P.S.R. ENGINEERING COLLEGE

(An Autonomous Institution & Affiliated to Anna University, Chennai)

SIVAKASI - 626140

M.E. Structural Engineering

PG REGULATION-2012

CURRICULUM AND SYLLABI

[1st To 4th Semester]

THIS IS THE FINAL VERSION OF THE SYLLABUS AS RATIFIED AND APPROVED BY THE ACADEMIC COUNCIL OF THE COLLEGE IN THE MEETINGS HELD ON 7/7/2012, 1/6/2013

DEAN(ACAD)

REGULATIONS FOR PG PROGRAMME (M.E/M.C.A/M.B.A)
CANDIDATE ADMITTED DURING THE ACADEMIC YEAR 2012 - 2013 AND ONWARDS
[PG Regulation-2012]

PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires:

i. "**Programme**" means Post graduate Degree Programme (M.E., M.C.A. and M.B.A)

ii. **"Branch**" means specialization or discipline of M.E. Degree Programme like "Applied Electronics", "Computer Science and Engineering", etc.

iii. "**Course**" means Theory or Practical subject that is normally studied in a semester, like Applied Mathematics, Embedded System Design, etc.

iv. "**Head of the Institution**" means the Principal of a College / Institution who is responsible for all academic activities of that College / Institution and for implementation of relevant Rules and Regulations.

v. **"Head of the Department"** means Head of the Department concerned.

vi. "**Controller of Examinations"** means the Authority of the College who is responsible for all activities of the Examinations.

vii. "**University**" means ANNA UNIVERSITY.

viii. **"College"** or **"Institution"** means P.S.R. Engineering College.

1. ADMISSION REQUIREMENTS

1.1 Candidates for admission to the first semester of the Master's Degree Programme shall be required to have passed an appropriate Degree Examination of Anna University or any other examination of any University or authority accepted as equivalent thereto.

1.2 Eligibility conditions for admission such as class obtained, number of attempts in qualifying examination and physical fitness will be as prescribed from time to time. &

1.3 Any other conditions as notified by the Government of Tamil Nadu.

2. PROGRAMMES OFFERED AND MODE OF STUDY

2.1. P.G. PROGRAMMES OFFERED

- M.E. Computer Science and Engineering
- M.E. Structural Engineering
- M.E. Applied Electronics
- M.E. Engineering Design
- M.E. Power Electronics and Drives
- M.C.A
- M.B.A

2.2. MODE OF STUDY

Full Time / Part Time (Daytime)

Candidates admitted should be available in the College/ Institution/ University during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

3. DURATION AND STRUCTURE OF THE P.G.PROGRAMMES

3.1 The minimum and maximum periods for completion of the PG Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.E	4	8
M.B.A	4	8
M.C.A	6	12

The Curriculum and Syllabi of all the P.G. Programmes shall be approved by the Academic Council of the College. The number of Credits to be earned for the successful completion of the programme shall be as specified in the Curriculum of the respective specialization of the P.G. Programme.

3.2 Credits will be assigned to the courses for different modes of study as given below:

3.2.1 The following will apply to all modes of P.G. Programmes.

- One credit for each lecture period allotted per week
- One credit for each tutorial period allotted per week
- One credit for each seminar/practical session of two periods designed per week.

3.2.2 The minimum prescribed credits required for the award of the degree shall be within the limits specified below:

PROGRAMME	PRESCRIBED CREDIT RANGE
M.E. (Full Time)	65 to 75
M.C.A	118
M.B.A	90

3.3 The P.G. Programmes will consist of:

- core subjects
- elective subjects
- project work / thesis / Dissertation
- The Programme will also include design projects / planning projects / seminars / practicals / practical training, if they are specified in the Curriculum.

3.4 The Curriculum and Syllabi of all the P.G. Programmes shall be approved by the Academic Council of the College.

3.5 A student shall pass all the subjects specified in the curriculum of the programme for the successful completion of the programme.

3.6. Each semester shall normally consist of 90 working days or 450 hours or 540 periods of 50 minutes duration. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course (subject) being taught. End-Semester Examination will ordinarily follow immediately after the last working day of the semester.

3.7 The maximum marks assigned to different courses shall be as given below:

3.7.1. i. Each of the theory subjects (excluding project work) shall carry maximum of 100 marks out of which the internal assessment will carry 25 marks, while the end semester Examination will carry 75 marks. The practical classes for all the Practical/Lab component subjects will be assessed continuously and marks will be entered in the prescribed proforma. The progress of Practical classes will be monitored by a committee formed by the concerned Head of the Departments / Professor in-charge of the course to ensure that the concerned staff conducts the laboratory experiments as specified in the syllabus. The maximum marks for the Practical/Lab component courses shall be 100, out of which the continuous internal assessment will carry 25 marks, while the end semester practical examination will carry 75 marks. The award of the end semester practical examination marks shall be conducted by both the Internal and External examiners.

ii. The project report / Thesis / Dissertation of M.E. programme, during Phase I, will be evaluated based on the report and a viva-voce examination by an Internal Examiner and an External Examiner.

iii. The project work / Thesis / Dissertation of M.E. programme, during Phase II, will be evaluated based on the Project Report and a viva-voce examination by a team consisting of the supervisor / Internal Examiner and External Examiner for each specialization.

The project report / Thesis / Dissertation of M.B.A. programme (no phases), will be evaluated based on the report and a viva-voce examination by an Internal Examiner and an External Examiner.

iv. Practical Training / Summer Project if specified in the Curriculum shall not exceed the maximum duration of 4 weeks and should be organized by the Head of the Department for every student.

Practical Training / Summer Project of M.B.A. programme if specified in the Curriculum shall not exceed the maximum duration of 6 weeks and should be organized by the Head of the Department for every student.

v. At the end of Practical Training / Summer Project the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a Departmental Committee constituted by the Head of the Institution. Certificates submitted by the students shall be attached to the mark list sent by the Head of the Institution.

3.7.2 The electives from the curriculum are to be chosen with the approval of the Head of the Department.

3.7.3 A candidate may be permitted by the Head of the Department to choose one or two subjects from P.G. Programmes offered from other departments in the college / institution during the period of his / her study, provided the Head of the Department offering such course also agrees and there is no clash in the time-table for the lecture classes.

3.8. PROJECT WORK/THESIS *I* DISSERTATION

3.8.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the Department concerned.

3.8.2 A candidate may, however, in certain cases, be permitted to work on the project in an Industrial/Research Organization, on the recommendations of Head of the Department, with the approval of the Head of the Institution. In such cases, the Project work shall be jointly supervised by a supervisor of the department and an

Engineer / Scientist from the Organization and the student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress.

3.8.3 The Project work / Thesis / Dissertation (Phase-II) shall be used for a minimum of 16 weeks during the final semester from the next day of viva voce examination of Phase-1 Project.

The Project work / Thesis / Dissertation of M.B.A programme shall be used for a minimum of 16 weeks during the final semester.

3.8.4 The Project Report / Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted at the end of the IV semester. The last date for the submission of Thesis (Phase-II) will be six months from the last date of the submission of Phase-I Project Report or Third Semester examination or 24 months from the date of commencement of First Semester class work, whichever is later. However, in exceptional cases, based on the recommendation of the Professor-in-charge of the course the Chairman, Academic Council can permit an extension of time not exceeding 31 days. If a candidate submits the project report/ thesis report/ dissertation after the specified deadline, he / she is deemed to have failed in the Project Work / Thesis ⁄ Dissertation and shall re-enroll for the same in a subsequent semester.

For M.B.A programme, the Project Report / Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted at the end of the IV semester. The last date for the submission of Thesis will be six months from the commencement of fourth semester. However, in exceptional cases, based on the recommendation of the Professor-in-charge of the course the Chairman, Academic Council can permit an extension of time not exceeding 31 days. If a candidate submits the project report ⁄ thesis report/ dissertation after the specified deadline, he *I* she is deemed to have failed in the Project Work / Thesis / Dissertation and shall re-enroll for the same in a subsequent semester.

3.8.5 Every candidate doing M.E. shall, based on his / her project work thesis dissertation, send a paper for publication in a journal or a conference in which full papers are published after usual review. An acknowledgement for having communicated to the journal or conference shall be attached to the report of the project work /thesis / dissertation. Such acknowledgements shall be sent to the Office of the Controller of Examinations along with the evaluation marks by the team of examiners without which the marks shall not be accepted.

3.8.6 A student who has passed in all the courses prescribed in the curriculum for the award of the degree shall not be permitted to re-enroll to improve his/her marks in a course or the aggregate marks.

3.8.7 The medium of instruction, examination, seminar and project / thesis / dissertation reports shall be English.

4. FACULTY ADVISER

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will attach a certain number of students to a teacher of the Department who shall function as Faculty Adviser for those students throughout their period of study. Such Faculty Adviser shall advise the students and monitor the subjects taken by the students, check the attendance and progress of the students attached to him / her and counsel them periodically. If necessary, the faculty adviser may also discuss with or inform the parents about the progress of the students.

5. CLASS COMMITTEE

5.1 A Class Committee consists of teachers of the concerned class, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include Solving problems experienced by students in the class room and in the laboratories.

- Clarifying the regulations of the degree programme and the details of rules therein.
- Informing the student representatives the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of regulations regarding the weightage used for each assessment. In the case of practical courses (Iaboratory/ drawing/ project work/ seminar etc.) the breakup of marks for each experiment/ exercise/ module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide additional help or guidance or coaching to such weak students.

5.2 The class committee for a class under a particular specialization is normally constituted by the Head of the Department. However, if the students of different specializations are mixed in a class, the class committee is to be constituted by the Head of the Institution.

5.3 The class committee shall be constituted on the first working day of any semester or earlier.

5.4 At least 2 student representatives (usually 1 boy and 1 girl) shall be included in the class committee.

5.5 The chairperson of the class committee may invite the Faculty Adviser(s) and the Head of the Department to the meeting of the class committee.

5.6 The Head of the Institution may participate in any class committee of the institution.

5.7 The chairperson is required to prepare the minutes of every meeting, submit the same to the Head of the Institution within two days of the meeting and arrange to circulate among the concerned students and teachers. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the management by the Head of the Institution.

5.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weight age of assessments within the framework of the Regulations. Two or three subsequent meetings may be held at suitable intervals. During these meetings the student members representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

6. COURSE COMMITTEE FOR COMMON COURSES

Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the Course Coordinator shall be made by the Head of the Department /Head the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The "Course committee" shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the test(s).

