ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

STRUCTURAL ENGINEERING

Department of Civil Engineering

M.Tech Two Year Degree Course

(Applicable for the batch admitted from 2020-21)

GUDLAVALLERU ENGINEERING COLLEGE

(An Autonomous Institute with Permanent Affiliation to JNTUK, Kakinada)

Seshadri Rao Knowledge Village

GUDLAVALLERU - 521 356, Krishna District, Andhra Pradesh

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VISION & MISSION OF THE COLLEGE

Vision

To be a leading institution of engineering education and research, preparing students for leadership in their fields in a caring and challenging learning environment.

Mission

- To produce quality engineers by providing state-of-the-art engineering education.
- To attract and retain knowledgeable, creative, motivated and highly skilled individuals whose leadership and contributions uphold the college tenets of education, creativity, research and responsible public service.
- To develop faculty and resources to impart and disseminate knowledge and information to students and also to society that will enhance educational level, which in turn, will contribute to social and economic betterment of society.
- To provide an environment that values and encourages knowledge acquisition and academic freedom, making this a preferred institution for knowledge seekers.
- To provide quality assurance.
- To partner and collaborate with industry, government, and R and D institutes to develop new knowledge and sustainable technologies and serve as an engine for facilitating the nation's economic development.
- To impart personality development skills to students that will help them to succeed and lead.
- To instil in students the attitude, values and vision that will prepare them to lead lives of personal integrity and civic responsibility.
- To promote a campus environment that welcomes and makes students of all races, cultures and civilizations feel at home.
- Putting students face to face with industrial, governmental and societal challenges.

VISION & MISSION OF THE DEPARTMENT

Vision

To provide quality education embedded with knowledge, ethics and advanced skills and preparing students globally competitive to enrich the civil engineering research and practice.

Mission:

- Aims at imparting integrated knowledge in basic and applied areas of civil engineering to cater the needs of industry, profession and the society at large.
- To develop faculty and infrastructure making the department a centre of excellence providing knowledge base with ethical values and transforming innovative and extension services to the community and nation.
- To make the department a collaborative hub with leading industries and organizations, promote research and development and combat the challenging problems in civil engineering which leads for sustenance of its excellence.

III. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-I : To prepare the students with comprehensive and in depth understanding of knowledge and research directions in structural engineering discipline

PEO-II : To Prepare the students applying the established engineering method to solve complex and challenging engineering problem

PEO-III: To inculcate ethical practices in students making them creative innovative and pro-active demeanour and understand the significance of lifelong learning in global perspective.

IV. PROGRAM OUTCOMES (POs)

PO-1 : An ability to independently carry out research /investigation and development work to solve practical problems.

PO-2 : An ability to write and present a substantial technical report/document.

PO-3 : Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

V. ACADEMIC REGULATIONS

Applicable for the students of M.Tech from the Academic Year 2020-21.

1. PG – M.Tech Programs

The following M.Tech Programs are offered at present

i. Structural Engineering (SE)
ii. Power Electronics and Electric Drives (PEED)
iii. Machine Design (MD)
iv. VLSI Design and Embedded Systems (VLSID & ES)
v. Computer Science and Engineering (CSE)

2. Duration of the Program

The duration of the program is two academic years consisting of four semesters. However, a student is permitted to complete the course work of M.Tech program in the stipulated time frame of four academic years from the date of joining.

3. Minimum Instruction Days

Each semester consists of a minimum of ninety instruction days.

4. Program Credits

Each specialization of the M.Tech programs is designed to have a total of 70 credits and the student shall have to complete the two year course work and earn all the 70 credits for the award of M.Tech Degree.

5. Attendance Regulations

5.1 A student is eligible to write the semester end examinations if he acquires a minimum of 40% attendance in each subject and a 75% of attendance in aggregate of all the subjects.

5.2 Condoning of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester will be considered for genuine reasons such as medical grounds and participation in co-curricular and extra-curricular activities and shall be granted only after approval by the College Academic Committee. Student should submit application for medical leave along with medical certificate from a registered medical practitioner within three days from reporting to the class work after the expiry of the medical leave. In case of participation in co-curricular and extra-curricular activities, either in the college or other colleges, students must take prior written permission from HoD concerned and should also submit the certificate of participation from the organizer of the event within three days after the completion of the event. Only such cases will be considered for condoning attendance shortage.

5.3 A student shall be eligible to claim for condonation of attendance shortage only once during the two years (four semesters) course work.

5.4 A student will not be promoted to the next semester unless he satisfies the attendance requirement of the current semester. He may seek re-admission for that semester when offered next.

5.5 Shortage of Attendance below 65% in aggregate shall in *NO* case be condoned.

5.6 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that semester and their registration shall stand cancelled.

5.7 A fee stipulated by the college shall be payable towards condoning attendance shortage.

5.8 A Student is required to put up a minimum of 75% attendance in the Mandatory Non-credit courses for getting the satisfactory grade.

6. Examinations and Scheme of Evaluation

6.1 Theory Courses :

Each theory course shall be evaluated for a total of 100 marks, consisting of 30 marks for internal assessment and 70 marks for semester end examination.

Internal Assessment:

i) Of 30 marks for internal assessment, 10 marks are for continuous assessment in the form of two assignments and 20 marks are based on two mid-term examinations.

ii) Each assignment carries 10 marks and the average of two assignments shall be taken as the marks for continuous assessment.

iii) Each mid-term examination is conducted for 30 marks with one and half hour duration. Each mid-term examination consists of three questions, each for 10 marks. All the questions need to be answered.

iv) Sum of the 80% marks of better scored mid-term examination and 20% marks of less scored mid-term examination are scaled down for 20 marks.

v) For the project based theory course, the distribution of 30 marks for internal evaluation shall be 20 marks for theory, based on two mid- term examinations and 10 marks for project. Each mid-term examination is conducted for 30 marks with one and half hour duration. Each mid-term examination consists of two questions, each for 15 marks, with internal choice. All the questions need to be answered. Sum of the 80% marks of better scored mid-term examination and 20% marks of less scored mid-term examination are scaled down for 20 marks.

External Assessment:

i) Semester End Examination will be conducted for 70 marks consisting of five internal choice questions i.e. "either" or choice, carrying 14 marks each. There will be two questions from each unit and the student should answer either of the two questions.

ii) For the project based theory course, the pattern of semester end examination is same as the above. There will be no external assessment for project component.

6.2 Laboratory Courses :

i) For practical subjects the distribution shall be 15 marks for Internal Evaluation and 35 marks for the End Examination. There shall be continuous evaluation by the internal subject teacher during the semester for 15 internal marks. Of the 15 marks for internal, 5 marks for day-to-day evaluation, 5 marks for Record and 5 marks shall be evaluated by conducting an internal laboratory test towards the end of semester.

ii) The semester end examination shall be conducted for 35 marks by the teacher concerned and an external examiner appointed by the controller of examinations.

6.3 Mini Project with Seminar:

Mini Project with seminar shall be evaluated for a total of 50 Marks.

i) Of 50 marks, 15 marks shall be awarded by the project supervisor based on student's involvement in carrying out the project and the remaining 35 marks are based on presentation and viva-voce before a committee consisting of supervisor, head of the department and a senior faculty of the department.

ii) There will be no external assessment for mini project with seminar.

6.4 Audit Course (Mandatory Non-credit Course):

i) A student is required to take up two Non-Credit course viz. Constitution of India, English for Research Paper writing, one in first semester and the other in second semester. Marks are awarded based on the day-to-day performance in the seminars organized under each course. A student is required to score 40 marks out of 100 marks despite putting up a minimum of 75% attendance to be declared satisfactory in each mandatory non-credit course. The M.Tech degree shall only be awarded if a student gets satisfactory grade in each of the two mandatory non-credit courses and besides acquiring 70 credits of the M.Tech degree course.

ii) A student whose shortage of attendance is condoned in the case of credit courses in that semester shall also be eligible for condoning shortage of attendance up to 10% in the case of mandatory non-credit courses also.

iii) A student has to repeat the course whenever it is offered, if he does not get satisfactory grade or not fulfilling the attendance requirements in each non-credit course for getting the degree awarded.

