC and Ferro-cement - Housing, Water Storage, Boats and miscellaneous applications - Composite Materials - Introduction to Analysis and Design of Cement Composite Structural Elements – Ferro-cement, SIFCON and Fiber Reinforced Concrete.

Total: 45 Hours

Reference(s)

1. Jones, Robert M, Mechanics Of Composite Materials, United Kingdom, CRC Press, 2018.
2. Swamy R.N., New Concrete Materials, 1st Ed., Blackie, Academic and Professional, Chapman & Hall, 1983.
3. Bentur, Arnon, and Mindess, Sidney. Fibre Reinforced Cementitious Composites. United Kingdom, CRC Press, 2006.

21ST57 DESIGN OF INDUSTRIAL STRUCTURES 3 0 0 3

Course Objectives

- To impart knowledge on classification of industries and their functional requirements
- To familiarize the students on the design of silos, bunkers and chimneys
- To impart knowledge on pre-engineered buildings

Programme Outcomes (POs)

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations
d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. To impart knowledge on the classification of Industries
2. Demonstrate the functional requirements for any industry
3. Design the industrial RC structures
4. Design the industrial steel structures
5. Analyze the materials in pre-engineered concept

UNIT I **9 Hours**

GENERAL

Classification of Industries and Industrial Structures - Specific requirements for Industries like Engineering, Textiles, Chemicals, etc. - Site layout and external facilities required

UNIT II **9 Hours**

FUNCTIONAL REQUIREMENTS

Nature and artificial lighting protection from the sun light - Services Electrical wiring fixtures - cable and pipe bridge - Electrical installation -substations - Effluent disposal - Heating and Ventilation - Air conditioning - Fire expanse and chutes - fire alarm, extinguishers and hydrants - Guidelines from factories act

UNIT III **9 Hours**

DESIGN OF R.C STRUCTURES

Design and detailing of R.C. gable frames, corbels and nibs, bunkers, silos, R.C.C chimney, Principles of folded plates and shell roofs

UNIT IV **9 Hours**

DESIGN OF STEEL STRUCTURES

Gantry girders -steel chimneys - Steel Bunker and Silo

UNIT V **9 Hours**

PRE ENGINEERED BUILDINGS

Introduction-Advantages and Disadvantages-Primary and secondary structural elements-foundation-wall materials- metal roofing

Total: 45 Hours

Reference(s)

1. P. Dayaratnam, Design of Steel Structures, A.H. Wheeler &Co., Ltd., Allahabad, 2008
2. S.N. Manokar, Tall Chimneys -Design and Construction, Tata McGraw Hill,1986
3. N. Krishnaraju, Advanced Reinforced Concrete Design, 2016, CBS PUB & DIST PVT Limited INDIA
4. S.K.Duggal, Design of Steel Structures, 2009, Tata McGraw Hill
5. IS: 9178 Criteria for design of Steel bins for Storage of Bulk Materials Part I - General Requirements and Assessment of Loads and Part II - Design Criteria. IS: 3483 Code of Practice for Noise Reduction in Industrial Buildings.
6. IS: 6060 Code of Practice for Day lighting of Factory buildings

21ST58 ADVANCED DESIGN OF FOUNDATIONS 3 0 0 3

Course Objectives

- To impart knowledge on the selection of best foundation solutions for different types of soils and structures
- To equip the students to evaluate the load carrying capacity of piles and well foundation
- To impart the knowledge on stability analysis and design of retaining structures

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Select and design a particular type of shallow foundation using theoretical methods and penetration tests conducted in the field.
2. Select and design the suitable pile foundation based on the soil characteristics.
3. Use the earth retaining structures and earth reinforcements in construction.
4. Select and design a special type of foundation according to soil characteristics and use dewatering methods.
5. Analyze the machine characteristics and design the machine foundation

UNIT I **9 Hours**

INTRODUCTION

Soil investigation report for foundation structure - Types and selection of suitable foundation -Basic requirement of foundation-Bearing Capacity-Theoretical methods (Terzaghi, Meyorhof,Vesic) - IS method-Penetration tests-SPT,SCPT& DCPT-Plate load test-Types of shallow foundations - General principle of design of raft foundation - Introduction to Floating foundation. Demonstration of SPT and Cone penetration test.