7. PROCEDURES FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

7.1 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topic covered), separately for each course. This should be submitted to the Head of the Department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the Department will put his signature and date after due verification. At the end of the semester, the record should be verified by the Head of the Institution who will keep this document in safe custody (for five years).

7.2 Theory Subjects [25 marks)

(a). Unit Tests [60% weightage]:

Three tests each carrying sixty (60) marks shall be conducted by the Department / Institution. The total marks obtained in all the tests put together out of 180, shall be reduced to 60 marks and rounded to nearest integer (this implies equal weightage

to all the three tests). However a retest at the discretion of the Head of the Department may be conducted for the deserving candidates.

(b). Assignment/Seminar/Miniproject [30% weightage]:

A student has an option to choose any one of the following:

i) Assignment:

Two assignments each carrying 15 marks and requiring work of average 5 to 6 hours of study and written work of average 5 to 6 hours shall be given to be carried out by each student in a separate assignment folder, duly indexed with headings, date of submission, marks, remarks and signature of faculty with date etc.

ii) Assignment and Seminar:

A student has to carry out one assignment and one seminar each carrying 15 marks each. An assignment normally requires work of average 5 to 6 hours of study and written work of average 5 to 6 hours which has to be submitted in a separate assignment folder, duly indexed with headings, date of submission, marks, remarks and signature of faculty with date etc. The student has to make one technical seminar on current topics related to the specialization. The students are expected to submit a report his/her presentation. The seminar will be assessed by the course tutor with common parameters as described by the department.

iii) Mini project

A student can carry out mini project carrying 30 marks either in hardware or software with the approval of the head of the department. The student has to submit a report before the end of the semester. Mini project will be assessed based on the model, presentation and report as decided by the department.

(c). Attendance [10% weightage]:

A maximum of 10 marks for attendance out of 100 marks shall be given to each student depending on his / her attendance percentage as per the distribution given below:

Percentage of Attendance	Marks
75	2
76 – 80	4
81 – 84	6

85 – 90	8
91 and above	10

7.3 Practical Subjects [25 marks]

Every practical exercise / experiment shall be evaluated based on conduct of exercise / experiment and records maintained. There shall be at least one test.

The criteria for determining the internal assessment marks are:

Experiment / Record / Average Practical classes' performance: 50 % Weightage

Practical Test : 40 % Weightage

Attendance : 10 % Weightage

Total 100 marks shall be reduced to 25 Marks.

7.4 Theory Subjects with Laboratory Component

(a). Unit Tests [60% weightage]:

If there is a theory subject with Laboratory component, there shall be three tests; the first two tests (each 60 Marks) will be from theory portions and third test (maximum mark 60) will be for laboratory component. The total 180 marks should be reduced to 60 marks. However a retest at the discretion of the Head of the Department may be conducted for the deserving candidates.

(b). Assignment [30% weightage]:

Two assignments each carrying 15 marks and requiring work of average 5 to 6 hours of study and written work of average 5 to 6 hours shall be given to be carried out by each student in a separate assignment folder, duly indexed with headings, date of submission, marks, remarks and signature of faculty with date etc.

(c). Attendance [10% weightage]:

A maximum of 10 marks for attendance out of 100 marks shall be given to each student depending on his / her attendance 'percentage as per the distribution given below:

Percentage of Attendance	Marks
75	2
76 – 80	4

81 – 84	6
85 – 90	8
91 and above	10

7.5 M.E. Project Work

There shall be a minimum of two reviews for both Phase-I and Phase-II to be conducted separately. The internal and external marks distribution for each phase is given in the table below. The student shall make presentation on the progress made before the review committee. The Head of the Institution/Department shall constitute a review committee for each branch of study.

Project (M.E)	Internal (25 %)		External (75%)	
	Review-I	Review-II	Thesis by External	Viva-voce
Phase-I	25	25	60	90
Phase-II	50	50	120	180

M.B.A/M.C.A. Project Work

There shall be a minimum of two reviews and a model viva-voce for Project Work to be conducted with internal 100 marks and external 300 marks. The student shall make presentation on the progress made before the review committee. The Head of the Institution / Department shall constitute a review committee.

Project work (M.B.A/M.C.A)	Internal (25 %)			External (75%)	
	Review-I	Review-II	Viva-voce	Project Report	Viva-voce
	25	25	50	120	180

8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester.

8.1 A candidate will be permitted to appear for the Examination for any semester, only if

i) he / she secures not less than 75% of attendance in the number of working days during that semester, provided that it shall be open to Chairman of the Academic Council and any authority delegated with such powers (by the governing body) to grant exemption (based on the recommendation of the Head of the Department) to a candidate who has failed to secure 75% of the attendance for valid reasons and has secured not less than 65% of the attendance. Such exemptions can be allowed only ONCE during his/ her entire course of study.

ii) Candidates representing University in State / National/International/Inter University Sports events, Co & Extra - Curricular activities, paper or project presentation with prior permission from the Head of Institution are given exemption up to 10% of the required attendance and such candidates shall be permitted to appear for the current semester examination.

iii) his / her conduct has been certified to be satisfactory by the concerned Head of Department.

iv) Condonation can be allowed only ONCE during his/ her entire course of study.

8.2 Candidates who do not complete the semester (as per clause 8.1), will not be permitted to write the end-semester examination and are not permitted to go to next semester. They are required to repeat the incomplete semester in a subsequent academic year after getting the necessary permission from the authorities.

9. REQUIREMENTS FOR APPEARING FOR SEMESTER EXAMINATION

A candidate shall normally be permitted to appear for the semester examination of the current semester if he/she has satisfied the semester completion requirements (Subject to Clause 8.1) and has registered for examination in all courses of that semester. Registration is mandatory for all arrear subjects along with current semester subjects, failing which the candidate will not be permitted to move to the higher semester.

10. END SEMESTER EXAMINATION

10.1 There shall be one end-semester examination of 3 hours duration for each lecture based course.

10.2 The project report / Thesis / Dissertation of M.E. programme, during Phase I, will be evaluated based on the report and a viva-voce examination by an Internal Examiner and an External Examiner.

10.3 The project work / Thesis / Dissertation of M.E. programme, during Phase II, will be evaluated based on the Project Report and a viva-voce examination by a team consisting of the supervisor / Internal Examiner and an External Examiner for each specialization.

The following will be the weightages for different courses.

Lecture or Lecture cum Tutorial

Internal Assessments	25%
Semester Examination	75%

Laboratory based subjects

Internal Assessments	25%
Semester Examination	75%

Project work

Internal Assessment	25%
Evaluation of Project Report	
by external examiner	30%
Viva- Voce Examination	45%
(by both Internal & External Examiners)	

M.E.Project

(i). For PHASE- I [Maximum Marks: 100]

Internal Assessment:	50 Marks [Guide: 50 %, Committee: 50%]]
Semester Examination:	150 Marks [Evaluation: 60 Marks, Viva-Voce: 90Marks]

(ii). For Phase- II [Maximum Marks: 400]

Internal Assessment:	100 Marks [Guide: 50%, Committee: 50%)
Semester Examination:	300 Marks [Evaluation: 120 Marks, Viva-Voce: 180 Marks)

MBA Project [MaximumMarks:400]

Internal Assessment:	100 Marks
Semester Examination:	300 Marks [Evaluation: 120 Marks, Viva-Voce: 180 Marks)

11. PASSING REQUIREMENTS

11.1. For each subject the examination will be conducted for 100 marks. A candidate who secures not less than 50% at the total marks in the End Semester examination and Internal Assessment put together in both theory and Practical subjects, including Project work, subject to securing a minimum of 50% in the End - Semester examination, wherever applicable, shall be declared to have passed the examination in that subject. When the mark secured for 100 is converted to 75, for a pass minimum 37 marks must be secured.

11.2 If a candidates fails to secure a pass in a particular course it is mandatory that he/she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course; he/she should continue to register and reappear for the examination till he / she secures a pass.

12. MALPRACTICE

If a student indulges in malpractice in any of the end semester examinations, he / she shall be liable for punitive action as and when prescribed by the Anna University.

13. ELIGIBILITY FOR THE AWARD OF THE MASTER'S DEGREE

13.1 A student shall be declared eligible *for* the award *of* the degree if he/she has successfully passed all the subjects as specified by the curriculum corresponding to his / her programme within the stipulated time.
No disciplinary action is pending against him/her.

13.2 The award *of* the degree must have been approved by the University.

14. ISSUE OF MARK SHEETS

Individual mark sheet / grade sheet for each semester will be issued, containing the following information through the Head of the Department concerned, after the publication of the results.

i) The grades obtained in each course.
ii) Whether the candidate has passed / failed in the courses concerned.

15. CLASSIFICATION OF THE DEGREE AWARDED

15.1 A candidate who qualifies for the Degree (vide clause 13) by passing the examination in all subjects of the entire course in first attempt within the specified minimum number of semesters securing a CGPA of not less than 8.5 shall be declared to have passed the examination for the degree in FIRST CLASS WITH DISTINCTION. For this purpose the withdrawal from examination (vide clause 16) will not be construed as an appearance. Further, the authorized break of study (vide clause 17(iii)) will not be counted for the purpose of classification.

15.2 A candidate who qualifies for the award of the Degree (vide clause 13) having passed the examinations in all the subjects of the course within the specified minimum number of semesters reckoned from his/her commencement of study plus one year securing a CGPA of not less than 6.5 shall be declared to have passed the examination for the degree in FIRST CLASS. For this purpose, the authorized break of study (vide clause 17(iii)} will not be counted for the purpose of classification.

15.3 All other candidates (not covered in clauses 15.1 and 15.2) who qualify for the award of the degree (vide Clause 13) shall be declared to have passed the examination in Second Class.

15.4 A candidate who is absent in semester examination in a subject / project work after having enrolled for the same shall be considered to have appeared in that examination for the purpose of classification.

16. PROVISION FOR WITHDRAWAL FROM EXAMINATION

A candidate may, for valid reasons (medically unfit / unexpected family situations), be granted permission to withdraw from appearing for any subject or subjects of only one semester examination during the entire duration of the degree programme. Also only one application for withdrawal is permitted for that semester examination in which withdrawal is sought. Withdrawal application shall be valid only if the candidate is, otherwise, eligible to write the examination and if it is made prior to the commencement of the last examination in that semester and duly recommended by the Head of Department and approved by the Head of the Institution.