6.5 Massive Open Online Courses (MOOCs):

i) Each student may register for Massive Open Online Course (MOOC) as per the course structure.

ii) A student may register for MOOC offered by NPTEL, CISCO, MICROSOFT and SAYLOR or any other agency with a prior approval from the departmental committee.

iii) The duration of the course shall be a minimum of 12 weeks.

iv) The Head of the Department shall appoint one mentor for each course.

v) The courses should be other than those offered under regular curriculum and are to be approved by the departmental committee consisting of the head of the department, mentor and one/two senior faculty members before the commencement of each semester.

vi) During the course, the mentor monitors the students' assignment submissions given by the agency.

vii) Students need to submit all the assignments given and need to take final exam at the proctor centre.

viii) The required credits shall be awarded on submission of certificate from the approved agency.

ix) In case if student does not qualify in the chosen subject, the same or an alternative equivalent subject may be registered again in the next semester with the recommendation of the HoD concerned and shall pass.

6.6 Project Work:

Every candidate shall be required to submit a dissertation on a topic approved by the Project Review Committee. A Project Review Committee (PRC) shall be constituted for each specialization with Head of the Department / a Senior Faculty as Chairman and two other senior faculty members.

Registration and Submission of Dissertation:

i) A candidate who has been promoted to 3rd semester shall be eligible to register for the project work.

ii) The eligible candidate can choose his project supervisor and submit the title, objective, abstract and plan of action of the proposed project work to the department for approval by the PRC. The candidate whose proposal is approved by the PRC shall register for the project work. The minimum duration of project work will be 36 weeks from the date of registration.

iii) If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. In case of such changes, the candidate has to register afresh.

iv) There shall be three reviews on the progress of the project work by the PRC. First review shall be at the end of III semester as per the academic calendar. Second review and final reviews shall be at the middle and at the end of IV semester respectively. The candidate needs to submit a report on the progress

of his work and present it before the PRC for assessment in each review. The PRC may suggest for an extension of date of submission of dissertation if the progress of work is not satisfactory or absent himself for the review.

v) A candidate who has passed all the courses of three semesters and shown satisfactory progress of project work is permitted to submit the dissertation after 36 weeks from the date of registration.

vi) If a candidate fails to submit the dissertation by the end of the IV semester, he has to take the permission for an extension by paying the semester(s) tuition fee.

vii) Three copies of the Project Thesis along with plagiarism check (Similarity index should be less than 50%) report certified by the supervisor and head of the department and application for submission of dissertation shall be submitted to the department.

viii) Project evaluation and Viva-Voce examination is conducted at the end of IV semester by a committee consisting of Project Supervisor, senior faculty of the department, HoD and an External Examiner. The external examiner shall be nominated by the chief controller of examinations from the panel of examiners suggested by the department.

The following grades are awarded for the project work:

1. Excellent 2. Very Good 3. Good
4. Satisfactory 5. Unsatisfactory

The Grade "**Unsatisfactory**" is treated as Fail. Failed Students should take supplementary examination after making required modifications, if any, in the dissertation with a minimum gap of 8 weeks by paying the required examination fee.

7. Criteria for Passing a Course and Award of Grades:

7.1 Criteria for Passing a Course:

i) A candidate shall be declared to have passed in individual theory / laboratory course, if he secures a minimum of 50% aggregate marks (internal & semester end examination marks put together), subject to securing a minimum of 40% marks in the semester end examination.

ii) The candidate shall be declared to have passed in Mini project with seminar if he secures 50% marks.

iii) The candidate shall be declared to have successfully completed the project work if he secures a minimum of 'satisfactory' grade in the project evaluation and viva-voce examination.

iv) On passing a course of a program, the student shall earn assigned credits in that course.

7.2 Method of Awarding Letter Grade and Grade Points for a Course:

A letter grade and grade points will be awarded to a student in each course based on his performance, as per the grading system given below.

Theory /Elective /Laboratory /Seminar / Term Paper /Project Dissertation (%)	Grade Points	Letter Grade
≥ 90	10	O (Outstanding
≥ 80 & < 90	9	A+ (Excellent)
≥ 70 & < 80	8	A (Very Good)
≥ 60 & < 70	7	B+ (Good)
≥ 50 & < 60	6	B (Above Average)
< 50	0	F (Fail)

7.3 Calculation of Semester Grade Point Average (SGPA)* for semester:

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as given below:

SGPA = $\frac{\sum(CR\ X\ GP)}{\sum CR}$ for each semester.

where CR = Credits of a course

GP = Grade Points awarded for a course

* SGPA is calculated for a candidate who passed all the courses in that semester.

7.4 Eligibility for Award of M.Tech Degree:

A student will be declared eligible for the award of the M. Tech. Degree if he fulfills the following academic regulations.

(a) Pursued a course of study for not less than two academic years and not more than four academic years.

(b) Registered for prescribed **70** credits and secured **70** credits.

(c) Students, who fail to complete their Two years Course of study within Four years or fail to acquire the prescribed **70** Credits for the award of the degree within four academic years from the year of their admission shall forfeit their seat in M. Tech course and their admission shall stand cancelled.

7.5 Calculation of Cumulative Grade Point Average (CGPA) for Entire Program:

The CGPA is calculated as given below:

CGPA = $\frac{\sum(CR\ X\ GP)}{\sum CR}$ for entire program.

where CR = Credits of a course

GP = Grade points awarded for a course

* CGPA is calculated for a candidate who passed all the prescribed courses excluding project work.

7.6 Award of Division:

After satisfying the requirements prescribed for the completion of the program, the student shall be eligible for the award of B.Tech Degree and shall be placed in one of the following grades:

CGPA	Class
≥ 7.5	First Class with Distinction *
≥ 6.5 & < 7.5	First Class
≥ 6.0 & < 6.5	Second Class

*** CGPA** ≥ 7.5 will be awarded first class with distinction provided the student must have fulfilled all the program requirements in two (2) years duration.

8. Supplementary Examinations

i) Supplementary examinations will be conducted once in a year along with regular examinations.

ii) Semester end supplementary examinations shall be conducted till next regulation comes into force for that semester after the conduct of the last set of regular examinations under the present regulation.

iii) Thereafter supplementary examinations will be conducted in the equivalent courses as decided by the Board of Studies concerned.

9. Challenge Valuation

Challenge valuation of failed or passed subjects shall be performed as per the following norms.

i) Students can submit the application for challenge valuation, along with the prescribed fee receipt for evaluation of his answer script(s) of theory course(s) as per the notification issued by the Controller of Examinations.

The Controller of Examinations shall arrange for challenge valuation of such answer script(s).

ii) The challenge valuation will be carried out by a three member committee comprising an external subject expert nominated by the Chief Controller of Examinations, the internal subject expert and the BoS Chairman.

iii) After the challenge valuation, if the grade is improved or there is a change in the status i.e., fail to pass, the improved grade shall be notified, otherwise, the previous grade will remain.

10. Re-admission Criteria

A candidate, who is detained in a semester due to lack of attendance has to obtain written permission from the Principal for readmission into the same semester after duly fulfilling the required norms stipulated by the college and by paying the required tuition fee and special fee in addition to paying an administrative fee of Rs.1,000/-

11. Break in Study

Student, who discontinues the studies for what-so-ever reason, can get readmission into appropriate semester of M.Tech program only with the prior permission of the Principal of the College, provided such candidate shall follow the transitory regulations applicable to the batch he joins. An administrative fee of Rs.2,000/- per each year of break in study in addition to the prescribed tuition and special fees shall be paid by the candidate to condone his break in study.

12. Transitory Regulations

When a student is detained due to shortage of attendance, he/she may be readmitted into the same semester in which he/she has been detained. However, the academic regulations under which the detained student was first admitted shall continue to be applicable to him/her. A candidate, who is detained in a semester, on readmission shall be required to do all the courses in the curriculum prescribed for the batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed such courses in the earlier semester(s) he was originally admitted into and he will be offered substitute subjects in place of them as decided by the Board of Studies. However, the decision of the Board of Studies will be final.

13. Withholding of Results

If the student has not paid the dues, if any, to the College or if any case of indiscipline is pending against him, the result of the student will be withheld. His degree will be withheld in such cases.

14. Malpractices

i) The Principal shall refer the cases of malpractices in internal assessment tests and semester end examinations to a malpractice enquiry committee constituted by him for the purpose. Such committee shall follow the approved levels of punishment. The Principal shall take necessary action against the erring students based on the recommendations of the committee.

ii) Any action by the candidate trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder.

iii) Malpractices identified at spot centre during valuation

The following procedure is to be followed in the case of malpractice cases detected during valuation, scrutiny etc. at spot centre.

I. A notice is to be served to the candidate(s) involved **(i)** through the Principal of the college, **(ii)** to the candidate(s) to his college address and **(iii)** to the candidate(s) to his permanent address regarding the malpractice.

DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices / Improper conduct	Punishment
If the candidate		
1.a	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination.)	Expulsion from the examination hall and cancellation of the performance in that subject only.
b	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through Cell phones with any candidates or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The hall ticket of the candidate shall be cancelled.

3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for the examinations of the remaining subjects of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or takes out or arranges to send out the question paper during the examination or answer book during or after the examination.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of performance in that subject.

6.	Refuses to obey the orders of the Chief Superintendent/Assistant Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in or around the examination hall or organises a walkout or instigates others to walkout or threatens the officer-in-charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the Officer-in-charge or any person on duty in or outside the examination hall of any of his relations or indulges in any other act of misconduct or mischief which results in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the Officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	Expulsion from the examination hall and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester / year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat.

9	If student of the college who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to the police and a police case is registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be referred to the Chief Superintendent of Examinations for future action towards suitable punishment.	

II. A committee consisting of the following is to be constituted at spot centre to process such malpractice cases and the recommendations of the malpractice committee are to be sent to the Chief Controller of Examinations.

1. Principal — Chairman
2. Vice Principal - Academics — Member
3. Chief examiner of that subject — Member
4. Controller of Examinations — Convener

The involvement of the staff, who are in charge of conducting examinations, valuing examination papers and preparing / keeping records

of documents related to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and appropriate disciplinary action will be taken after thorough enquiry.

15. Other Matters

i) Deserving physically challenged candidates will be given additional examination time and a scribe based on the certificate issued by the concerned authority. Students who are suffering from contagious diseases are not allowed to appear either for internal or semester end examinations.

ii) The students who participated in coaching / tournaments held at State / National / International levels through University / Indian Olympic Association during semester end external examination period will be promoted to subsequent semesters as per the guidelines of University Grants Commission Letter No. F.1-5/88 (SPE/PES), dated 18-08-1994.

iii) The Principal shall deal in an appropriate manner with any academic problem which is not covered under these rules and regulations, in consultation with the Heads of the Departments and subsequently such actions shall be placed before the Academic Council for ratification. Any emergency modification of regulation, approved in the meetings of the Heads of the Departments shall be reported to the Academic Council for ratification.

16. General

i) The Academic Council may, from time to time, revise, amend or change the regulations, schemes of examination and /or syllabi.

ii) The academic regulations should be read as a whole for the purpose of any interpretation.

iii) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Chairman of the Academic Council is final.

v) Wherever the word he, him or his occurs, it will also include she, her and hers.

VI. CURRICULAR COMPONENT

Sl. No.	Course Work - Subject Areas	Total No.of Credits	% of Total Credits
1	Humanities and Social Sciences (HSS)	3	4.28
2	Professional Core (PC)	20	28.59
3	Professional Electives (PE)	15	21.43
4	Open Electives (OE)	3	4.28
5	Others (Mini Project with Seminar, Dissertation, Audit etc.)	29	41.42

COURSE STRUCTURE

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SYLLABUS

COURSE STRUCTURE

I Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	CE3901	Advanced Structural Analysis **	3	-	-	3
2	CE3902	Theory of Elasticity	3	-	-	3
3		Professional Elective - I	3	-	-	3
4		Professional Elective - II	3	-	-	3
5	BA3901	Research Methodology & IPR	3	-	-	3
6	CE3908	Advanced Structural Engineering Lab	-	-	4	2
7	CE3909	Advanced Concrete Technology Lab	-	-	4	2
		Total	**15**	**-**	**8**	**19**
8	BA3902	Constitution of India (Audit Course)	2	-	-	

II Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1	CE3910	Finite Element Methods in Structural Engineering **	3	-	-	3
2	CE3911	Structural Dynamics	3	-	-	3
3		Professional Elective - III	3	-	-	3
4		Professional Elective - IV	3	-	-	3
5	CE3918	Computer Applications in Structural Engineering Lab	-	-	4	2
6	CE3919	Structural Design Lab	-	-	4	2
7	CE3920	Mini Project with Seminar	-	-	6	3
		Total	**12**	**-**	**14**	**19**
8	EG3901	English for Research Paper Writing (Audit Course)	2	-	-	-

III Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1		Professional Elective - V	3	-	-	3
2		Open Elective	3	-	-	3
3		Dissertation Phase - I	-	-	20	10
		Total	**6**	**-**	**20**	**16**

** Project Based Course

L : Lecture T : Tutorial P : Practical

IV Semester

Sl. No.	Course Code	Name of the Course / Laboratory	No.of Periods per week			No.of Credits
			L	T	P	
1		Dissertation Phase - II	-	-	32	16
		Total	**-**	**-**	**32**	**16**

Professional Electives:

Professional Elective - I

MA3901 Computational Methods in Structural Engineering
CE3903 Advanced R.C. Design
CE3904 Experimental Stress Analysis

Professional Elective - II

CE3905 Theory of Plates and Shells
CE3906 Advancements in Concrete Technology
CE3907 Design of Pre-stressed Concrete Structures

Professional Elective - III

CE3912 Advanced Design of Steel Structures
CE3913 Stability of Structures
CE3914 Design of High-rise Structures

Professional Elective - IV

CE3915 Design of Bridge Structures
CE3916 Repairs and Retrofitting of Structures
CE3917 Ground Improvement Methods

Professional Elective - V

CE3921 Earthquake Resistant Design of Structures
CE3922 Design of Sub-structures
CE3923 MOOCs

Open Electives:

CE3924 Sustainable Development
EE3924 Energy Audit, Conservation & Management
ME3924 Rapid Prototyping
EC4924 Automotive Electronics (Otther than VLSID&ES)
CS3924 Soft Computing Techniques

SYLLABUS

ADVANCED STRUCTURAL ANALYSIS

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- Impart overall knowledge on the analysis of cables
- Familiarize students with the knowledge on analyzing the beams and frames by flexibility and stiffness methods
- Acquire the knowledge on plastic theory

Course Outcomes

Upon successful completion of the course, the students will be able to

- Analyze the suspension cables with and without temperature effect
- Formulate the Flexibility and stiffness matrices for beams and frames
- Evaluate statically indeterminate beams, rigid jointed plane frames using Flexibility method
- Evaluate statically indeterminate beams, rigid jointed plane frames using Stiffness method
- Apply plastic analysis principles to determinate beams, indeterminate beams and portal frames

Course Content

UNIT– I: Cables

Analysis of cables under uniformly distributed and concentrated loads; Shape of the cable under self-weight; Effect of temperature changes in suspension cables; Anchor cables.

UNIT–II: Flexibility and Stiffness Matrices

Flexibility andstiffness; Flexibility matrix; Stiffness matrix; Relationship between flexibility matrix and stiffness matrix.

UNIT–III: Flexibility Method (Matrix Approach)

Analysis of continuous beams with or without sinking, rigid jointed plane frames (Single bay, single storey with vertical legs only) by flexibility method with matrix approach.

UNIT–IV: Stiffness Method (Matrix Approach)

Analysis of continuous beams with or without sinking, rigid jointed plane frames (Single bay, single storey with vertical legs only) by stiffness method with matrix approach.

UNIT–V: Plastic Analysis of Structures

Moment - Curvature relationship for flexural members; Evaluation of fully plastic moment; Shape factor; Collapse load factor; Upper and lower bound theorems; Collapse load analysis of indeterminate beams, single bay and single storied portal frames, Plastic analysis of a gable frame.

Text Books

1. Structural Analysis – A matrix approach by G. S. Pandit& S.P. Gupta, 2008, Tata Mc. Graw – Hill Publishing Co. Ltd., New Delhi.
2. Basic Structural Analysis by C.S. Reddy, McGraw Hill Education; 3rd Edition, 2010.
3. Limit state Design of steel structures by S.K. Duggal, 2 edition, 2017, McGraw Hill Education, New Delhi.

Reference Books

1. Analysis of structures Vol.2 by Prof V.N. Vazirani, Dr. M. M. Ratwani, Dr. Sk. Duggal, 16th Edition, 2016, Khanna Publishers, New Delhi.
2. Indeterminate Structural Analysis by C.K.Wang, 5th Edition 2014, McGraw Hill Education, New Delhi.