UNIT II **9 Hours**

DEEP FOUNDATIONS

Introduction - Load carrying capacity of different types of piles and pile groups according to IS:2911-2010 - Pile load test -Settlement of piles- Negative skin friction-Lateral load resistance of piles - Design of Piles and Pile cap and detailing of reinforcements-Design of well foundation (IRC approach). Case studies on deep foundations

UNIT III **9 Hours**

EARTH RETAINING STRUCTURES

Sheet pile structures - Cantilever sheet pile walls in granular soils and cohesive soils - Anchored Bulk head - Free earth support method- Fixed earth support method - Construction of diaphragm walls - Reinforced Earth - Introduction to Geosynthetics - Basic Mechanism of reinforced earth - Choice of soil and reinforcement-Reinforced earth retaining walls - Design and check for stability - Case studies on reinforced soil.

UNIT IV **9 Hours**

SPECIAL FOUNDATIONS

Expansive Soils-Introduction-Identification of expansive soils-Swell potential and swelling pressure-Foundations on expansive soils - Under reamed pile foundation - Vibro replacement (stone column & sand columns) - Well points - Deep well- Vertical drains, vacuum consolidation, Electro- osmotic methods, Design of dewatering systems

UNIT V **9 Hours**

MACHINE FOUNDATIONS

Introduction-Fundamentals of soil dynamics- Types of machine foundations-General criteria for design of machine foundation-Design of foundation for Reciprocating Machines and Impact machines -Vibration isolation- Construction aspects of machine foundations. Study experiment - Block vibration test.

Total: 45 Hours

Reference(s)

1. V.N.S. Murthy, Advanced Foundation Engineering, CBS Publisher, 2017
2. Swami Saran, Soil Dynamics and Machine Foundations, Galgotia Publications Private Ltd, 1999
3. Poulos, H. G. and Davis, E. H. (1980). Pile Foundation analysis and design, John Willey and Sons, Inc., New York
4. Robert M. Koerner, Designing with Geosynthetics, 6th Edition, Vol. 1, Xlibris Corporation, USA, 2012.
5. Das, B.M. Principles of Foundation Engineering, 8th Edition, Cengage Learning, 2015
6. P.C. Varghese, Foundation Engineering, Prentice-Hall of India Private Ltd, New Delhi,2006

21ST59 STRUCTURAL HEALTH MONITORING 3 0 0 3

Course Objectives

- To introduce the concepts involved in the assessment, evaluation and technical diagnosis of different structural systems of strategic importance
- To impart knowledge on both elementary and advanced applications of SHM with case studies

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Understand the structural health monitoring process
2. Identify Structural Health Monitoring Methods.
3. Analyze the damage identification methods
4. Identify the sensor networking in structures based on the damage level
5. Apply the structural health monitoring strategy to various structures

UNIT I **9 Hours**

INTRODUCTION TO STRUCTURAL HEALTH MONITORING

Introduction - Components of SHM process - SHM issues applied to concrete structures - Level of uncertainties in SHM process

UNIT II **9 Hours**

STRUCTURAL HEALTH MONITORING METHODS

Short-term and Long-term Monitoring - Local and Global Monitoring - Static and Vibration-based SHM - SHM planning and Management - SHM Methods

UNIT III **9 Hours**

DAMAGE IDENTIFICATION METHODS

Damage Identification - Visual Inspection - Comparison of damage identification methods - Non Destructive testing and Evaluation - Vibration based damage detection

UNIT IV **9 Hours**

SENSOR NETWORKING

Sensor Technologies - Fiber optic sensors - Smart Sensing for SHM - Sensing requirements in special structures - Sensor requirements and Data Acquisition - Acquisition system and Networking for SHM - Wireless Sensor Networking - MEMS - Artificial Intelligence in SHM

UNIT V 9 Hours

APPLICATIONS OF STRUCTURAL HEALTH MONITORING

SHM layout design of offshore structures - Application of SHM in bridges, buildings and offshore structures - Application in structural control strategies - Future of SHM

Total: 45 Hours

Reference(s)