Withdrawal shall not be construed as an appearance for the eligibility of a candidate for the purpose of classification vide clause 15.1 and 15.2.

(i) "Withdrawal application is to be made within TEN days prior to the commencement of the examination".
(ii) "Withdrawal is NOT permitted for arrears examinations of the previous semesters".
(iii) Notwithstanding the requirement of mandatory TEN days notice, applications for withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

17. AUTHORIZED BREAK OF STUDY FROM A PROGRAMME

i) Break of study shall be granted only once for valid reasons (on medical grounds only) for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme In the middle of the semester for valid reasons and rejoin the programme in a later semester, permission may be granted based on the merits of the case provided he / she applies to the Head of the Institution with recommendation from the concerned HOD in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of Department stating the reasons therefore and the probable date of rejoining the programme .

ii) However, if the candidate. has not completed the first semester of the programme, break of study will be considered only on valid medical reasons. The candidate permitted to rejoin the programme after the break shall be governed by the rules and regulations in force at the time of rejoining. Such candidates may have to do additional courses prescribed by the Academic Council, if the regulation is changed.

iii) The authorized break of study will not be counted for the duration specified for passing all the courses for the purpose of classification vide Clause 15.1 and 15.2.

iv) The total period for completion of the programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 3 irrespective of the period of break of study in order that he / she may be eligible for the award of the degree (vide clause 13).

v) If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Break of Study' and Clause 17(iii)is not applicable for this case.

18. REVALUATION

Copies of answer script for theory subject(s) can be obtained from the Office of the Controller of Examinations on payment of a prescribed fee specified for this purpose through proper application.

A candidate can apply for revaluation of his / her semester examination answer paper in a theory course, within a week from the declaration of results, on payment of a prescribed fee through proper application to the Office of the Controller of Examinations, as per the norms given by the Chairman, Academic Council. Revaluation is not permitted for Practical Courses and Project work.

19. RANK OF A STUDENT

A candidate who qualifies for the Degree by passing the examination in all subjects of the entire course in first attempt within a period of two consecutive academic years from the date of admission to the course can be given his position in the class as rank. The Rank is determined from I Semester to IV Semester examination mark percentages.

20. PROCEDURE FOR USING SCRIBER

If a candidate is physically handicapped (in case of accidents / ill health) at the time of examination, then he / she may be permitted to use a scriber to write the examination. In such case 30 minutes extra time will be permitted. The Scriber should be a non-engineering student / graduate.

21. INDUSTRIAL VISIT

Every student is required to undergo one Industrial visit, starting f*rom* the first semester of the Programme. Every teacher shall take the students at least for one industrial visit in a year.

22. DISCIPLINE

Every student is required to observe disciplined and decorous behavior both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the College. In the event an act of indiscipline being reported, the Principal shall constitute a disciplinary committee consisting of three Heads of Departments of which one should be from the faculty of the student, to inquire into acts of discipline. The disciplinary action is subject to review by the University in case the student represents to the University. Any expulsion of the student from the college shall be with prior concurrence from Directorate of Technical Education / University.

23. CREDIT SYSTEM

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

Range of Total Marks	Letter Grade	Grade Points (GP)
90 to 100	S	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
55 to 59	D	6
50 to 54	E	5
0 to 49	U	0

Incomplete	I	0
Withdrawal	W	0
Absent	AB	0

"U" - denotes failure in the course.

"I" - denotes incomplete as per clause 8.1 and hence prevention from writing End Semester Examination.

"W" - denotes withdrawal from the subject.

"RA" - Reappearance denotes failure in the course.

"AB" - Absent

After results are declared, Consolidated Mark sheets will be issued to each student which will contain the following details:

The list of subjects enrolled during the semester and the grades scored. The Grade Point Average (GPA) for the semester and the Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the points corresponding to the grades scored in those subjects, taken for all the subjects, to the sum of the number of credits of all the subjects in the semester.

$$GPA = \frac{\text{Sum of } [\ C \times GP\ ]}{\text{Sum of } C}$$

Where, C - credit of a particular subject &

GP - grade point obtained by the student in the respective subjects.

CGPA will be calculated in a similar manner, considering all the subjects enrolled from first semester. 'U", "I", "W' and "AB" grades will be excluded for calculating GPA and CGPA. Each subject is normally assigned certain number of credits with 1 credit per lecture period per week, 1 credit per tutorial period per week, 1 credit for 2 periods of laboratory or practical or seminar or project work per week (2 credits for 3 or 4 periods of practical). However, the performance of a student is evaluated only based on the mark system.

24. REVISION OF REGULATIONS AND CURRICULAM

The college may from time to time revise, amend or change the regulations, scheme of examinations and syllabi, if found necessary.

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REGULATION – 2012

M.E. STRUCTURAL ENGINEERING

CURRICULUM I TO IV SEMESTERS (FULL TIME)

SEMESTER I

Sl. No.	Subject Code	Course Title	L	T	P	C
Theory						
1	12SE11	Applied Mathematics	3	1	0	4
2	12SE12	Concrete Structures	3	0	0	3
3	12SE13	Structural Dynamics	3	1	0	4
4	12SE14	Theory of Elasticity and Plasticity	3	1	0	4
5	-	Elective I*	3	0	0	3
6	-	Elective II*	3	0	0	3
TOTAL			18	3	0	21

SEMESTER II

Sl. No.	Subject Code	Course Title	L	T	P	C
Theory						
1	12SE21	Finite Element Analysis	3	1	0	4
2	12SE22	Experimental Techniques and Instrumentation	2	0	2	3
3	12SE23	Steel Structures	3	0	0	4
4	12SE24	Earthquake Analysis and Design of Structures	3	0	0	4
5	-	Elective I*	3	0	0	3
6	-	Elective II*	3	0	0	3
Practical						
7	12SE25	Advanced Structural Engineering Laboratory	0	0	4	2
TOTAL			17	1	6	21

SEMESTER III

Sl. No.	Subject Code	Course Title	L	T	P	C
Theory						
1	-	Elective I*	3	0	0	3
2	-	Elective II*	3	0	0	3
3	-	Elective III*	3	0	0	3
Practical						
4	12SE31	Practical Training (4Weeks)	0	0	0	1
5	12SE32	Project Work (Phase I)	0	0	6	3
TOTAL			9	0	6	13

SEMESTER IV

Sl. No.	Subject Code	Course Title	L	T	P	C
Practical						
1	12SE41	Project Work (Phase II)	0	0	30	15
TOTAL			0	0	30	15

TOTAL NO.OF CREDITS TO BE EARNED FOR THE AWARD OF DEGREE 21+21+13+15=70

ELECTIVES FOR M.E. STRUCTURAL ENGINEERING

Sl. No.	Subject Code	Course Title	L	T	P	C
SEMESTER I						
1	12SE1A	Advanced Concrete Technology	3	0	0	3
2	12SE1B	Mechanics of Composite Materials	2	0	2	3
3	12SE1C	Optimisation of Structures	3	0	0	3
4	12SE1D	Prefabricated Structures	2	0	2	3
5	12SE1E	Prestressed Concrete	3	0	0	3
SEMESTER II						
6	12SE2A	Computer Aided Design	3	0	0	3
7	12SE2B	Design of Shell and Spatial Structures	3	0	0	3
8	12SE2C	Maintenance and Rehabilitation of Structures	3	0	0	3
9	12SE2D	Nonlinear Analysis of Structures	3	0	0	3
10	12SE2E	Stability of Structures	3	0	0	3
SEMESTER III						
11	12SE3A	Design of Bridges	3	0	0	3
12	12SE3B	Design of Steel Concrete Composite Structures	3	0	0	3
13	12SE3C	Design of Tall Buildings	3	0	0	3
14	12SE3D	Industrial Structures	3	0	0	3
15	12SE3E	Offshore Structures	3	0	0	3
16	12SE3F	Theory of Plates	3	0	0	3
17	12SE3G	Wind and Cyclone Effect on Structures	3	0	0	3

12SE11	APPLIED MATHEMATICS	L	T	P	C
		3	1	0	4

OBJECTIVE:

To familiarize the students in the field of differential and elliptic equations to solve boundary value problems associated with engineering applications.

To expose the students to variation formulation and numerical integration techniques and their applications to obtain solutions for buckling, dynamic response, heat and flow problems of one and two dimensional conditions.

UNIT–I ONE DIMENSIONAL WAVE AND HEAT EQUATIONS 10+3

Laplace transform methods for one-dimensional wave equation–Displacements in a long string–longitudinal vibration of an elastic bar– Fourier transform methods for one-dimensional heat conduction problems in infinite and semi-infinite rods.

UNIT–II ELLIPTICEQUATION 9+3

Laplace equation – Properties of harmonic functions– Solution of Laplace's equation by means of Fourier transforms in a half plane, in an infinite strip and in a semi- infinite strip –Solution of Poisson equation by Fourier transform method.

UNIT–III CALCULUSOFVARIATIONS 9+3

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives–Functionals dependant on functions of several independent variables–Variational problems with moving boundaries – Direct methods–Ritz and Kantorovich methods.

UNIT–IV EIGENVALUEPROBLEMS 9+3

Methods of solutions: Faddeev – Leverrier Method, Power Method with deflation– Approximate Methods: Rayleigh–Ritz Method

UNIT–V NUMERICALINTEGRATION 8+3

Gaussian Quadrature –One and Two Dimensions –Gauss Hermite Quadrature – Monte Carlo Method– Multiple Integration by using mapping function

TOTAL(L:45 + T:15)=60

REFERENCES:

1. SankaraRao,K.,"IntroductiontoPartialDifferentialEquations",Prentice Hall of India Pvt.Ltd., NewDelhi,1997.
2. Rajasekaran.S,"Numerical Methods in Science and Engineering A Practical Approach", A.H.Wheeler and Company Private Limited,1986.
3. Gupta, A.S., "Calculus of Variations with Applications", Prentice Hall of India Pvt.Ltd., NewDelhi,1997.
4. And rews,L.C. and Shivamoggi, B.K., "IntegralTransformsforEngineers" , Prentice Hall of India Pvt.Ltd., NewDelhi,2003.

COURSE OUTCOMES:

CO1: Apply the field of differential and elliptic equations to solve boundary value problems associated with engineering applications.

CO2: Obtain the solutions for buckling, dynamic response, heat and flow problems of one and two dimensional conditions using transforms.

CO3: Be familiar with the methods for finding Eigen values.

CO4: Apply the various formulation and numerical integration techniques in various fields.