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THEORY OF ELASTICITY

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- impart knowledge of principal stresses and strains and analytical skillsof solving problems using plane stress and plane strain.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply knowledge of mechanics and mathematics to model elastic bodies as continuum
- formulate boundary value problems; and calculate stresses and strains
- solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.
- gain the knowledge on concepts of torsion and thermal stress

Course Content

UNIT – I: Analysis of Stress

Definition and notation of stress, equations of equilibrium in differential form, stress components on an arbitrary plane, equality of cross shear, stress invariants, principal stresses, octahedral stress, planes of maximum shear, stress transformation, plane state of stress, Numerical problems.

UNIT – II: Analysis of Strain

Plane strain, Strain at a point, Measurement of surface strains, Displacement field, strains in term of displacement field, infinitesimal strain at a point, engineering shear strains, strain invariants, principal strains, octahedral strains, compatibility equations, strain transformation, Numerical Problems.

UNIT – III: Two-Dimensional Elasticity Problems

Relation between plane stress and plane strain, stress functions for plane stress and plane strain state, Airy's stress functions, Investigation of Airy's stress function for simple beams, bending of a narrow cantilever beam of rectangular cross section under edge load. Bending of simply supported beam under UDL. General equations in polar coordinates, stress distribution symmetrical about an axis, Numerical Problems.

UNIT – IV: Torsion

Torsion of Straight bars – bars with elliptical cross section – other elementary Solution – membrane analogy – torsion of rectangular bars – solution of torsional problems by energy method – use of soap films in solving torsional problems.

UNIT – V: Thermal Stress

Simplest cases of thermal stress distribution, method of strain suppression, Longitudinal temperature variation in a strip, the thin circular disk- temperature symmetrical about center, Numerical Problems.

Text Books

1. Theory of Elasticity by S P Timoshenko and J N Goodier, 3rd edition, McGraw-Hill Higher Education.
2. Theory of Elasticity by Sadhu Singh, Khanna Publications.

Reference Books

1. Theory of Elasticity by Valiappan, Mc. Graw Hill Publications.
2. Applied Elasticity by C.T. Wang, McGraw-Hill Publications.
3. Elasticity Theory by Applications and Numeric- Martin H. Sadd, Oxford Publications.

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Professional Elective - I

COMPUTATIONAL METHODS IN STRUCTURAL ENGINEERING

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- become familiar with numerical methods.
- know how to solve ODE numerically.
- understand the procedures to find correlation and regression.
- know how to solve linear and fractional programming problems.

Course Outcomes

Upon successful completion of the course, the students will be able to

- solve eigen value problems and system of D.E.s
- apply different methods to solve the problems related to finite differences.
- solve boundary value problems numerically

4. find correlation, regression for a given data and able to estimate different parameters.

- find the optimal solutions to linear and fractional programming problems.

Course Content

UNIT – I: Solutions of Linear Equations

Iterative methods : Gauss – Siedel iteration method, Successive over –relaxation method.

Eigen values and Eigen vectors: Jacobi method for symmetric matrices, Rutishauser method of arbitrary matrices – Power method.

UNIT – II: Finite Difference and their Applications

Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation - Use of unevenly spaced pivotal points – Application to Simply Supported Beams.

UNIT – III: Numerical Solutions of Ordinary Differential Equations

Boundary Value Problems: Shooting Method – solution through a set of equations - derivative boundary conditions - Rayleigh Ritz Method.

UNIT – IV: Random Variables And Estimation Theory

Probability - Probability distributions - moments, M.G.F-Two dimensional random variables correlation, regression multiple and partial correlation and regression - Estimation theory basic concepts (Review) - Estimation of parameters - Maximum likelihood estimates - method of moments.

UNIT – V: Optimization Techniques

Linear Programming: Mathematical formulation-graphical solution of two variable – simplex method-artificial variable technique- Big M method- linear fractional programming problem.

Text Books

1. Numerical methods for Engineers by Steven C.Chapra and Raymond P.Canale – McGraw Hill Book Company.
2. Introductory Methods of Numerical Analysis by S. S. Sastry (PHI)
3. An Outline of Statistical Theory, Vol. I, II by A. M. Goon, M. K. Gupta, B. Dasgupta (The World Press Pvt. Ltd.)
4. Linear and Nonlinear Optimization: Second Edition, Igor Griva, Stephen G. Nash, ArielaSofer

Reference Books

1. Advanced Engineering Mathematics by Stanley Grossman & William R. Derrick (Harper & Row Publishers).
2. Applied numerical analysis by Curtis. F.Gerald- AddesonWesely Publishing Company.

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Professional Elective - I

ADVANCED R.C. DESIGN

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- Impart the knowledge on designing various type of structures like bunkers, silos, grid floors, flat slabs, shear walls and multi-stored building frames.

Course Outcomes

Upon successful completion of the course, the students will be able to

- design the bunkers and silos
- analyze grid floors using approximate methods
- design flat slab.
- gets reasonable expertise to implement ductile detailing and also design solid shear walls
- gain the knowledge on concept of designing Multi-storeyed building frames

Course Content

UNIT – I: Bunkers and Silos

Introduction - Design principles and theories - IS Code provision - design of rectangular bunkers - design of cylindrical soils.

UNIT – II: Approximate analysis of Grid Floors

Introduction, analysis of rectangular grid floors by Timoshenko's plate theory and stiffness matrix method, comparison of methods of analysis, reinforcement detailing in grid floor.

UNIT – III: Flat Slabs

Introduction, components, IS code provisions, Design Methods, design for flexure and shear

UNIT – IV: Ductile Detailing

Ductile detailing of RCC beams and columns using IS: 13920-1993 code **Design of Shear Walls:** Design and Detailing of Shear Walls considering shear wall-frame interaction in a tall RC structure subjected to seismic loading.

UNIT – V: Multi-Storey Building Frames

Introduction-analysis of Multi-storey Frames-Method of substitute Frames-Design Example-Bending Moments in Columns-Analysis of Multi-storey frames subjected to horizontal forces-Design Example.

Text Books

1. P.C. Varghese, “Advanced Reinforced Concrete Design”, Prentice Hallpublication(Unit II,III&IV)
2. N.Krishnam Raju ,”Advanced Reinforced concrete Design”, CBSpublication.(Unit I&V)

Reference Books

1. Park & Paulay, “Reinforced Concrete”, John Wiley & sons Publications.
2. Pillai and Menon, “Reinforced concrete Design “.
3. H.J. Shah, “*Reinforced Concrete”*, Charotar Publishers, 2014.

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Professional Elective - I

EXPERIMENTAL STRESS ANALYSIS

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- learn about the various approaches of stress application on any members.
- understand the knowledge of analysis of stress on concrete.

Course Outcomes

Upon successful completion of the course, the students will be able to

- explain the importance of stress and various methods of stresses applied.
- apply the knowledge of strain measurement and using them in design criteria.
- enumerate strain rosettes and applications to concrete.
- understand the importance of 2 D photoelasticity.

Course Content

UNIT – I: Principles of Experimental Approach

Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods – Simplification of problems.

UNIT – II: Strain Measurement using Strain Gauges

Definition of strain and its relation of experimental Determinations Properties of Strain Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – various types – Gauge factor – Materials of adhesion base.

UNIT – III: Strain Rossettes and Non – Destructive Testing of Concrete

Introduction – the three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge. Ultrasonic Pulse Velocity method – Application to Concrete. Hammer Test – Application to Concrete.

UNIT – IV: Theory of Photoelasticity

Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polar scope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law.

UNIT – V: Two-Dimensional Photoelasticity

Introduction – Isochramic Fringe patterns- Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photo elastic Materials.

Text Books

1. Experimental stress analysis by Dr.SadhuSingh.khanna Publishers 5th edition.
2. Experimental Stress analysis by U.C.Jindal, Pearson Pubilications, latest edition.
3. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers 4th edition.

Reference Books

1. Theory of Elasticity by S P Timoshenko and J N Goodier, MC.Graw Hill Company Publishers 3rd edition.
2. Experimental Stress Analysis by J W Dally and W F Riely, MC.Graw Hill Company Publishers 3rd edition.
3. Experimental Stress Analysis and Motion Measurements by R C Dove and P H Adams, Publisher: Merrill; First *Edition edition*(1964)
4. Some Basic Problems of the Mathematical Theory of Elasticity by N I Mushelishvili, Third, revised and augmented edition, Moscow, 1949.

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Professional Elective - II

THEORY OF PLATES AND SHELLS

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- familiarize the behavior of the plates and shells with different geometry under various types of loads.