1. Balageas, D., Fritzen, C.P. and Guemes, A. eds., 2010. Structural health monitoring (Vol. 90). John Wiley & Sons.
2. Chandrasekaran, S. 2016. Offshore structural engineering: Reliability and Risk Assessment, CRC Press, Florida, ISBN:978-14-987-6519-0.
3. Chandrasekaran, S. 2017. Dynamic analysis and design of ocean structures, Springer, 2nd Ed., Singapore.Do, R., 2014
4. Passive and active sensing technologies for structural health monitoring. University of California, SanDiego.
5. Glisic, B. and Inaudi, D., 2008. Fibre optic methods for structural health monitoring. John Wiley & Sons
6. Nagayama, T. and Spencer Jr, B.F., 2007. Structural health monitoring using smart sensors. Newmark Structural Engineering Laboratory. University of Illinois at Urbana-Champaign.

21ST60 THEORY OF PLATES AND SHELLS 3 0 0 3

Course Objectives

- To impart knowledge about the behavior of plates and shells
- To analyse the behavior of plate and shells and to design as per codal recommendations

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Analyze the internal forces of rectangular plates for different support conditions by Naviers and Levy''s method.
2. Find the symmetrical bending of simply supported circular plates for different loads acting on it.
3. Identify the behavior of folded plates and design them as per ACI and ASCE codes.
4. Analyze the internal forces for various shaped shell members by idealizing the structure.
5. Design the cylindrical shell and Reinforced hypar shell roof by ASCE and detailing the reinforcement

UNIT I **9 Hours**

ANALYSIS OF RECTANGULAR PLATES

Introduction- General Behavior of plates- Assumptions Small deflection theory of thin plates - Governing

differential equation for deflection of plate - Boundary conditions. Bending of Isotropic Rectangular Plates: Navier solution for an all-round simply supported rectangular plate subjected to uniformly distributed load, sinusoidal load and point load - Levys solution for a rectangular plate with different boundary conditions and subjected to uniformly distributed load -Analysis of vibrations of plate.

UNIT II **9 Hours**

ANALYSIS OF CIRCULAR PLATES

Symmetrical bending of circular plates - Simply supported solid circular plate subjected to a uniformly distributed load, an end moment and partially distributed load.

UNIT III **9 Hours**

ANALYSIS AND DESIGN OF FOLDED PLATES

Structural behavior of folded plates - Assumptions - Analysis of folded plates - Design of prismatic folded plate roofs as per ACI- ASCE task committee recommendations - Reinforcements details.

UNIT IV **9 Hours**

ANALYSIS OF SHELL STRUCTURES

Structural behavior of thin shells - Classification of shells methods of generating the surface of different shells like conoid, hyperbolic and elliptic paraboloid Membrane - Theory of shells - Edge disturbances- Geometry of hypar shell Analysis of membrane forces in the edge members.

UNIT V **9 Hours**

DESIGN OF SHELL STRUCTURES

Design of cylindrical shells with edge beams using theory for long shells - Design of cylindrical shell with ASCE manual No.31 coefficients - Detailing of reinforcement in shells and edge beams - Design of R.C. hypar shell roof of the inverted and tilted inverted umbrella type - Design and detailing of RC spherical shell and conical shells Design examples.

Total: 45 Hours

Reference(s)

1. G.S. Ramaswamy, (2005), Design and construction of concrete shell roofs, CBS Publishers and distributors.
2. Timoshenko and Krieger, (2002), Theory of Plates and Shells, McGraw Hill Inc, New Delhi.
3. Chatterjee, (1996), Theory and Design of Concrete Shells, Oxford and IBH, New Delhi.
4. K. Chandrasekara, (1998), Analysis of Thin concrete Shells, Tata McGraw Hill Book Company.
5. Arthur W. Leissa (1969), Vibration of plates, Scientific and Technical Information Division, National Aeronautics and Space Administration.