12SE12	CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the behaviour, analysis and design of R.C.structures.

UNIT–I OVERALL REVIEW 9

Review of limit state design of beams, slabs and columns according to IS Codes. Calculation of deflection and crack width according to IS and ACI Codes

UNIT–II DESIGN OF SPECIALRC ELEMENTS 10

Design of slender columns-Design of RC walls-ordinary and shear walls. Strut and tie method of analysis for corbels and deep beams, Design of corbels, Deep-beams and grid floors.

UNIT–III FLAT SLABS AND FLAT PLATES 10

Design of flat slabs and flat plates according to IS and ACI methods –Design of shear reinforcement – Design of spandrel beams Yield line theory and Hillerborgs strip method of design of slabs.

UNIT–IV INELASTIC BEHAVIOUR OFCONCRETE STRUCTURES 9

Inelastic behaviour of concrete beams and frames, moment - rotation curves, moment redistribution. Baker's method of plastic design. Design of cast-in-situ joints in frames.

UNIT–V DETAILING AND FIELD PRACTICE 7

Detailing for ductility - Fire resistance of structural members – Quality of control of concrete

TOTAL: 45

REFERENCES:

1. UnnikrishnaPillai and Devdas Menon "Reinforced concrete Design', TataMc Graw Hill Publishers Company Ltd., New Delhi, 2006.
2. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, 2007.
3. Varghese, P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India, 2005.
4. Purushothaman, P, "Reinforced Concrete Structural Elements: Behaviour Analysis and Design", Tata McGraw Hill, 1986
5. Sinha.N.C. and Roy S.K., "Fundamentals of Reinforced Concrete", S.Chand and Company Limited, New Delhi, 2003.

COURSE OUTCOMES:

CO1: Understand and analyze the behaviour of reinforced concrete subjected to flexure, shear and axial loading.

CO2: Identify underlying plastic concepts in modern concrete design methods

CO3: Design reinforced concrete beams, slabs and columns in accordance to IS code.

CO4: Enumerate the concept of reinforced concrete, using moment redistribution and Baker's method.

CO5: Produce design calculations and drawings in appropriate professional formats

12SE13	STRUCTURAL DYNAMICS	L	T	P	C
		3	1	0	4

OBJECTIVE:

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

UNIT–I PRINCIPLES OF VIBRATION ANALYSIS 9+3

Equations of motion by equilibrium and energy methods, free and forced vibration of single degree of freedom systems, Effect of damping, Transmissibility.

UNIT–II TWO DEGREE OF FREEDOM SYSTEMS 9+3

Equations of Motion of Two degree of freedom systems, normal modes of vibration, applications

UNIT–III DYNAMIC ANALYSIS OF MDOF 9+3

Multi degree of freedom systems, orthogonality of normal modes, approximate methods. Mode superposition technique, numerical integration procedure.

UNIT–IV DYNAMIC ANALYSIS CONTINUOUS SYSTEMS 9+3

Free and forced vibration of continuous systems, Rayleigh – Ritz method – Formulation using Conservation of Energy – Formulation using Virtual Work.

UNIT–V PRACTICAL APPLICATIONS 9+3

Idealisation and formulation of mathematical models for wind, earthquake, blast and impact loading, aerodynamics, gust phenomenon, principles of analysis.

TOTAL(L:45 + T:15)=60

REFERENCES:

1. Mario Paz, Structural Dynamics:"Theory and Computation", Kluwer Academic Publication, 2004
2. Anil K.Chopra, "Dynamics of Structures", Pearson Education, 2001
3. John M.Biggs, "Introduction to Structural Dynamics", McGraw Hill, 1964
4. Leonard Meirovitch, "Elements of Vibration Analysis", McGraw Hill, 1986
5. Kolousek.V, Pirner.M, Fischer.O and Naprstek.J, "Wind Effects on Civil Engineering Structures", Elsevier Publications, 1984

COURSE OUTCOME:

CO1: Understand the response of structural systems to dynamic loads and displacements.
CO2: Realize the behaviour and response of linear and non-linear SDOF and MDOF structures with various dynamic loading.
CO3: Understand the behaviour and response of MDOF structures with various dynamic loading.
CO4: Find suitable solution for continuous system.
CO5: Understand the behaviour of structures subjected to dynamic loads such as wind, earthquake and blast.

12SE14	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
		3	1	0	4

OBJECTIVE:

To understand the concept of 3D stress, strain analysis and its applications to simple problems.

UNIT–I ELASTICITY **9+3**

Analysis of stress and strain, Equilibrium equations - Compatibility equations - stress strain relationship. Generalized Hooke's law.

UNIT–II ELASTICITY SOLUTION **9+3**

Plane stress and plane strain - Simple two dimensional problems in Cartesian and polar co-ordinates.

UNIT–III TORSION OF NON-CIRCULAR SECTION **9+3**

St.venant's approach - Prandtl's approach – Membrane analogy - Torsion of thin walled open and closed sections.

UNIT–IV ENERGY METHODS **9+3**

Strain energy – Principle of virtual work – Energy theorems – Rayleigh Ritz method – Finite difference method – Application to elasticity problems.

UNIT–V PLASTICITY **9+3**

Physical Assumptions – Yield criteria - Plastic stress strain relationship. Elastic plastic problems in bending – torsion and thick cylinder.

TOTAL(L:45 + T:15)=60

REFERENCES:

1. Timoshenko, S and GoodierJ.N."Theory of Elasticity", McGraw Hill BookCo., Newyork, 1988.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, New Delhi 1988.
3. Slater R.A.C, "Engineering Plasticity", John Wiley and Son, New York, 1977.
4. Chou P.C. and Pagano, N.J. "Elasticity Tensor, Dyadic and EngineeringApproaches", D.VanNostrand Co., Inc., London, 1967.
5. Hearn , E.J. "Mechanics of Materials", Vol.2, Pergamon Press, Oxford, 1985
6. Irving H.Shames and James, M.Pitarresi, "Introduction to Solid Mechanics", Prentice Hall of India Pvt. Ltd., Newl Delhi -2002.

COURSE OUTCOMES:

CO1: Analyse the stresses and strains.
CO2: Determine the solution of elasticity problems.
CO3: Analyse torsion of non-circular sections and thin walled sections.
CO4: Analyse the beams and columns using energy methods.
CO5: Solve problems of plasticity

12SE21	FINITE ELEMENT ANALYSIS	L	T	P	C
		3	1	0	4

OBJECTIVE:

To study the energy principles, finite element concept, stress analysis, meshing, nonlinear problems and applications.

UNIT–I INTRODUCTION **9+3**

Boundary Value Problems – Approximate Solutions – Variational and Weighed Residual Methods – Ritz and Galerkin Formulations – Concept of Piecewise Approximation and Finite Element – Displacement and Shape Functions -Weak Formulation – Minimum Potential Energy – Generation of Stiffness Matrix and Load Vector

UNIT–II STRESS ANALYSIS **9+3**

Two Dimensional problems – Plane Stress, Plane Strain and Axisymmetric Problems – Triangular and Quadrilateral Elements –Natural Coordinates –Isoperimetric Formulation – Numerical Integration – Plate Bending and Shell Elements – Brick Elements –Elements for Fracture Analysis

UNIT–III MESHING AND SOLUTION PROBLEMS **9+3**

Higher Order Elements – p and h Methods of Mesh Refinement – ill conditioned Elements – Discretisation Errors – Auto and Adaptive Mesh Generation Techniques - Error Evaluation

UNIT–IV NONLINEAR, VIBRATION AND THERMAL PROBLEMS **9+3**

Material and Geometric Nonlinearity – Methods of Treatment – Consistent System Matrices – Dynamic Condensation – Eigen Value Extraction - thermal analysis.

UNIT–V PLASTICITY **9+3**

Modeling and analysis using recent softwares.

TOTAL(L:45 + T:15)=60

REFERENCES:

1. S. S. Bhavikatti, “Finite Element Analysis”, New Age Publishers, 2007.
2. C. S. Krishnamurthy, “Finite Element Analysis: Theory and Programming”, Tata McGraw-Hill, 1995
3. David Hutton, “Fundamentals of Finite Element Analysis”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005.
4. Bathe, K.J., “Finite Element Procedures in Engineering Analysis”, Prentice Hall Inc., 1996.
5. Sienkiewicz, O.C. and Taylor, R.L., “The Finite Element Method”, McGraw – Hill, 1987.
6. Chandrupatla, R.T. and Belegundu, A.D., “Introduction to Finite Elements in Engineering”, Prentice Hall of India, 1997.
7. Moaveni, S., “Finite Element Analysis Theory and Application with ANSYS”, Prentice Hall Inc., 1999.

COURSE OUTCOMES:

CO1: Develop finite element formulations of degree of freedom problems and solve them

CO2: Implement the Galerkin residual weak formulation into the Finite Element Method for the solution of Ordinary and Partial Differential Equations

CO3: Use finite element analysis programs based upon either “p-method” or “h-method” finite element mathematical formulations.

CO4: Able to solve the Non linear and thermal Problems.

CO5: Able to use the modeling and analysis softwares.

12SE22	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION	L 2	T 0	P 2	C 3

OBJECTIVE:

To learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.

UNIT–I	FORCES AND STRAIN MEASUREMENT	6+6

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long-term monitoring – vibrating wire sensors– Fibre optic sensors.

UNIT–II	VIBRATION MEASUREMENTS	6+6

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – Chart Plotters – Digital data Acquisition systems.

UNIT–III	ACOUSTICS AND WIND FLOW MEASURES	6+6

Principles of Pressure and flow measurements – pressure transducers – sound level meter – venturimeter and flow meters – wind tunnel and its use in structural analysis
– structural modeling – direct and indirect model analysis

UNIT–IV	DISTRESS MEASUREMENTS AND CONTROL	6+6

Diagnosis of distress in structures – crack observation and measurements – corrosion of reinforcement in concrete – Half cell, construction and use – damage assessment – controlled blasting for demolition – Techniques for residual stress measurements.

UNIT–V	NON DESTRUCTIVE TESTING METHODS	6+6

MLoad testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating, Advanced NDT methods – Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR , Ground penetrating radar (GPR).