Course Outcomes

Upon successful completion of the course, the students will be able to

- evaluate the deflection of plates for different loadings.
- understand the concept of folded plates.
- determine various forces in shells.
- explain the concept of curvature in shells.
- gain knowledge on beams, theory of cylindrical shells.

Course Content

UNIT – I: Rectangular Plates

Pure bending of Plates – Relations between bending moments and curvature – Derivation of governing differential equation for plate – Slope and curvature of slightly bent plates. Rectangular Plates: Plates under uniformly distributed load with different boundary conditions.

UNIT – II: Circular Plates

Circular plates: Symmetrically loaded, Circular plates under various loading Conditions, Circular plate with a circular hole at center.

UNIT – III: Folded Plates

Structural behavior of folded plates; Equation of three shears; Application of Simpson's and Whitney's methods.

UNIT – IV: Introduction To Shells

Introduction to shells -Classification of shells- Equations of Equilibrium of shells: Derivation of stress resultants, principles of membrane theory and bending theory.

UNIT – V: Cylindrical Shells

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schosrer's theory. Beam method of analysis..

Text Books

1. Timoshenko and Krieger - Theory of plates and shells, McGraw-Hill book company, INC, New York.
2. H.Kraus - Thin Elastic Shells, John Wiley and sons (1967), New York
3. P.C. Varghese," Design of Reinforced Concrete Shells and Folded plates", PHI Learning Private Limited, New Delhi (2010).
4. J.N.Reddy (1999)-Theory and Analysis of Elastic Plates, Taybr and Francis, Philadelphia.

Reference Books

1. S.S.Bhavikatti ,"Theory of plates and shells", New Age International, New Delhi
2. Chandrasekhar k (2001) – Theory of Plates, University Press, Hyderaba
3. J. Ramachandran," Thin Shells Theory and Problems", Universities Press. "Stresses in shells", Flugge, 2nd Edition, Springer.
4. Bairagi. K," Plate Analysis", Khanna Publisher, New Delhi.
5. Ramaswamy. G.S," Design and Construction of Concrete Shell Roofs", Mc GrawK.Chandrasekhara

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Professional Elective - II

ADVANCEMENTS IN CONCRETE TECHNOLOGY

I Semester

Lecture	: 4	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- To become familiar to latest types, properties and applications of cements and admixtures
- build the knowledge on different types of prospecting aggregates
- impart knowledge on characteristics of quality, durability and concrete construction.
- familiarize with latest technology developments in construction

Course Outcomes

Upon successful completion of the course, the students will be able to

- explain the properties and applications of latest cements and admixtures.
- identify the suitability of different types of prospecting aggregates and their use.
- determine the role Quality and durability of concrete in concrete construction
- explain about special processes in concreting.
- enumerate the usage of concrete coatings and surface treatments.

Course Content

UNIT–I: Cements

Review of cements including blended and special cements, manufacture, chemical composition, chemical and physical processes of hydration, modern methods of analysis.

UNIT–II: Admixtures

Review of types and classification; chemical composition; origin and manufacture; actions and interactions; usage; effects on properties of concretes, mortars and grouts; applications.

UNIT–III: Aggregates

Review of types; elementary mineralogy and petrology; aggregate prospecting; production of artificial aggregates; sampling and testing.

UNIT–IV: Quality, Durability of Concrete and Concrete Construction

Quality of mixed concrete: outline of problems involved; control techniques; selection of control procedures. Quality of finished product- Durability concept; pore structure and transport processes; reinforcement corrosion Chloride attack sulphate attack - Fire resistance; frost damage; alkali-silica reaction; methods of providing durable concrete;

UNIT–V: Special Processes and Technology for Particular Types of Structure

Sprayed concrete; underwater concrete; grouts, grouting and grouted concrete; mass concrete; slip-form construction; pumped concrete; concrete for liquid retaining structures; vacuum process.

Text Books

1. Concrete Technology, M.S.Shetty, Edition -2006, S.Chand& Co.
2. Properties of Concrete, A.M.Neville, 5thedition(2012), Pearson.

Reference Books

1. Concrete Technology, M.L.Gambhir, 3rd edition TataMc.Graw Hill Publishers, New Delhi
2. Concrete Technology by A.R. Santha Kumar, Edition-2013, Oxford UniversityPress, New Delhi.
3. Design of Concrete Mixes by N.Krishnam Raju,2nd edition,CBS Publishers &Distributors
4. IS 456:2016 Plain and Reinforced Concrete - Code of Practice.
5. CONCRETE – Microstructure, properties and materials, fourth edition, P.Kumar Mehta/ Paulo J.M. MONTEIRO, McGraw Hill Education (india) Private limited, Chennai.

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Professional Elective - II

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- understand the basics of elements of prestressed concrete, systems, analysis and design of various elements of prestressed concrete structures subjected to flexure, shear, torsion and axial tension.

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand the basic aspects of pre stressed concrete, and analyze the pre stressed concrete beams for flexure
- calculate losses in the pre stressed concrete and deflections of uncracked members.
- transfer of prestress in pre-tensioned and post-tensioned members and design of end blocks with anchorage zone reinforcement.
- design of prestressed concrete members for flexure axial tension, shear and torsional members.
- design of prestressed concrete slabs.

Course Content

UNIT–I: Introduction to Pre-stressed Concrete

Introduction, Tensioning devices, Pretensioning and Post –tensioned Systems, Basic assumptions, Analysis of Prestress, Resultant Stresses at a section, Pressure line and internal resisting couple, load balancing concept, stresses in tendons and Cracking Moments.

UNIT–II: Losses of Prestress and Deflections

Nature of Losses of prestress in pretension and post-tension, total losses allowed for in design, importance of control of deflections, factors, short-term deflections of uncracked members, long-time deflections and requirements of various codes of practice.

UNIT–III: Transmission of Pre-stresses

Transmission of prestressing force by bond, transmission length, bond stresses, transverse tensile stresses, end-zone reinforcement, flexural-bond stresses, stress distribution in end block, investigations on anchorage zone stresses and reinforcement.

UNIT–IV: Limit State Design of Strucures

Philosophy and criteria of limit-state design, design loads and strengths, serviceability limit states, crack widths and principles of dimensioning of prestressed concrete members, design of sections for flexure, axial tension, shear and torsion.

UNIT–V: Design of Slabs

Types of prestressed concrete floor slabs, design of prestressed concrete one-way slab, two-way slab and simple flat slabs.

Text Books

1. T.Y. Lin, “Design of Pre-stressed Concrete Structures”, Asia Publishing House, 2010.
2. N. Krishna Raju, “Pre-stressed Concrete”, Tata McGraw Hill, New Delhi, 2018.

Reference Books

1. Edward G. Nawy, “Prestressed Concrete A Fundamental Approach”,fifth edition, Prentice Hall.
2. Y. Guyan, “Limit State Design of Pre stressed Concrete”, Applied Science Publishers, 1972.
3. IS: 1343- Code of Practice for Prestressed Concrete.

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RESEARCH METHODOLOGY & IPR

I Semester

Practical	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- impart the importance of research & IPR in professional growth.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analyze various research methodologies
- perform research design
- collect and analyze the data required for research
- able to write research reports
- apply for Patents, Designs, Trade and Copyright.

Course Content

UNIT – I: Introduction

Research Methodology: Meaning of Research – Objectives – Types – Research Approaches – Significance of Research - Research Methods versus Methodology – Research and Scientific Method – Research Process – Criteria of Good Research – Research Ethics – Problems Encountered by Researchers in India.

Defining the Research Problem: What is a Research Problem? – Selecting the Problem – Necessity of Defining the problem – Technique Involved in Defining a Problem – An Illustration – Conclusion.

UNIT – II: Research Design

Meaning of Research Design – Need for Research Design – Features of a Good Design – Important Concepts Relating to Research Design – Different Research Designs – Basic Principles of Experimental Designs – Important Experimental Designs – Conclusion.

UNIT – III: Data Collection & Preparation, Report Writing

Data Collection: Introduction – Experiments and Surveys – Collection of Primary Data – Collection of Secondary Data – Selection of Appropriate Method for Data Collection – Case Study Method

Data Preparation: Data Preparation Process – Some Problems in Preparation Process – Missing Values and Outliers – Types of Analysis – Statistics in Research

Report Writing: Significance of Report Writing – Difference Steps in Writing Report – Layout of the Research Report – Types of Reports – Oral Presentation –

Mechanics of Writing a Research Report – Precautions for Writing Research Reports - Conclusion.