21ST61 MAINTENANCE AND REHABILITATION OF STRUCTURES

3 0 0 3

Course Objectives

- To emphasize the importance of maintenance and inspection of structures
- To impart fundamental knowledge on various repairing strategies

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

d. Function as an effective and responsible leader of a multidisciplinary team with ethical commitments to ensure sustainable development of the society

e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Demonstrate the various types of distress in concrete structures
2. Identify the effects due to climate, temperature, chemicals, wear and erosion on structures
3. Analyze the failures in structures due to design and construction errors
4. Identify and suggest the techniques for repairing of concrete structures
5. Analyze and suggest the suitable repair techniques

UNIT I **9 Hours**

INTRODUCTION

General Consideration - Distresses monitoring- Causes of distresses - Assessment procedure for evaluating a damaged structure - Quality assurance - Defects due to climate, chemicals, wear and erosion - Inspection - Structural appraisal - Economical appraisal

UNIT II **9 Hours**

BUILDING CRACKS

Causes - diagnosis - remedial measures - Thermal and Shrinkage cracks - unequal loading - Vegetation and trees - Chemical action - Foundation movements - Techniques for repair - Epoxy injection

UNIT III **9 Hours**

MOISTURE PENETRATION

Sources of dampness - Moisture movement from ground - Reasons for ineffective DPC - Roof leakage - Pitched roofs - Madras Terrace roofs - Leakage of Concrete slabs -Dampness in solid walls - condensation - hygroscopic salts- remedial treatments - Ferro-cement overlay - Chemical coatings - Flexible and rigid coatings

UNIT IV **9 Hours**

REPAIRS TO MATERIALS (POLYMERS) AND STRUCTURES

Methods of repair - repairing, spalling and disintegration - Repairing of concrete floors and pavements. Steel Structures: Types and causes for deterioration - preventive measures - Repair procedure- Brittle fracture - Lamellar tearing - Defects in welded joints - Mechanism of corrosion - Design to protect against corrosion - Design and fabrication errors - Distress during erection. Masonry Structures: Discoloration

and weakening of stones - Biocidal treatments - Preservation -Chemical preservatives - Brick masonry structures - Distresses and remedial measures - Definition of Structural Health Monitoring - Motivation for Structural health monitoring

UNIT V **9 Hours**

STRENGTHENING OF STRUCTURES USING FIBRE REINFORCED POLYMER WRAPING

General principle - relieving loads - Strengthening super structures – plating-Conversion to composite construction - post stressing - Jacketing - bonded overlays- Reinforcement addition - strengthening the substructures - under pinning-Increasing the load capacity of footing- Repair of structures distressed due to earthquake- Design for rehabilitation

Total: 45 Hours

Reference(s)

1. Dension, C. Alien and H. Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical, UK, 1991.
2. B. A. Richardson, Remedial Treatment of Buildings, Construction Press, London, 1995.
3. R. T. Alien and S. C. Edwards, Repair of Concrete Structures, Blakie and Sons, UK, 1994
4. S. M. Johnson, Deterioration, Maintenance and Repair of Structures, McGraw-Hill Book Company, Newyork, 1965
5. P. K. Guha, Maintenance and Repairs of Buildings, New Central Book Agency (P) Ltd, Calcutta, 2011
6. SP25-84 Hand Book on Causes and Prevention of Cracks on Buildings, Indian Standards Institution, New Delhi, 1984

21ST62 DESIGN OF FORMWORK 3 0 0 3

Course Objectives

- To understand the design of forms for various elements such as beams, columns, slabs and walls

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

Course Outcomes (COs)

1. Infer formwork and accessories required for formworks
2. Classify the materials of formwork for various elements in a building
3. Analyze the various loads to be considered for design of formwork
4. Design the beam and column forms with examples
5. Design the slab and wall forms with appropriate checks for deflection

UNIT I **9 Hours**

INTRODUCTION

Introduction - Forms for beams, columns, slabs and walls - General objectives of formwork of a building - Framed panel formwork -Formwork accessories - formwork types and techniques

UNIT II **9 Hours**

FORMWORK MATERIALS

Lumber - Types - Finish - Sheathing ratio -Working stresses -Repetitive member stress - Plywood -Types and grades -Textured surfaces and strength - Reconstituted wood -Steel -Aluminum -Form lining materials - Hardware and fasteners - Nails in Plywood -Bolts, lag screws and connectors - Bolt loads