TOTAL(L:30+ T:30)=60

REFERENCES:

1. Sadhu Singh, “Experimental Stress Analysis”, Khanna Publishers, New Delhi,1996
2. Dalley.J.W andRiley.W.F, “Experimental Stress Analysis”, McGraw HillBook Company, N.Y. 1991
3..Srinath.L.S, Raghavan.M.R, ingaiah.K, Gargesha.G, Pant.B and Ramachandra.K, “Experimental Stress Analysis”, Tata McGraw Hill Company, New Delhi, 1984
4. Sirohi.R.S.,Radhakrishna.H.C, “Mechanical Measurements”, New AgeInternational (P) Ltd. 1997
5. Bray.D.E. andStanley.R.K., “Course Material on Non-destructive Evaluation”,
6. McGraw Hill Publishing Company, New York.1989
7. Ravisankar.K.andChellappan.A., “Advanced course on Non-DestructiveTesting and Evaluation of Concrete Structures”, SERC, Chennai, 2007.
8. Ganesan.T.P, “Model Analysis of Structures”, University Press, India, 2000.

COURSE OUTCOME:

CO1: Choose the methodology of measuring errors and strains and calibrate the machineries and equipment used in the laboratory.

CO2: Use various vibration measuring instruments and analyse the structures using digital display unit

CO3: Scale the model using direct and indirect model analysis (Using Buckingham PI Theorem).

CO4:Measure distress in the structures using various electronic equipment.

CO5:Perform advanced NDT methods in accessing the load testing of structures

12SE23	STEEL STRUCTURES	L	T	P	C
		3	1	0	4

OBJECTIVE:

To study the behaviour of members and connections, analysis and design of steel towers, chimneys. Study the design of with cold formed steel and plastic analysis of structures.

UNIT–I GENERAL **9**

Design of members subjected to lateral loads and axial loads, Analysis and design of Industrial Buildings and bents, Sway and non-sway frames, Design of Purlins, Louver rails, Gable column and Gable wind girder - Design of Moment Resisting Base Plates
– Analysis of Gable Frames.

UNIT–II DESIGN OF CONNECTIONS **9**

Types of connections – Welded and riveted – Throat and Root Stresses in Fillet Welds – Seated Connections – Unstiffened and Stiffened seated Connections – Moment Resistant Connections – Clip angle Connections – Split beam Connections– Framed Connections.

UNIT–III ANALYSIS AND DESIGN OF STEEL TOWERS **9**

Analysis and Design of Microwave / Transmission Line Towers - Types of bracing patterns - Sag and Tension calculations. Design of Self-supporting Chimney – Design of Base Plates, Foundations and Anchor bolts and Guyed Steel Chimney - Guy ropes- Stresses due to wind. Along with load calculation - Gust Factor Method.

UNIT–IV PLASTIC ANALYSIS OF STRUCTURES **9**

Introduction, Shape factor, Moment redistribution, Combined mechanisms, Analysis of portal frames, Effect of axial force - Effect of shear force on plastic moment, Connections - Requirement – Moment resisting connections. Design of Straight Corner Connections – Haunched Connections – Design of continuous beams.

UNIT–V DESIGN OF LIGHT GAUGE STEEL STRUCTURES **9**

Behaviour of Compression Elements - Effective width for load and deflection determination – Behaviour of Unstiffened and Stiffened Elements – Design of webs of beams – Flexural members – Lateral buckling of beams – Shear Lag – Flange Curling – Design of Compression Members – Wall Studs.

TOTAL: 45

REFERENCES:

1. Subramanian, “Design of Steel Structures”, Oxford University Press, 2008.
2. Dayaratnam.P, “Design of Steel Structures”, A.H. Wheeler, India, 2007.
3. Linton E. Grinter, “Design of Modern Steel Structures”, Eurasia Publishing House, New Delhi, 1996.
4. John E. Lothers, “Design in Structural Steel”, Prentice Hall of India, New Delhi, 1990.
5. Lynn S. Beedle, “Plastic Design of Steel Frames”, John Wiley and Sons, NewYork, 1990.
6. Wie Wen Yu, “Design of Cold Formed Steel Structures”, McGraw Hill Book Company, New York, 1996.

COURSE OUTCOME:

CO1: Design various industrial steel buildings and components such as purlins, louver rails, Gable frames
CO2: Design different types of steel connections and joints.
CO3: Have an exposure to design steel tower and chimneys.
CO4: Design for plasticity.
CO5: Perform design of light gauge steel structures.

12SE24 EARTHQUAKE ANALYSIS AND DESIGN OF STRUCTURES

L	T	P	C
3	1	0	4

OBJECTIVE:

To study the effect of earthquakes, analysis and design of earthquake resistant Structures.

UNIT–I EARTHQUAKES AND GROUND MOTION 9

Engineering Seismology (Definitions, Introduction to Seismic hazard, Earthquake Phenomenon), Seismotectonics and Seismic Zoning of India, Earthquake Monitoring and Seismic Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters, Microzonation.

UNIT–II EFFECTS OF EARTHQUAKE ON STRUCTURES 9

Dynamics of Structures (SDOFS/ MDOFS), Response Spectra - Average Response Spectra - Design Response Spectra, Evaluation of Earthquake Forces as per codal provisions, Effect of Earthquake on Different Types of Structures, Lessons Learnt From Past Earthquakes

UNIT–III EARTHQUAKE RESISTANT DESIGN OF MASONRYSTRUCTURES 9

Structural Systems - Types of Buildings, Causes of damage, Planning Considerations, Philosophy and Principle of Earthquake Resistant Design, Guidelines for Earthquake Resistant Design, Earthquake Resistant Earthen Buildings, Earthquake Resistant Masonry Buildings - Design consideration – Guidelines.

UNIT–IV EARTHQUAKE RESISTANT DESIGN OF RC STRUCTURES 9

Earthquake Resistant Design of R.C.C. Buildings - Material properties - Lateral load analysis - Design and detailing – Rigid Frames – Shear wall – Coupled Shear wall.

UNIT–V SPECIAL TOPICS 9

Mathematical modeling ofmultistoried RC Buildings – Capacity based design. Vibration Control - Tuned Mass Dampers – Principles and application, Basic Concept of Seismic Base Isolation – various Systems- Case Studies, Important structures.

TOTAL: 45

REFERENCES:

1. PankajAgarwal and Manish Shrikhande, “Earthquake Resistant Design ofStructures”, Prentice Hall of India, 2006.
2. S K Duggal, “Earthquake Resistant Design of Structures”, Oxford UniversityPress, 2007.
3. Course Notes "Design of Reinforced Concrete Buildings", IIT Kanpur, June1999.
4. Paulay,T and Priestly, M.N.J., “Aseismic Design of Reinforced Concrete andMasonry buildings”, John Wiley and Sons, 1991.
5. Bruce A Bolt, “Earthquakes” W H Freeman and Company, New York, 2004
6. BungaleS.Taranath "Structural Analysis and Design of Tall Buildings - McGraw Hill Book Company, New York, 1999.

COURSE OUTCOME:

CO1: Describe ground motion and its relationship to seismic design of structures.
CO2: Calculate earthquake induced lateral force on the structure.
Include earthquake resistant features in masonry buildings.
CO3: Apply the basic principles of conceptual design for earthquake resistant RC buildings and carry out the detailed design of earthquake resistant RC buildings.
CO4: Adopt vibration control methods for buildings located in earthquake zone

12SE25	ADVANCED STRUCTURAL ENGINEERING LABORATORY	L	T	P	C
		0	0	4	4

LIST OF EXPERIMENTS

1. Fabrication, casting and testing of simply supported reinforced concrete beam for strength and deflection behaviour
2. Testing of simply supported steel beam for strength and deflection behaviour.
3. Fabrication, casting and testing of reinforced concrete column subjected to concentric and eccentric loading.
4. Dynamic testing of cantilever steel beam
    a) To determine the damping coefficients from free vibrations.
    b) To evaluate the mode shapes.
5. Static cyclic testing of single bay two storied steel frames and evaluate
    a) Drift of the frame.
    b) Stiffness of the frame.
    c) Energy dissipation capacity of the frame.
6. Determination of in-situ strength and quality of concrete using
    i) rebound hammer and
    ii)Ultrasonic Pulse Velocity Tester

LABORATORY EQUIPMENTS REQUIREMENTS

1. Strong Floor
2. Loading Frame
3. Hydraulic Jack
4. Load Cell
5. Proving Ring
6. Demec Gauge
7. Electrical Strain Gauge with indicator
8. Rebound Hammer
9. Ultrasonic Pulse Velocity Tester
10. Dial Gauges
11. Clinometer
12. Vibration Exciter
13. Vibration Meter
14. FFT Analyser

REFERENCES:

1. Dally J W, and Riley W F, “Experimental Stress Analysis”, McGraw-Hill Inc. New York, 1991.

COURSE OUTCOMES:

CO1: Understand the behaviour of reinforced concrete and steel beam for strength and deflection.
CO2: Understand the dynamic behaviour of cantilever steel beam and also able to understand the strength and quality of concrete

12SE1A	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the properties of materials, tests and mix design for concrete.

UNIT–I CONCRETE MAKING MATERIALS 9

Aggregates classification, IS Specifications, Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates. Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements. Water Chemical admixtures, Mineral admixture.

UNIT–II CONCRETE 9

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage, Variability of concrete strength, durability of concrete.

UNIT–III MIX DESIGN 9

Principles of concrete mix design, Methods of concrete mix design, Testing of Concrete. Statistical quality control- sampling and acceptance criteria.

UNIT–IV SPECIAL CONCRETE 9

Light weight concrete, Fly ash concrete, Fibre reinforced concrete, Sulphur impregnated concrete, Polymer Concrete, Super plasticised concrete, hyper plasticized concrete, Epoxy resins and screeds for rehabilitation - properties and applications - high performance concrete. High performance fiber reinforced concrete, self-compacting-concrete.

UNIT–V CONCRETING METHODS 9

Process of manufacturing of concrete, methods of transportation, placing and curing. Extreme weather concreting, special concreting methods. Vacuum dewatering - underwater concrete, special form work.

TOTAL: 45

REFERENCES:

1. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.

2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.

3. A.R.Santhakumar ;"Concrete Technology",Oxford University Press,2007.

4.Rudhani G. Light Weight Concrete Academic Kiado, Publishing Home ofHungarian Academy of Sciences, 1963.

COURSE OUTCOMES:

CO1: Execute and test the concrete made with cement, aggregates and admixtures.
CO2: Describe the properties and durability of fresh and hardened concrete.
CO3: Execute mix proportioning of concrete and describe how the strength of concrete can be modified by changing the proportions.
CO4: Use suitable concrete for different structures considering the prevailing weathering conditions.
CO5: Decide the correct concreting methods in the field depending upon the requirement and site conditions

12SE1B	MECHANICS OF COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the behaviour of composite materials and to investigate the failure and fracture characteristics.