UNIT – IV: Nature of Intellectual Property

Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – V: Patent Rights & Developments

Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Text Books

1. Kothari C.R "Research Methodology-Methods and Techniques",New age international Publishers, New Delhi.
2. T. Ramappa, "Intellectual Property Rights in India"

Reference Books

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".
2. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

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ADVANCED STRUCTURAL ENGINEERING LAB

I Semester

Practical	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

To make the students

- familiarize with the advanced equipment, analysis & Testing of concrete and structures.

Course Outcomes

Upon successful completion of the course, the students will be able to

- determine the durability properties of concrete like permeability, carbon content, corrosion etc.
- determine the reinforcement cover by profometer.
- determine the compressive strength of hardened concrete by pulse velocity method
- evaluate the effect of dynamics on structure
- study the performance of beams and slabs

Experimental Investigations:

1. Assessment of quality of concrete by Pulse velocity Method
2. Measurement of Cover and bar diameter by Profometer
3. Evaluation of permeability of concrete by poroscope
4. Determination of chloride content in concrete
5. Measurement of static strain by electrical resistance strain gauge
6. Measurement of permeability in concrete
7. Dynamics of a rigid structure subjected to harmonic base excitation.
8. Dynamics of a flexible structure subjected to harmonic base excitation.
9. Study on Performance of RCC Beams designed for Bending and failing in Shear
10. Study on Performance of RCC Beams designed for Shear and failing in Bending
11. Study on Performance of RCC One-way slabs

NOTE: A Minimum of TEN experiments are to be conducted

Text Books

1. M.S. Shetty, Concrete technology, S. Chand Publications
2. S.R. DamodaraSwamy&Kavitha, Basics of Structural Dynamics and A seismic Design, Anuradha Publishers
3. Lab Manual Prepared by Faculty of civil Engineering Dept, Gudlavalleru Engineering College

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ADVANCED CONCRETE TECHNOLOGY LAB

I Semester

Practical	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

To make the students

- understand the characteristics and behavior of civil engineering materials used in buildings and infrastructure
- learn standard principles and procedure to design prepare and/or test materials such as concrete mix design including field test methods for fresh concrete.
- have exposure to practical applications including writing of a technical report related to each experiment.
- design and make conventional and high-performance cement concrete mixtures and evaluate their fresh and hardened properties

Course Outcomes

Upon successful completion of the course, the students will be able to

- prove good understanding of concepts and their applications in the lab
- write formal technical report & convey engineering message efficiently
- experimentally verify the assumptions made in the study of CE Materials.
- evaluate the strength and toughness properties of aggregate and concrete.
- determine the gradation, moisture content, unit weight, absorption capacity, voids content, and specific gravity of coarse and fine aggregate samples

List of Experiments:

1. Comparative study on Consistency, Initial setting time, final setting time, fineness and soundness of various grades of cement.
2. (a) Shape tests of Coarse Aggregates.
   (i) Flakiness Indes (ii) Elongation index
   (b) Strength tests on Coarse Aggregates
   (i) Crushing strength and (ii) Aggregate Impact strength
3. Grading of aggregates and grading curves.
4. Compressive strengths of various grades of cement.
5. Workability test on SCC-Slump flow + T500.
6. Workability test on SCC-L-box (Reference method for passing ability.
7. Workability test on SCC- V-funnel.

8. Accelerated curing of Concrete.
9. Influence of water-cement ratio on workability and strength of concrete.
10. RCPT.
11. Mix design and testing of high strength concrete.
12. Correlation between cube strength, cylinder strength.
13. Relation between Compressive Strength And Modulus Of Rupture of Concrete.

NOTE: A Minimum of TEN experiments are to be conducted

Reference Books

1. Indian Standard Methods of Physical Tests for cements IS: 4031, Indian Standards Institution.
2. Indian Standard Specifications for ordinary and low heat Portland cement IS: 269, Indian Standards Institution.
3. Neville. A. M, Properties of concrete, 3rd edition, Pitman publishing company, 1981.
4. Gambhir.M. L, Concrete Manual, 4thEdn., DhanpatRai Sons, Delhi
5. Indian Standard Methods of Test for Aggregate for concrete IS: 2386 Part-IV, Indian Standards Institution.
6. Indian Standard Specifications for Course and Fine Aggregate from Natural Sources for Concrete, IS: 383 Indian Standards Institution.

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Audit Course - I

CONSTITUTION OF INDIA

I Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- understand the structure of Executive, Legislature and Judiciary.
- understand the autonomous nature of Constitutional bodies like Supreme Court and High court controller and Auditor general of India and Election Commission of India.
- understand the Central and State relation financial and administrative.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply the knowledge on Fundamental Rights and Duties and Directive principles of state policy.
- explain the role of President and Prime Minister and also know the Structure of Supreme court and High court.
- understand the Structure of State Government and also analyze the role of Governor and Chief Minister.
- compare and Contrast District administration role and importance.
- evaluate the various commissions of viz., SC/ST/OBC and Women.

Course Content

UNIT–I:

History of Making of the Indian Constitution: Sources. Features – Citizenship, Preamble, Fundamental Rights and Duties, Directive principles of State Policy.

UNIT–II:

Union Government and its administration Structure of the Indian Union: Federalism – Centre – state relationship. President: Role, power and position. Prime Minister and Council of ministers. Loksabha, Rajyasabha The Supreme Court and High Court: Powers and Functions.

UNIT–III:

State Government and its Administration Governor – Role and Position – Chief Minister and Council of ministers.

UNIT–IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Mu-

nicipal Corporation, Pachayati raj: Functions, PRI: ZilaPachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT–V:

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books

1. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.
2. Subash Kashyap, Indian Constitution, National Book Trust.
3. J.C.Johari, Indian Government and Politics Hans.
4. H.M.Sreevani, Constitutional Law of India, 4th edition in 3 Volumes (Universal Law of Publication).

Reference Books

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.

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FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course objectives

To make the students

- Familiarize with the fundamentals of finite element method.
- Prepare for solving one dimensional and two-dimensionalproblems by FEM.
- Familirize the concepts of axi-symmetric and iso-parametric formulation.

Course Outcomes

Upon successful completion of the course, the students will be able to

- summarize the fundamentals of finite element method.
- develop the shape functions and stiffness matrices for various elements.
- solve the problems of one dimensional and two dimensionalby FEM.
- apply the concepts of axi-symmetric and iso-parametric formulation for solving problems.

Course Content

UNIT–I: Introduction to FEM

Introduction, Need of FEM, FEM VS Classical Methods, Advantages & Disadvantages, Applications of FEM, Functional Approximation Methods - Rayleigh – Ritz Method -Weight Residual Techniques, Steps involved in FEM as applicable to structural problems.

UNIT–II: One Dimensional Problems

Finite element modelling, Co-ordinates & shape functions, one dimensional scalar variable problem, Application to structural problems, Element stiffness of bar element due to axial loading, Formulation of stiffness matrix of bar element by direct stiffness method, minimum potential energy principle, Temperature effects.

UNIT–III: Analysis of Beams, Frames & Trusses

Derivation of stiffness matrix for beams by strain energy concept & direct stiffness method - problems on these concepts. Moment-curvature relation. Derivation of Stiffness matrix for trusses, stress calculations and problems on these concepts, Temperature Effects, Derivation of stiffness matrix for a frame element.

UNIT–IV: Two Dimensional Problems

Finite element modelling of 2-D elements, Derivation of shape functions for two-dimensional linear element (Triangular) by area co-ordinates, problems on these concepts. Stress strain relationship matrix formulation for 3D & 2D systems, and stiffness matrix for CST element, Problems on these concepts.

UNIT–V: Axi-Symmetric Problems & ISO-Parametric Elements

Introduction, Axi-symmetric formulation, Derivation of shape function for axisymmetric triangular element, stress –strain relationship matrix, stain & stress displacement matrices- Stiffness matrix for Axi-symmetric triangular element & Problems on these concepts. Iso-parametric formulation, Higher order elements, Derivation of shape functions for a four noded quadrilateral element using natural coordinates, strain displacement matrix, stress-strain relationship matrix, stiffness matrix for Iso-parametric element.

Text Books

1. Finite Elements Methods in Engineering by TirupatiR.Chandrapatla and Ashok D.Belgaundu.
2. Finite Element Analysis by Sk.Md, Jalaludin, Anuradha Publishers

Reference Books

1. FEA –Theory & Programming by C.S. Krishna Murthy- Tata McGraw Hill, New Delhi.
2. FEA by S.S. Bhavakatti-New age international publishers FEA by David V Hutton, Tata McGraw Hill, New Delhi.