UNIT III **9 Hours**

DESIGN CONSIDERATIONS

Design considerations- Live loads and wind pressure -Concrete pressure on formwork- Concrete density - Height of discharge - Temperature -Rate of placing - Consistency of concrete - Vibration -Hydrostatic pressure and pressure distribution

UNIT IV **9 Hours**

DESIGN OF BEAM AND COLUMN FORMS

Beam forms - Column Forms -Allowable stresses - Check for bending, deflection and lateral stability - Examples

UNIT V **9 Hours**

DESIGN OF SLAB AND WALL FORMS

Basic simplification - Slab forms - Wall Forms - Allowable stresses - Check for deflection - Examples

Total: 45 Hours

Reference(s)

1. Robert L. Peurifoy, Garold D. Oberlender, Formwork for Concrete Structures, McGraw-Hill, 2006.
2. Hurd. M.K., Formwork for Concrete, Special Publication No.4 Fifth Edition American Concrete Institute, 2003.
3. Austin. C.K., Formwork for Concrete, Cleaver- Hume Press ltd., London, 2006.
4. Indian Concrete Institute, Technical Monograph for Formwork, 2002.
5.

21ST63 ANALYSIS AND DESIGN OF TALL BUILDINGS

3 0 0 3

Course Objectives

- To impart Knowledge on behavior of tall multi-storied buildings
- To analyze and design the tall multi-storied buildings

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

b. Design and analyze structural elements or processes based on national and international codes of

practices considering social, economic and environmental sustainability, public health and safety
c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations
e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Compare the design philosophy of working stress and limit state methods with different combination of loading
2. Differentiate the structural behavior of various systems using growth, height and structural form
3. Design of total structural systems and analyse the forces acting in 2D and 3D structures
4. Illustrate the losses in prestressing structural elements on different structural shapes
5. Evaluate the structural stability and its stiffness using approximate methods

UNIT I **9 Hours**

LOADING AND DESIGN PROCESS

Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, modal analysis - combination of loading, - Static and Dynamic approach - Analytical and wind tunnel experimental methods - Design philosophy - working stress method, limit state method and plastic design

UNIT II **9 Hours**

BEHAVIOR OF VARIOUS STRUCTURAL SYSTEMS

Factors affecting growth, height and structural form. High rise behavior, Rigid frames, braced frames, In-filled frames, shear walls, coupled shear walls, wall-frames, tubulars, cores, outrigger - braced and hybrid mega systems

UNIT III **9 Hours**

ANALYSIS AND DESIGN

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist - Computerized 3D analysis - Assumptions in 3D analysis - Simplified 2D analysis

UNIT IV **9 Hours**

STRUCTURAL ELEMENTS

Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow, Design for differential movement, creep and shrinkage effects, temperature effects and fire resistance

UNIT V **9 Hours**

STABILITY ISSUES

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational, Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation

Total: 45 Hours

Reference(s)

1. Bryan Stafford Smith, Alexcoull, Tall Building structures, Analysis and Design, John Wiley and Sons, Inc., 2005
2. P. Gupta, Proceedings National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities, New Age International Limited, Publishers, Nov. 1995
3. S. B. Mehta, High Rise Buildings, M/S Skyline, 1978
4. Lynn S. Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1986.

21ST64 SOIL STRUCTURE INTERACTION 3 0 0 3

Course Objectives

- The students will be able to understand the significance of soil-structure interaction in the case of different types of structures, including embedded and buried structures.

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences
b. Design and analyze structural elements or processes based on national and international codes of practices considering social, economic and environmental sustainability, public health and safety

Course Outcomes (COs)

1. Identify the impact of soil-structure interaction on the behaviour of a structure
2. Assess the effects of beam on elastic foundation
3. Analyse the plate on elastic medium
4. Formulate the theoretical solutions for settlement and load distribution of piles
5. Predict the load deflection behaviour of laterally loaded piles

UNIT I **9 Hours**

SOIL-FOUNDATION INTERACTION

Introduction to soil - Foundation interaction problems, Scope of soil-foundation interaction analysis, soil response models, Winkler Elastic continuum, two parameter elastic models, Elastic plastic behaviour, Time dependent behaviour, Determination of subgrade modulus and parameters influencing subgrade modulus.