UNIT–I INTRODUCTION **9**

Introduction to Composites, Classifying composite materials, Commonly used fiber and matrix constituents, Composite Construction, Properties of Unidirectional Long Fiber Composites, Short Fiber Composites.

UNIT–II STRESS STRAIN RELATIONS **9**

Concepts in solid mechanics, Hooke's law for orthotropic and anisotropic materials, Linear Elasticity for Anisotropic Materials, Rotations of Stresses, Strains, Residual Stresses

UNIT–III ANALYSIS OF LAMINATED COMPOSITES **9**

Governing equations for anisotropic and orthotropic plates. Angle-ply and cross ply laminates. Static, dynamic and stability analysis for simpler cases of composite plates. Interlaminar stresses.

UNIT–IV FAILURE AND FRACTURE OF COMPOSITES **9**

Netting Analysis, Failure Criterion, Maximum Stress, Maximum Strain, Fracture Mechanics of Composites, Sandwich Construction.

UNIT–V APPLICATIONS AND DESIGN **9**

Metal and Ceramic Matrix Composites, Applications of Composites, Composite Joints, Design with Composites, Review, Environmental Issues.

TOTAL: 45

REFERENCES:

1. Daniel and Ishai, "Engineering Mechanics of Composite Materials", OxfordUniversity Press, 2005.
2. Jones R.M., "Mechanics of composite materials", McGraw-Hill, KogakushaLtd., Tokyo, 1975.
3. Agarwal.B.D. and Broutman.L.J., "Analysis and Performance of fiber composites", John-Wiley and Sons, 1980.
4. Michael W.Hyer, "Stress Analysis of Fiber-Reinforced Composite Materials", McGraw Hill, 1999.
5. Mukhopadhyay.M, "Mechanics of Composite Materials and Structures",University Press, India, 2004.

COURSE OUTCOMES:

CO1: Identify the fiber types and classify the composite material.
CO2: Relate the stress –strain properties, longitudinal and transverse properties of composites lamina.
CO3: Analyse the laminated composites and compute the lamina strength.
CO4: Find the failure criterion and fracture mechanics of composites.
CO5: Apply the load deformation relation, residual stresses for the design of composites.

12SE1C	OPTIMISATION OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the optimization methodologies applied to structural engineering

UNIT–I BASIC PRINCIPLES AND CLASSICAL OPTIMIZATION TECHNIQUES 9

Definition - Objective Function; Constraints - Equality and inequality - Linear and non-linear, Side, Non-negativity, Behaviour and other constraints - Design space- Feasible and infeasible – Convex and Concave - Active constraint - Local and global optima. Differential calculus – Optimality criteria Single variable optimization - Multivariable optimization with no constraints -(Lagrange Multiplier method) – with inequality constraints (Khun-Tucker Criteria).

UNIT–II LINEAR AND NON-LINEAR PROGRAMMING 10

LINEAR PROGRAMMING: Formulationof problems - Graphical solution - Analytical methods - Standard form - Slack, surplus and artificial variables - Canonical form - Basic feasible solution - simplex method - Two phase method - Penalty method - Duality theory - Primal - Dual algorithm.
NON LINEAR PROGRAMMING: One Dimensional minimization methods: Unidimensional - Unimodal function – Exhaustive and unrestricted search - Dichotomous search - Fibonacci Method - Golden section method - Interpolation methods. Unconstrained optimization Techniques.

UNIT–III GEOMETRIC PROGRAMMING 8

Posynomial - degree of difficulty - reducing G.P.P to a set of simultaneous equations - Unconstrained and constrained problems with zero difficulty - Concept of solving problems with one degree of difficulty..

UNIT–IV DYNAMIC PROGRAMMING 9

Bellman's principle of optimality - Representation of a multistage decision problem - concept of sub-optimization problems using classical and tabular methods.

UNIT–V STRUCTURAL APPLICATIONS 9

Methods for optimal design of structural elements, continuous beams and single storied frames using plastic theory - Minimum weight design for truss members - Fully stressed design - Optimization principles to design of R.C. structures such as multistorey buildings, water tanks and bridges.

TOTAL: 45

REFERENCES:

1. Rao,S.S. "Optimization theory and applications", Wiley Eastern (P) Ltd.,1984
2. Uri Krish, "Optimum Structural Design", McGraw Hill Book Co. 1981
3. Spunt, "Optimization in Structural Design", Civil Engineering and Engineering Mechanics Services, Prentice-Hall, New Jersey 1971.
4. Iyengar.N.G.R and Gupta.S.K, "Structural Design Optimisation", Affiliated East West Press Ltd, New Delhi, 1997.

COURSE OUTCOMES:

CO1: Apply the basic ideas in optimization to make the structures as lightly as possible.
CO2: Apply the linear programming techniques in engineering optimization.
CO3: Solve the unconstrained and constrained optimization problems in structural design.
CO4: Understand the methods in solving the problems related to geometric and dynamic Programming.
CO5: Have knowledge in advanced techniques of optimization such as genetic algorithm and Artificial Neural Networks.

12SE1D	PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To Study the design principles, analysis and design of elements.

UNIT–I DESIGN PRINCIPLES **9**

General Civil Engineering requirements, specific requirements for planning and layout of prefabricates plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and codal provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

UNIT–II REINFORCED CONCRETE **9**

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, - Connections – Beam to column and column to column.

UNIT–III FLOORS , STAIRS AND ROOFS **9**

Types of floor slabs, analysis and design example of cored and panel types and two- way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.

UNIT–IV WALLS **9**

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

UNIT–V INDUSTRIAL BUILDINGS AND SHELL ROOFS **9**

Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing design. Cylindrical, Folded plate and hypar-prefabricated shells, Erection and jointing, joint design, hand book based design.

TOTAL: 45

REFERENCES:

1. B.Lewicki, Building with Large Prefabricates, Elsevier Publishing Company, Amsterdam/London/New York, 1966
2. Koncz.T., Manual of Precast Concrete Construction, Vol.I II and III, Bauverlag, GMBH, 1971.
3. Structural Design Manual, Precast Concrete Connection Details, Society forthe Studies in the use of Precase Concrete, Netherland BetorVerlag, 1978.
4. LassloMokk, Prefabricated Concrete for Industrial and Public Sectors, AkademiaiKiado, Budapest, 1964.
5. Murashev.V., Sigalov.E., and Bailov.V., Design of Reinforced ConcreteStructures, Mir Publishers, 1968.
6. Gerostiza. C.Z., Hendrikson, C. and Rehat D.R., Knowledge Based ProcessPlanning for Construction and Manufacturing, Academic Press, Inc., 1989.
7. Warszawski, A., Industrialization and Robotics in Building - A managerial approach, Harper and Row, 1990.

COURSE OUTCOMES:

CO1: Explain the prefabricated elements and the technologies used in fabrication and erection.

CO2:Identify the production technologies used to making prefabricated structures.

CO3:Design floors, stairs, roofs, walls and industrial buildings,

CO4:Examine the expansion & contraction joints in structural connection

CO5: Design the loads for industrial building and shell roofs

.12SE1E	PRESTRESSED CONCRETE	L	T	P	C
		3	0	0	3

OBJECTIVE:

Principle of prestressing, analysis and design of prestressed concrete structures.

UNIT–I PRINCIPLES OF PRESTRESSING 9

Principles of Prestressing - types and systems of prestressing, need for High Strength materials, Analysis methods losses, deflection (short-long term), camber, cable layouts.

UNIT–II DESIGN OF FLEXURAL MEMBERS 9

Behaviour of flexural members, determination of ultimate flexural strength – Codal provisions - Design of flexural members, Design for shear, bond and torsion. Design of end blocks.

UNIT–III DESIGN OF CONTINUOUS BEAMS 9

Analysis and design of continuous beams - Methods of achieving continuity - concept of linear transformations, concordant cable profile and gap cables

UNIT–IV DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks - Design of compression members with and without flexure - its application in the design piles, flagmasts and similar structures.

UNIT–V DESIGN OF COMPOSITE MEMBERS 9

Composite beams - analysis and design, ultimate strength - their applications. Partial prestressing - its advantages and applications.

TOTAL: 45

REFERENCES:

1. Krishna Raju, “Prestressed Concrete”, Tata McGraw Hill PublishingCo,2000.

2. Sinha.N.C.and.Roy.S.K, “Fundamentals of Prestressed Concrete”, S.Chand and Co., 1998.

3. Lin.T.Y., “Design of Prestressed Concrete Structures”, John Wiley and SonsInc,1981.

4. Evans, R.H. and Bennett, E.W., “Prestressed Concrete”, Champman and Hall, London, 1958.

5. Rajagopalan.N, Prestressed Concrete, Narosa Publications, New Delhi, 2008.

COURSE OUTCOMES:

CO1: Explain the principle, types and systems of prestressing and analyse the deflections.
CO2: Determine the flexural strength and design the flexural members, end blocks.
CO3: Analyse the statically indeterminate structures and design the continuous beam.
CO4: Design the tension and compression members and apply it for design of piles.
CO5: Analyse the stress, deflections, flexural and shear strength and apply it for the design of composite members.

12SE2A	COMPUTER AIDED DESIGN	L	T	P	C
		2	0	2	3

OBJECTIVE:

To learn the principles of Computer graphics, Structural analysis, Finite element analysis and Application packages, Optimization and Artificial intelligence.

UNIT–I COMPUTER GRAPHICS **6+6**

Graphic primitives - Transformations - Basics of 2-D drafting - Modeling of curves and surfaces – Wire frame modeling - Solid modeling - Graphic standards - Drafting software packages and usage .

UNIT–II STRUCTURAL ANALYSIS **6+6**

Computer methods of structural analysis –Analysis through software packages.

UNIT–III STRUCTURAL DESIGN **6+6**

Computer aided design of steel and RC Structural elements - Detailed drawing – Bill of materials

UNIT–IV OPTIMIZATION **6+6**

Application of linear programming - Simplex algorithm - Post-optimality analysis - Project scheduling - CPM and PERT applications.