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STRUCTURAL DYNAMICS

II Semester

Lecture	: 3	nternal Marks	: 30
Credits	: 3	External Marks	: 70

Course objectives

To make the students

- To create an understanding on degrees of freedom & dynamic loading and ability to formulate the equations of motion and apply them to simple dynamic problems.
- To familiarize on obtaining the natural frequencies & mode shapes and impart the knowledge on mode super position method to undamped forced motion of multi- degreefreedom system
- To impart knowledge on flexural vibrations of simple beams with different end connections

Course Outcomes

Upon successful completion of the course, the students will be able to

- develop differential equation of motion for an undamped single degree freedom system.
- explain different types of damping and concept of logarithmic decrement.
- obtain the response of two-degree freedom system against harmonic and impulsive loadings.
- understand how to formulate stiffness and mass matrices for carrying out free vibration analysis and obtain response against forced motion applying mode super position method
- formulate the natural frequencies and mode shapes of simple beams with different end conditions

Course Content

UNIT–I: Theory of Vibrations

Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation

UNIT–II: Introduction to Structural Dynamics

Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle.

UNIT–III: Single Degree of Freedom Systems

Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT–IV: Multi Degree of Freedom Systems

Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion -Undamped free vibrations -Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition method –procedure –Examples on both free and forced vibration of two-degree freedom systems.

UNIT–V: Continuous Systems

Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure -Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

Text Books

1. "Structural dynamics" by Mario Paz and Leight; CBS Publishers, 1st edition 1985.
2. S.R.Damodarasamy & S.Kavitha "Structural Dynamics and Aseismic Design" PHI Learning private Ltd, New Delhi.

Reference Books

1 Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi

2 Raymond W.Clough, Joseph Penzien, "Dynamics of Structures",Mc.GrawHill Book Company

3. Ray R.C.Craig "Structural Dynamics –An Introduction to computer methods" John Wiley & Sons

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Professional Elective - III

ADVANCED DESIGN OF STEEL STRUCTURES

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course objectives

To make the students

- To impart the concepts of designing water tanks, bridges, transmissiontowers and chimneys.
- To familiarize on plastic behavior, plastic moment and plastic mechanismof steel structures like simple beams and portal frames.

Course Outcomes

Upon successful completion of the course, the students will be able to

- apply the design principles to elevated steel water tanks.
- identify the configuration of truss bridges and understand the design
- principles of truss elements.
- develop the methodology of designing transmission line tower structures.
- understand the design concepts of self-supporting chimneys & foundations.
- develop confidence levels in understanding the plastic analysis, plastic
- mechanism and apply to simple beams & frames.

Course Content

UNIT – I: Water Tanks

Design of elevated water storage steel tanks – Rectangular/pressed steel tanks – Stays in pressed steel tanks , accessories and staging – Permissible stresses— simple problems.

UNIT – II: Truss Bridges

Through type truss bridges (Pratt type only) - component parts of a truss bridge- self weight of truss girders- assumptions for design of truss bridges - Design of compression and tension members, top & bottom lateral bracings and top portal bracing.

UNIT – III: Towers

Introduction, Loads on towers-shape, sag, and tension in uniformly loaded conductors- Analysis of towers- Masts- Trestles- Stresses in trestles due to vertical and horizontal loads- design of members in towers- design of tower foundation.

UNIT – IV: Chimneys

Introduction, Dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability considerations. Design procedure only.

UNIT – V: Plastic Analysis

Plastic analysis of steel structures – Plastic bending in beams, collapse mechanism – Fully plastic Moment – Shape factor and Plastic moment – Ultimate load carrying capacity of simple beams and portal frames.

Note: Designs are by limit state method as per IS 800-2007.

Text Books

1. Design of steel structures vol II Dr. Ramachandra, Standard Book House
2. B.C.Punmia, Ashok kumarjain&Arunkumarjain "Comprehensive Design of steel structures" Laxmi publications, New Delhi.

Reference Books

1. A.S.Arya&J.L.Ajmani "Design of Steel Structures" Nemchand& Brothers, New Delhi.
2. P.Dayaratnam "Design of Steel Structures" Wheeler publishing, New Delhi.
3. V.N.Vazirani&M.M.Ratwani "Steel Structures" Khanna publications, New Delhi.
4. Relevant steel codes of Bureau of Indian standard.

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Professional Elective - III

STABILITY OF STRUCTURES

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course objectives

To make the students

- To impart the knowledge on linear and nonlinear behavior of structures.
- To familiarize the student with stability of plates under combined loads.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analyze these structures with linear and nonlinear behavior.
- gain the knowledge on Stability of Continuous systems.
- distinguish between elastic buckling and in- elastic buckling.

Course Content

UNIT–I: Criteria for Design of Structures

Concept of stability, strength, and stiffness - Stability of discrete systems - Linear and nonlinear behavior.

Beam Columns: Differential equation for beam columns – Beam column with concentrated loads – Continuous with lateral load – Couples – Beam column with built in ends – Continuous beams with axial load – Determination of allowable stresses.

UNIT–II: Elastic Buckling

Elastic buckling of bars: Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non-Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non-Sway mode.

UNIT–III: In-Elastic Buckling

In-elastic buckling: Buckling of straight bars – Double modulus theory, Tangent modulus theory. Empirical formulae of design – various end conditions– Design of columns based on buckling. Rayleigh Ritz method – Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames.

UNIT–IV: Torsional Buckling

Torsional Buckling: Pure torsion of thin-walled bars of open cross section – Non uniform torsion of thin-walled bars of open cross section - Torsional buckling – Buckling on Torsion and Flexure.

UNIT–V: Lateral Buckling

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending.

Text Books

1. Principles of Structural Stability Theory by Alexander Chajes, P H I Publications.
2. Theory of Elastic stability by Timshenko & Gere-McGraw Hill Publications.

Refernce Books

1. An introduction to the elastic stability of structures by Simitses,G.J., 2nd Edition, Prentice Hall.
2. Stability of structures by Bazant, Z.P. and Cedolin, L., 1st Edition, OxfordUniversity Press, Oxford.
3. Buckling of Bars, Plates and Shells by Brush, B.O., and Almoroth,B.O., 3rd Edition, McGraw Hill, NY.
4. Guide to stability design criteria for metal Structures by Galambos,T.V., 2nd Edition,Wiley, NY.

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Professional Elective - III

DESIGN OF HIGH-RISE STRUCTURES

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course objectives

To make the students

- To study the behavior, analysis and design of tall structures.

Course Outcomes

Upon successful completion of the course, the students will be able to

- explain the behavior of tall buildings due to various types of loads.
- analyze and design such buildings by approximate, accurate and simplified methods.

Course Content

UNIT–I: Loading and Design Principles

Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, - Equivalent lateral force, modal analysis - combination of loading, – Static and Dynamic approach - Analytical and wind tunnel experimental methods - Design philosophy - limit state method. Codal provisions.

UNIT–II: Behaviour of Various Structural Systems

Factors affecting growth, height and structural form. High rise behavior, Rigid frames, braced frames, shear walls, coupled shear walls.

UNIT–III: Analysis and Design

Modelling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction. Analysis using substitute frame method for gravity loads and approximate methods for lateral loads.

UNIT–IV: Structural Elements

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

UNIT–V: Stability Issues

Application of software in analysis and design of multi- storied building/ chimney/ transmission tower.

Text Books

1. Beedle.L.S., “Advances in Tall Buildings”, CBS Publishers and Distributors, Delhi, 1986
2. Bryan Stafford Smith and Alexcoull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 2005.

Reference Books

1. .Lin T.Y.and Stotes Burry D, “Structural Concepts and systems for Architects and Engineers”,

2.John Wiley, 1985.5.Taranath B.S., “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 1988.

3.Is code for tall buildings.

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Professional Elective - IV

DESIGN OF BRIDGE STRUCTURES

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course objectives

To make the students

- Impart overall knowledge on analysis and design of RC bridges
- Familiarize students with the knowledge of bridge sub structure and bearings

Course Outcomes

Upon successful completion of the course, the students will be able to

- gain the knowledge on requirements of major bridges
- design deck slab bridges
- acquire knowledge on design of pier and abutment
- design the Bridge bearings
- gain the knowledge on well foundations

Course Content

UNIT–I: Investigation on Major Bridges

Coverage; Topographical details; Catchment area map; Hydrological particulars; Geotechnical details; Seismology of the area; Navigational requirements; Construction resources; selection of suitable site for construction of a bridge; Traffic forecast.