UNIT II **9 Hours**

BEAM ON ELASTIC FOUNDATION

Infinite beam, two parameters, Isotropic elastic half space, Analysis of beams of finite length and various end conditions, Method of superposition and strain energy method, Classification of finite beams in relation to their stiffness.

UNIT III **9 Hours**

PLATE ON ELASTIC MEDIUM

Infinite plate, Winkler, Saint Venant"s Principle, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates,

simple solutions

UNIT IV **9 Hours**

ELASTIC ANALYSIS OF PILES

Elastic analysis of single pile, Group action of pile, settlement of pile group under compressive load by Interaction Factor Approach, negative skin friction, Analysis of Piled raft system

UNIT V **9 Hours**

LATERALLY LOADED PILES

Load deflection prediction of laterally loaded piles, Reese and Matlock"s generalized solution, displacement of pile group under lateral load by Interaction Factor Approach

Total: 45 Hours

Reference(s)

1. Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998.
2. McCarthy, D.F. Essentials of Soil Mechanics and Foundations, basic geotechnics (6th Edition), Prentice Hall, 2002
3. Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
4. Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley, 1980. 5. Scott, R.F. Foundation Analysis, Prentice Hall, 1981
5. Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.
6. ACI 336, Suggested Analysis and Design Procedures for Combined Footings and Mats, American Concrete Institute, Dehit, 1988.

21ST65 EXPERIMENTAL STRESS ANALYSIS AND TECHNIQUES

3 0 0 3

Course Objectives

- To familiarize the students about the measurement of strain and effects of vibrations and wind blow
- To make the students analyse the structure by non-destructive testing method and model analysis

Programme Outcomes (POs)

a. Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated solutions using principles of natural sciences and engineering sciences

c. Use modern engineering tools and techniques including software for structural analysis, design and drawing and numerical and statistical data analysis with due understanding of their limitations

e. Comprehend the practical implications of solving various complex structural engineering problems and communicate the same to the society through effective reports and presentations particularly in the area of transfer of technology

Course Outcomes (COs)

1. Evaluate the Measurement system of strains in structural elements
2. Evaluate the different measurement method of vibrations
3. Analyse the construction and damage assessment of RC Structures

4. Determination of strength by using NDT testing
5. Apply the influence lines in model studies

UNIT I **9 Hours**

STRAIN MEASUREMENT

Methods of Measurement -Calibration-Load calibration of testing machines - I.S. Code provisions - Measurement system- Mechanical, Optical and Acoustical extensometers -Strain measurement - Electrical resistance strain gauges - Principle, Types, Performance, Uses - Strain Rosettes- Wheatstone Bridge - Electronic load cells - Proving rings

UNIT II **9 Hours**

MEASUREMENT OF DISPLACEMENT VIBRATION

Measurement of vibration - Vibration galvanometers- Vibrometer - Characteristics of Structural vibration-Pressure gauges-Velocity transducers- Seismic transducers - Linear Variable Differential Transformer-Cathode ray oscilloscope - X Y Plotter - Wind Tunnels - Flow meters- Venturimeter - Digital Data Acquisition systems

UNIT III **9 Hours**

DISTRESS MEASUREMENT AND NON DESTRUCTIVE TESTING METHOD

Diagnosis of distress in structures - Cracks in structures-Formation of cracks - Types of cracks - Causes of cracks- Crack measurement - Monitoring and measurement of crack movement- Corrosion of reinforcement in RCC- Half-cell-Construction and use - Damage assessment - Controlled blasting for demolition, Advanced NDT methods - Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR, Ground penetrating radar

UNIT IV **9 Hours**

PHOTOELASTICITY

Photoelasticity - Two dimensional photo elasticity, Sources of light - photo elastic effects - stress optic law-Interpretation of fringe pattern - Compensation and separation techniques - Photo elastic materials. Introduction to three dimensional photo elasticity

UNIT V **9 Hours**

MODEL ANALYSIS

Model laws- Laws of similitude - Model materials- Model testing - Necessity for Model analysis - Advantages-Applications - Types of similitude - Scale effect in Models - Indirect model study - Direct model study - Limitations of model investigations - Structural problems demand in model studies- Usage of influence lines in model studies