UNIT–V ARTIFICIAL INTELLIGENCE **6+6**

Introduction - Heuristic search - knowledge based expert systems – Rules and decision tables – Inference mechanisms- Simple applications - Genetic algorithm and applications. Principles of Neural network - Architecture and applications of KBES - Expert system shells

TOTAL(L:30 + T:30)=60

REFERENCES:

1. Krishnamoorthy C.S and Rajeev S., “Computer Aided Design”, NarosaPublishing House, New Delhi, 1991.
2. GrooverM.P.andZimmers E.W. Jr.," CAD/CAM, Computer Aided Design and Manufacturing, Prentice Hall of India Ltd, New Delhi, 1993.
3. Harrison H.B., “Structural Analysis and Design Vol.I and II”, Pergamon Press,1991
4. Hinton E.and Owen D.R.J., “Finite Element Programming”, Academic Press, 1977.
5. Rao. S.S., “Optimisation Theory and Applications ", Wiley Eastern Limited, New Delhi, 1977.
6. Richard Forsyth (Ed.), “Expert System Principles and Case Studies”, Chapman and Hall, 1996.

COURSE OUTCOME:

CO1: Be familiar with 2 D drafting and can use drafting software.
CO2: Perform structural analysis using analysis package
CO3: Design the structures with computer methodologies.
CO4: Optimize the structural design with various computer packages and graphics.
CO5: Apply artificial intelligence to real life applications.

12SE2B	DESIGN OF SHELL AND SPATIAL STRUCTURES	L	T	P	C
		2	0	2	3

OBJECTIVE:

Study the behaviour and design of shells, folded plates, space frames and application of FORMIAN software.

UNIT–I CLASSIFICATION OF SHELLS **6+6**

Classification of shells, types of shells, structural action, - Design of circular domes, conical roofs, circular cylindrical shells by ASCE Manual No.31.

UNIT–II FOLDED PLATES **6+6**

Folded Plate structures, structural behaviour, types, design by ACI - ASCE Task Committee method – pyramidal roof.

UNIT–III INTRODUCTION TO SPACE FRAME **6+6**

Space frames - configuration - types of nodes - general principles of design Philosophy - Behaviour.

UNIT–IV ANALYSIS AND DESIGN **6+6**

Analysis of space frames – detailed design of Space frames – Introduction to Computer Aided Design and Software Packages.

UNIT–V SPECIAL METHODS **6+6**

Application of Formex Algebra, FORMIAN for generation of configuration.

TOTAL(L:30 + T:30)=60

REFERENCES:

1. Billington.D.P, “Thin Shell Concrete Structures”, McGraw Hill Book Co., New York, 1982.
2. Santhakumar.A.R and Senthil.R, “Proceedings of International Conference onSpace Structures”, Anna University, Chennai, 1997.
3. Subramanian.N,”Principles of Space Structures”, Wheeler Publishing Co.1999.
4. Ramasamy, G.S., “Design and Construction of Concrete Shells Roofs”, CBS Publishers, 1986.
5. ASCE Manual No.31, “Design of Cylindrical Shells”.

COURSE OUTCOMES:

CO1: Analyse and design various shell and spatial structures

CO2: Understand the behaviour of folded plates.

CO3:Know the structural behaviour and philosophy of space frames.

12SE2C MAINTENANCE AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

To study the damages, repair rehabilitation of structures.

UNIT–I MAINTENANCE AND REPAIR STRATEGIES 8

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT–II SERVICEABILITY AND DURABILITY OF CONCRETE 8

Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking.

UNIT–III MATERIALS AND TECHNIQUES FOR REPAIR 15

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement and polymers coating for rebars loadings from concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels and cathodic protection.

UNIT–IV REPAIRS TO STRUCTURES 10

Repair of structures distressed due to earthquake – Strengthening using FRP - Strengthening and stabilization techniques for repair.

UNIT–V DEMOLITION OF STRUCTURES 4

Engineered demolition techniques for structures - case studies.

TOTAL: 45

REFERENCES:

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical, UK, 1991.
2. Allen R.T and Edwards S.C, "Repair of Concrete Structures", Blakie andSons, UK, 1987
3. Raikar, R.N., "Learning from failures - Deficiencies in Design, Construction and Service" - RandD Centre (SDCPL), RaikarBhavan, Bombay, 1987.
4. Santhakumar A.R., "Concrete Technology" Oxford University Press, 2007Printed in India by Radha Press, New Delhi, 110 031
5. Peter H.Emmons, "Concrete Repair and Maintenance Illustrated", GalgotiaPublications pvt.Ltd., 2001.
6. Dayaratnam.P and Rao.R, "Maintenance and Durability of ConcreteStructures", University Press, India, 1997.

COURSE OUTCOMES:

CO1: Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures

CO2: Plan towards the strength and durability of existing concrete structures.

CO3: Realize the basic concepts and materials available for repair works.

CO4: Posses the ability to find out suitable techniques for repair and demolition process.

CO5: Prepare repair and rehabilitation methodology for various deteriorated structures.

12SE2D	NON LINEAR ANALYSIS OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the concept of nonlinear behaviour and analysis of elements and simple structures.

UNIT–I ELASTIC ANALYSIS OF FLEXURAL MEMBERS 9

Introduction to nonlinear mechanics; statically determinate and statically indeterminate flexible bars of uniform and variable thickness.

UNIT–II INELASTIC ANALYSIS OF FLEXURAL MEMBERS 9

Inelastic analysis of uniform and variable thickness members subjected to small deformations; inelastic analysis of flexible bars of uniform and variable stiffness members with and without axial restraints

UNIT–III VIBRATION THEORY AND ANALYSIS OF OF FLEXURAL MEMBERS 9

Vibration theory and analysis of flexible members; hysteretic models and analysis of uniform and variable stiffness members under cyclic loading

UNIT–IV ELASTIC AND INELASTIC ANALYSIS OF PLATES 9

Elastic and inelastic analysis of uniform and variable thickness plates

UNIT–V NONLINEAR VIBRATION AND INSTABILITY 9

Nonlinear vibration and Instabilities of elastically supported beams.

TOTAL: 45

REFERENCES:

1. Sathyamoorthy,M.,"Nonlinear Analysis of Structures", CRC Press, Boca Raton, Florida, 1997.
2. Fertis, D. G.,"Nonlinear Mechanics", CRC Press, Boca Raton, Florida, 1998.
3. Reddy.J.N, "Non linear Finite Element Analysis", Oxford University Press,2008.

COURSE OUTCOMES:

CO1: Know the basic concepts of nonlinearity and its governing equation for various boundary conditions.

CO2: Understand the inelastic analysis with various boundary conditions of thin walled structural members

CO3: Understand the vibration theory and analysis of flexural members.

CO4: Perform static and dynamic analysis of plates.

CO5: Perform nonlinear analysis and instability of beams.

12SE2E	STABILITY OF STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the concept of buckling and analysis of structural elements.

UNIT–I BUCKLING OF COLUMNS **12**

States of equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem. Governing equation for columns - Analysis for various boundary conditions - using Equilibrium, Energy methods. Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method - Effect of shear on buckling

UNIT–II BUCKLING OF BEAM-COLUMNS AND FRAMES **9**

Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples Analysis of rigid jointed frames with and without sway - Moment distribution - Slope deflection and stiffness method.

UNIT–III TORSIONAL AND LATERAL BUCKLING **9**

Torsional buckling - Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions.Lateral buckling of beams, pure bending of simply supported beam and cantilever.

UNIT–IV BUCKLING OF PLATES **9**

Governing differential equation - Buckling of thin plates, various edge conditions - Analysis by equilibrium and energy approach - Approximate and Numerical techniques

UNIT–V INELASTIC BUCKLING **6**

Double modulus theory - Tangent modulus theory - Shanley's model - Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behaviour of plates.

TOTAL: 45

REFERENCES:

1. Timoshenko, S., and Gere., "Theory of Elastic Stability", McGraw Hill Book Company, 1963.
2. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall, 1974.
3. Ashwini Kumar, "Stability Theory of Structures", Tata McGraw Hill Publishing Company Ltd., New Delhi, 1995.
4. Iyenger.N.G.R.,, "Structural stability of columns and plates", Affiliated East West Press,1986.
5. Gambhir, "Stability Analysis and Design of Structures", springer, New York,2004.

COURSE OUTCOMES:

CO1: Analyze both static and dynamic instabilities, by both theoretical and numerical methods.

CO2: Examine the behaviour of beam columns and frames with and without side sway using classical and stiffness methods.

CO3: Be well versed in the lateral buckling, torsional buckling, flexural torsional buckling of various beams and non-circular sections.

CO4: Evaluate buckling of thin plates using energy methods and various numerical techniques.

CO5: Execute and work out the inelastic buckling using various methodologies.

12SE3A	DESIGN OF BRIDGES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the loads, forces on bridges and design of several types of bridges.

UNIT–I INTRODUCTION **6**

Classification, investigations and planning, choice of type, I.R.C.specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.

UNIT–II SHORT SPAN BRIDGES **9**

Load distribution theories, analysis and design of slab culverts, tee beam and slab bridges.

UNIT–III LONG SPAN GIRDER BRIDGES **12**

Design principles of continuous bridges, box girder bridges, balanced cantilever bridges.

UNIT–IV DESIGN OF PRESTRESSED BRIDGES **9**

Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

UNIT–V DESIGN OF PLATE GIRDER BRIDGES, BEARINGS AND SUBSTRUCTURES **9**

Design of riveted and welded plate girder bridges for highway and railway loading – wind effects – main section, splicing, curtailment, stiffeners – Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of foundations.

TOTAL: 45

REFERENCES:

1. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2008.
2. Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 1990
3. Jagadeesh.T.R. andJayaram.M.A. "Design of Bridge Structures", PrenticeHall of India Pvt. Ltd. 2004.
4. Raina V.K." Concrete Bridge Practice" Tata McGraw Hill Publishing Company, New Delhi, 1991.
5. Bakht, B. and Jaegar, L.G., "Bridge Analysis Simplified", McGraw Hill, 1985.
6. Derrick Beckett, "An introduction to Structural Design of Concrete Bridges", Surrey University Press, Henley Thomes, Oxford Shire, 1973.
7. Taylor, F.W., Thomson, S.E., and Smulski E., "Reinforced Concrete Bridges", John Wiley and Sons, New York, 1955.

COURSE OUTCOMES:

CO1: Understand the design theories for super structure and substructure of bridges
CO2: Design short span bridges.
CO3: Understand the behaviour of continuous bridges, box girder bridges.
CO4: Design prestressed concrete bridges.
CO5: Design railway bridges, plate girder bridges, different types of bearings , abutments, piers and various types of foundations for Bridges

12SE3B DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

To develop an understanding of the behaviour and design study of Steel concrete composite elements and structures.