Total: 45 Hours

Reference(s)

1. 1. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 2006
2. 2. J.W. Dally and W. F. Riley, Experimental Stress Analysis, McGraw-Hill, Inc. New York, 1978
3. 3. L.S. Srinath, Experimental Stress Analysis, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1984
4. 4. C.S. Rangan, Instrumentation Devices and Systems, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1983

5. 5. Ganesan.T.P, Model Analysis of Structures, University Press, India, 2000
6. 6. Ravisankar.K. and Chellappan.A., Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures, SERC, Chennai, 2007.

21XE01 ENGLISH FOR RESEARCH PAPER WRITING 2 0 0 2

Course Objectives

- Illustrate that how to improve your writing skills and level of readability.
- Learn about what to write in each section.
- Recognize the skills needed when writing a Title.
- Ensure the good quality of paper at very first-time submission.

Course Outcomes (COs)

1. Illustrate the research ideas and writing journal papers
2. Creating research paper writing

UNIT I **6 Hours**

Planning and Preparation, Word Order, Breaking-up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT II **6 Hours**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III **6 Hours**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT IV **6 Hours**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT V **6 Hours**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

Total: 30 Hours

Reference(s)

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

21XE02 COST MANAGEMENT OF ENGINEERING PROJECTS

2 0 0 2

Course Objectives

- To understand the cost concepts and different stages of project execution and its activities.
- To understand cost behavior, management and its quantitative techniques.

Course Outcomes (COs)

1. Apply the cost concepts in decision making.
2. Analyze the various stages of project execution and its activities.
3. Analyze the cost behavior and various types of costing.
4. Analyze the cost management and budget related decisions.
5. Analyze the quantitative techniques for cost management.

UNIT I **6 Hours**

COST CONCEPTS IN DECISION-MAKING

Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II **6 Hours**

PROJECT

Meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance.

UNIT III **6 Hours**

COST BEHAVIOR AND PROFIT PLANNING MARGINAL COSTING

Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning.

UNIT IV **6 Hours**

TOTAL QUALITY MANAGEMENT AND THEORY OF CONSTRAINTS

Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V **6 Hours**

QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Total: 30 Hours

Reference(s)

1. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

21XE03 STRESS MANAGEMENT 2 0 0 2

Course Objectives

- To achieve overall health of body and mind.
- To overcome stress by practicing yoga.

Course Outcomes (COs)

1. Develop healthy mind in a healthy body thus improving social health also.
2. Improve Efficiency of the body by practicing breathing exercises and yoga.

UNIT I **10 Hours**

Definitions of Eight parts of yoga. (Ashtanga)

UNIT II **10 Hours**

Yam and Niyam. Dos and Donts in life.i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

10 Hours

UNIT III

Asan and Pranayam, i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam.

Total: 30 Hours

Reference(s)

1. Yogic Asanas for Group Training-Part-I Janardan Swami Yogabhyasi Mandal, Nagpur. Model Curriculum of Engineering & Technology PG Courses [Volume-I][47].
2. Rajayoga or conquering the Internal Nature by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

21XE04 DISASTER MANAGEMENT 2 0 0 2

Course Objectives

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Course Outcomes (COs)

1. Illustrate the key concepts in disaster risk reduction and humanitarian response
2. Interpret the strengths and weaknesses of disaster management approaches, planning and programming

UNIT I **5 Hours**

INTRODUCTION

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II **5 Hours**

REPERCUSSIONS OF DISASTERS AND HAZARDS

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms and Cyclones, Tsunamis and Floods, Droughts and Famines, Landslides and Avalanches Man-made disaster Nuclear Reactor Meltdown, Industrial Accidents and Oil Slicks and Spills Outbreaks of Disease and Epidemics War and Conflicts.

UNIT III **5 Hours**

DISASTER PRONE AREAS IN INDIA

Study of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT IV **5 Hours**

DISASTER PREPAREDNESS AND MANAGEMENT

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V **5 Hours**

RISK ASSESSMENT

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People"s Participation In Risk Assessment. Strategies for Survival.

UNIT VI **5 Hours**

DISASTER MITIGATION

Disaster mitigation meaning, concept and strategies of disaster mitigation, emerging trends in mitigation. Structural mitigation and non-structural mitigation, programs of disaster mitigation in India.

Total: 30 Hours

Reference(s)

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies " , New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi
3. Goel S. L. "Disaster Administration And Management Text and Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

21XE05 VALUE EDUCATION 2 0 0 2

Course Objectives

- Interpret value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course Outcomes (COs)

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

UNIT I **8 Hours**

Values and self-development- Social values and individual attitudes-Work ethics- Indian vision of humanism- Moral and non- moral valuation-Standards and principles-Value judgements.

UNIT II **7 Hours**

Importance of cultivation of values- Sense of duty Devotion- Self-reliance- Confidence-Concentration-Truthfulness- Cleanliness-Honesty- Humanity- Power of faith- National Unity- Patriotism- Love for nature-Discipline.

UNIT III **8 Hours**

Personality and Behavior Development - Soul and Scientific attitude- Positive Thinking- Integrity and discipline-Punctuality- Love and Kindness- Avoid fault thinking- Free from anger- Dignity of labour-Universal brotherhood and religious tolerance-True friendship-Happiness Vs suffering- love for truth-Aware of self-destructive habits-Association and Cooperation-Doing best for saving nature.

UNIT IV **7 Hours**

Character and Competence -Holy books vs Blind faith, Self-management and Good health. Science of reincarnation, Equality, Nonviolence,Humility, Role of Women. All religions and same message, Mind your Mind, Self-control. Honesty, Studying effectively.

Total: 30 Hours

Reference(s)

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

21XE06 PEDAGOGY STUDIES 2 0 0 2

Course Objectives

- Review existing evidence on the review topic to inform programmer design and policy making undertaken by the DfID, other agencies and researchers
- Identify critical evidence gaps to guide the development.

Course Outcomes (COs)

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy verall personality

UNIT I **8 Hours**

INTRODUCTION AND METHODOLOGY

Aims and rationale- Policy background- Conceptual framework and terminology-Theories of learning-Curriculum- Teacher education-Conceptual framework- Research questions-Overview of methodology and Searching

UNIT II **7 Hours**

THEMATIC OVERVIEW

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education.

UNIT III **8 Hours**

EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school, curriculum and guidance materials best support effective pedagogy. Theory of change, Strength and nature of the body of evidence for effective pedagogical, practices, Pedagogic theory and pedagogical approaches, Teachers" attitudes and beliefs and Pedagogic strategies

UNIT IV **7 Hours**

PROFESSIONAL DEVELOPMENT

Alignment with classroom practices and follows up, Support Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Total: 30 Hours

Reference(s)

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379
3. Akyeampong K (2003) Teacher training in Ghana - does it count. Multi-site teacher education research project (MUSTER) country report 1. London: DFID
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272-282
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, "learning to read" campaign

21XE07 BUSINESS ANALYTICS 2 0 0 2

Course Objectives

- Illustrate the role of business analytics within an organization
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making
- To become familiar with processes needed to develop, report, and analyze business data
- Use decision-making tools/Operations research techniques and Manage business process using analytical and management tools

Course Outcomes (COs)

1. Implement the knowledge of data analytics
2. Apply the ability of think critically in making decisions based on data and deep analytics.
3. Analyze the ability to use technical skills in predicative and prescriptive modeling to support business decision-making
4. Determine the ability to translate data into clear, actionable insights
5. Analyze the decision problems in business analytics

UNIT I **6 Hours**

BUSINESS ANALYTICS AND STATISTICAL TOOLS

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics-Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview

UNIT II **6 Hours**

TRENDINESS AND REGRESSION ANALYSIS

Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology

UNIT III **6 Hours**

ORGANIZATION STRUCTURES OF BUSINESS ANALYTICS

Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization

UNIT IV **6 Hours**

FORECATING TECHNIQUES

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models

UNIT V **6 Hours**

DECISION ANALYSIS

Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making

Total: 30 Hours

Reference(s)

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press
2. Business Analytics by James Evan