UNIT–I INTRODUCTION **9**

Introduction to steel - concrete composite construction - theory of composite structures - construction.

UNIT–II DESIGN OF COMPOSITE MEMBERS **9**

Design of composite beams, slabs, columns, beam – columns - design of composite trusses.

UNIT–III DESIGN OF CONNECTIONS **9**

Types of connections, Design of connections in the composite structures - shear connections. Degree of shear connection – Partial shear interaction.

UNIT–IV COMPOSITE BOX GIRDER BRIDGES **9**

Introduction - behaviour of box girder bridges - design concepts.

UNIT–V GENERAL **9**

Case studies on steel - concrete composite construction in buildings - seismic behaviour of composite structures.

TOTAL: 45

REFERENCES:

1. Johnson R.P.,"Composite Structures of Steel and Concrete", BlackwellScientific Publications, UK, 2004.
2. Oehlers D.J. and Bradford M.A., "Composite Steel and Concrete StructuralMembers, Fundamental behaviour", Pergamon press, Oxford, 1995.
3. Proceedings of Workshop on "Steel Concrete Composite Structures", AnnaUniversity, 2007.

COURSE OUTCOMES:

CO1: Possess knowledge of the composite behaviour of structures.
CO2: Design various composite structural elements such as beams, columns, floors, slabs and concrete filled steel tubes.
CO3: Analyse the connection behaviour and design.
CO4: Enumerate the behaviour of box girder bridges and the design concepts of the same.
CO5: Have practical knowledge of construction and design of various structural elements and design concepts through case studies

12SE3C	DESIGN OF TALL BUILDINGS	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the behaviour, analysis and design of tall structures.

UNIT–I DESIGN PRINCIPLES AND LOADING 9

Design philosophy, Loading, sequential loading, materials - high performance, concrete - Fibre reinforced Concrete – Lightweight concrete - design mixes. Gravity loading Wind loading Earthquake loading.

UNIT–II BEHAVIOUR OF VARIOUS STRUCTURAL SYSTEMS 9

Factors affecting growth, Height and Structural form. High rise behaviour, Rigid frames, braced frames, Infilled frames, shear walls, coupled shear walls, wall-frames, tubulars, cores, futrigger - braced and hybrid mega systems.

UNIT–III ANALYSIS AND DESIGN 9

Modelling 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, computerised general three dimensional analysis.

UNIT–IV STRUCTURAL ELEMENTS 9

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 STABILITY OF TALL BUILDINGS 9

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

REFERENCES:

1. Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis andDesign”, John Wiley and Sons, Inc., 1991.
2. Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGrawHill, 1988.
3. Gupta.Y.P.,(Editor), Proceedings of National Seminar on High Rise Structures- Design and Construction Practices for Middle Level Cities, New AgeInternational Limited, New Delhi,1995.
5. Lin T.Y and Stotes Burry D, “Structural Concepts and systems for Architects and Engineers”, John Wiley, 1988.
6. Beedle.L.S., “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986.

COURSE OUTCOMES:

CO1: Know design principles and different types of loading
CO2: Describe the various structural systems used in the construction of tall structures.
CO3: Capable of analyzing the tall structures
CO4: Design of structural elements for secondary effects
CO5: Execute stability analysis, overall buckling analysis of frames, analysis for various secondary effects such as creep, shrinkage and temperature.

12SE3D	INDUSTRIAL STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the requirements, planning and design of Industrial structures.

UNIT–I PLANNING AND FUNCTIONAL REQUIREMENTS 9

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines of Factories Act.

UNIT–II INDUSTRIAL BUILDINGS 9

Roofs for Industrial Buildings - Steel and RCC - Gantry Girders - Design of Corbels and Nibs – Machine foundations.

UNIT–III POWER PLANT STRUCTURES 9

Types of power plants – Design of Turbo generator foundation – containment structures.

UNIT–IV POWER TRANSMISSION STRUCTURES 9

Transmission Line Towers - Substation Structures - Tower Foundations - TestingTowers.

UNIT–V AUXILLIARY STRUCTURES 9

Chimneys and cooling Towers – Bunkers and Silos – Pipe supporting structures.

TOTAL: 45

REFERENCES:

1. Manohar S.N, "Tall Chimneys - Design and Construction", Tata McGraw Hill,1985
2. Santhakumar A.R.an d Murthy S.S., "Transmission Line Structures", TataMcGraw Hill, 1992.
3. Srinivasulu P and Vaidyanathan.C, "Handbook of Machine Foundations", TataMcGraw Hill, 1976.
4. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, "Industrial Buildings: A Design Manual", Birkhauser Publishers, 2004.
5. Procs. of Advanced course on "Industrial Structures", Structural Engineering Research Centre, Chennai, 1982.

COURSE OUTCOMES:

CO1: Know the planning and functional requirements of various industries.
CO2: Get an idea about the materials used and design of industry structural elements.
CO3: Realize the basic concepts and design of power plant structures.
CO4: Design power transmission structures.
CO5: Possess the ability to understand the design concepts of chimneys, bunkers and silos.

12SE3E	OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the concept of wave theories, forces and design of jacket towers, pipes and cables.

UNIT–I WAVE THEORIES **8**

Wave generation process, small and finite amplitude wave theories.

UNIT–II FORCES OF OFFSHORE STRUCTURES **8**

Wind forces, wave forces on vertical, inclined cylinders, structures - current forces and use of Morison equation.

UNIT–III OFFSHORE SOIL AND STRUCTURE MODELLING **9**

Different types of offshore structures, foundation modeling, structural modeling.

UNIT–IV ANALYSIS OF OFFSHORE STRUCTURES **10**

Static method of analysis, foundation analysis and dynamics of offshore structures.

UNIT–V DESIGN OF OFFSHORE STRUCTURES **10**

Design of platforms, helipads, Jacket tower and mooring cables and pipe lines.

TOTAL: 45

REFERENCES:

1. Chakrabarti, S.K. "Hydrodynamics of Offshore Structures", ComputationalMechanics Publications, 1987.
2. Dawson.T.H., "Offshore Structural Engineering", Prentice Hall Inc EnglewoodCliffs, N.J. 1983
3. Brebia, C.A and Walker, S., "Dynamic Analysis of Offshore Structures", NewButterworths, U.K. 1979.
4. API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex,2000.
5. Reddy, D.V. and Arockiasamy, M., "Offshore Structures", Vol.1 and Vol.2, Krieger Publishing Company, Florida, 1991.

COURSE OUTCOMES:

CO1: Apply the concept of wave theories.

CO2: Understand the functions and behavior of offshore structures.

CO3: Describe the offshore structure and soil modelling.

CO4: Evaluate the behavior of structures for its dynamic loads.

CO5: Design of platforms, helipads, jacket towers and cables.

12SE3F	THEORY OF PLATES	L	T	P	C
		3	0	0	3

OBJECTIVE:

To study the behaviour and analysis of thin plates and the behaviour of anisotropic and thick plates.

UNIT–I INTRODUCTION TO PLATES THEORY **10**

Thin Plates with small deflection. Laterally loaded thin plates, governing differential equation, various boundary conditions.

UNIT–II RECTANGULAR PLATES **12**

Rectangular plates. Simply supported rectangular plates, Navier solution and Levy's method, Rectangular plates with various edge conditions, plates on elastic foundation.

UNIT–III CIRCULAR PLATES **8**

Symmetrical bending of circular plates.

UNIT–IV SPECIAL AND APPROXIMATE METHODS. **8**

Energy methods, Finite difference and Finite element methods.

UNIT–V ANISOTROPIC PLATES AND THICK PLATES **7**

Orthotropic plates and grids, moderately thick plates.

TOTAL: 45

REFERENCES:

1. Timoshenko, S. and Krieger S.W. “Theory of Plates and Shells”, McGraw HillBook Company, New York, 1990.
2. Bairagi, “Plate Analysis”, Khanna Publishers, 1996.
3. Reddy J N, “Theory and Analysis of Elastic Plates and Shells”, McGraw HillBook Company, 2006.
4. Szilard, R., “Theory and Analysis of Plates”, Prentice Hall Inc., 1995.
5. Chandrashekahara, K. Theory of Plates, University Press (India) Ltd., Hyderabad, 2001.

COURSE OUTCOMES:

CO1: Explain about various plate theories

CO2: Gain the knowledge of Navier’s solution, Levy’s solution and solve for the rectangular plates.

CO3: Analyse circular plates for any boundary conditions.

CO4: Use finite difference method for solving plate problems.

CO5: Realise the potential energy principle and find the solution of orthotropic plates and grids for various loadings

12SE3G	WIND AND CYCLONE EFFECTS ON STRUCTURES	L	T	P	C
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OBJECTIVE:

To study the concept of wind effects, analysis and design of structures.

UNIT–I INTRODUCTION **10**

Introduction, Spectral studies, Gust factor, Wind velocity, Method of measurement, variation of speed with height, shape factor, aspect ratio, drag effects.

UNIT–II WIND TUNNEL STUDIES **5**

Wind Tunnel Studies, Types of tunnels, Modeling requirements, Interpretation of results, Aero-elastic models.

UNIT–III EFFECT OF WIND ON STRUCTURES **12**

Wind on structures, Rigid structures, Flexible structures, Static and dynamic effects, Tall buildings, chimneys.

UNIT–IV IS CODES AND SPECIAL STRUCTURES **12**

Application to design, IS 875 code method, Buildings, Chimneys, Roofs, Shelters

UNIT–V CYCLONE EFFECTS **6**

Cyclone effect on structures, cladding design, window glass design.

TOTAL: 45

REFERENCES:

1.Cook.N.J., "The Designer's Guide to Wind Loading of Building Structures", Butterworths, 1989.

2.Kolousek.V, Pirner.M, Fischer.O and Naprstek.J, "Wind Effects on CivilEngineering Structures", Elsevier Publications, 1984

3. Peter Sachs, "Wind Forces in Engineering", Pergamon Press, New York,1972.

4. Lawson T.V., "Wind Effects on Building Vol. I and II", Applied Science Publishers, London, 1980.

COURSE OUTCOMES:

CO1: On completion of this course, students will be able to design high rise structures subjected wind load, even structures exposed to cyclone.

CO2: Understand wind tunnel studies

CO3: Design structures for wind and cyclone effects

CO4: Students will be conversant with various code provisions for the design of structures for wind load.