UNIT–II: Reinforced Concrete Slab Bridge Decks

General features, design coefficients, analysis of slab decks, design aids, minimum reinforcements, design of reinforced concrete culverts for IRC class AA & class A loads.

UNIT–III: Piers And Abutments

Types of piers and abutments; Materials of construction; Design of a pier and abutment.

UNIT–IV: Bearings

Classification of bearings; Guidelines for selection of bearings; Design considerations; Basis for metallic bearings; Ferrous bearings of traditional type; Design of elastomeric bearings

UNIT–V: Bridge Foundations

Types of foundations- Well foundation, open well foundation, components of well foundation – Pile foundations (designs not included) – Reinforcement detailing and bar bending schedule need to be prepared

Text Books

1. "Design of Bridges" by Krishna Raju N., 4th edition, Oxford and IBH Publishing Co., Ltd. (Units II, III, IV & V)
2. "Bridge Engineering" by PonnuSwamy, 4th edition, McGraw-Hill Publications (Units I).

References Books

1. "Essentials of Bridge Engineering" by Johnson victor D, 7th edition, Oxford, IBH Publishing Co., Ltd.
2. "Design of Concrete Bridges" by Vazirani, Ratvani&Aswani, 5th edition, Khanna Publishers.
3. "Analysis and Design of sub-structures" by Swami Saran, 2nd edition, Oxford IBH Publishing co ltd.

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Professional Elective - IV

REPAIRS AND RETROFITTING OF STRUCTURES

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- To familiarize with durability accepts, quality of concrete causes of deterioration.
- To impart the knowledge on inspection and assessment of distressed structures, strengthen measures.
- To familiarize with various concrete materials for repairs and various precautions during retrofitting.

Course Outcomes

Upon successful completion of the course, the students will be able to

- identify and evaluate the degree of damage in structures.
- point out the causes of distress in concrete.
- evaluate the existing buildings through field investigations.
- develop various maintenance and repair strategies.
- understand and use the different techniques for health monitoring.

Course Content

UNIT–I: Deterioration of Structures

Introduction – Deterioration of Structures – Distress in Structures – Causes and Prevention. Mechanism of Damage – Types of Damage.

UNIT–II: Corrosion of Steel Reinforcement

Corrosion of Steel Reinforcement – Causes – Mechanism and Prevention. Damage of Structures due to Fire – Fire Rating of Structures – Phenomena of Desiccation.

UNIT–III: Inspection & Testing

Inspection and Testing – Symptoms and Diagnosis of Distress – Damage assessment – NDT.

UNIT–IV: Repair of Structures

Repair of Structure – Common Types of Repairs – Repair in Concrete Structures – Repairs in Under Water Structures – Guniting – Shotcrete – Underpinning. Strengthening of Structures – Strengthening Methods – Retrofitting – Jacketing.

UNIT – V: Structural Health Monitoring

Health Monitoring of Structures – Use of Sensors – Building Instrumentation.

Text Books

1. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
2. Concrete Technology by A.R. Santakumar, Oxford University press.

References Books

1. Defects and Deterioration in Buildings, EF & N Spon, London.
2. Non-Destructive Evaluation of Concrete Structures by Bungey – Surrey University Press.
3. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W.H. Ranso, (1981).
4. Building Failures: Diagnosis and Avoidance, EF & N Spon, London, B.A. Richardson, (1991).

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Professional Elective - IV

GROUND IMPROVEMENT METHODS

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- To identify weak soils, suggest suitable improvements methods and to be familiar with the equipment's used for improvement.

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand the parameters of weak soil and the techniques used for treating such soils.
- dnow various types of stabilizers, stabilization techniques and its application in the field.
- dnow the environmental sustainability of each method.
- dnow various types of Grouting techniques
- acquire knowledge for application of grouting methods in the field

Course Content

UNIT–I: Dewatering

Introduction – Scope and necessity of ground improvement – New Technologies – Basic concepts – Drainage methods – Ground water lowering by well points – Deep well, Vacuum and Electro – Osmosis methods.

UNIT–II: Compaction and Sand Drains

In-situ compaction of cohesionless and cohesive soils – Shallow and deep compaction – Vibration methods – Vibro-compaction, Blasting, vibrating probe, Vibratory rollers, Vibro-displacement compaction, Vibroflotation – Concept, Factors influencing compaction – Heavy Tamping – Vertical drains – Preloading with sand drains, Fabric drains, Wick drains – Design of sand drains – Relative merits of different methods – Limitations.

UNIT–III: Stone Column and Consolidation

Precompression and consolidation – Dynamic consolidation – Electro-osmotic consolidation – Stone column – Functions – Methods of installation – Design estimation of load carrying capacity of stone column – Settlement of stone column – Lime piles – Earth reinforcement – Soil Nailing – Types of reinforcement material – Applications.

UNIT–IV: Stabilization

Introduction – Stabilization methods – Mechanical, Cement, Lime, Bitumen, Chemical stabilization – Electrical stabilization – Stabilization by Thermal and Freezing techniques – Ground improvement by excavating and replacing – Stabilization of expansive clays – Prewetting.

UNIT – V: Grouting

Introduction – Applications – Functions – Characteristics of grouts – Types of grout – Suspension and solution grouts – Basic requirements of grout – Displacement – Compaction grouting, displacement – Soil fracture grouting, Jet – Displacement grouting, Permeation grouting – Grouting equipment – Injection methods – Grout monitoring.

Text Books

1. Moseley M.D., Ground Treatment, Blackie Academic and Professional, 1998
2. Shroff, A.V., Grouting Technology, in Tunneling and Dam, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2009.

Reference Books

1. Purushothama Raj, P., Ground Improvement Techniques, Laxmi Publications (P) Ltd., New Delhi, 2005
2. Koerner, R.M., Designing with Geosynthetics (fourth edition), Prentice Hall, New Jersey, 1999.

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COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING LAB

II Semester

Lecture	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

To make the students

- apply the civil engineering software to some of the structural engineering problems.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analysis the structural elements using software designs.
- analysis the structural elements using software designs.
- design the structures for the dynamic loads using software's.
- solve the finite elements application problems of structural engineering by software's.

Any 10 of the following problems are to be solved using Computer Programs / Application software like STAAD/SAP/ETABS/ NISA (Civil) etc.

List of Experiments:

1. Introduction to software's
2. Analysis of determinate beam to different types of loading.
3. Analysis of continuous beam subjected to different types of loading.
4. Analysis of 2-D building frame for gravity loads.
5. Analysis of 3-D frame for gravity loads
6. Lateral forces on a building due to an earthquake using equivalent static method
7. Wind analysis of 3-D frames.
8. Analysis and Design of plate girder
9. Analysis of pin jointed plane trusses
10. Analysis and design of simple bridge deck.
11. Design of reinforced concrete retaining wall (cantilever type)
12. Open ended experiment.

Reference Books

1. Prof. Sham Tickoo, "Learning Bentley Staad.Pro V8I for Structural Analysis" dreamtech press.
2. S.Ramamrutham, R. Narayan, "Theory of structures" Dhanpat rai publishing company.
3. Punmia.B.C , Design of steel structures, Laxmi publications

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STRUCTURAL DESIGN LAB

II Semester

Lecture	: 4	Internal Marks	: 30
Credits	: 2	External Marks	: 70

Course Objectives

To make the students

- To apply the software in solving the structural design problems.

Course Outcomes

Upon successful completion of the course, the students will be able to

- analyse the structural elements using software.
- design the structures for different loads using software's.

The following problems are to be solved using ETABS

List of Experiments:

1. Introduction to soft wares
2. Analysis and design of single storied building frame for Seismic load and Wind load
3. Analysis and design of multi-storied building frame for Seismic load and Wind load
4. Design and detailing of RCC beam and column
5. Analysis and design of truss
6. Design and detailing of RCC shear wall
7. Design and detailing of RCC circular slab
8. Design of reinforced concrete retaining wall
9. Modelling of staircase
10. Design of isolated footing

Reference Books

1. S. Ramamrutham, "Design of Reinforced Concrete Structures", DhanpatRai Publishing Company (P) Ltd.
2. N. Subramanian, "Design of Reinforced Concrete Structures", Oxford; Illustrated edition.

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Audit Course - II

ENGLISH FOR RESEARCH PAPER WRITING

II Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

- To equip the trainees with the critical thinking skills required for crafting research issues into researchable questions.
- To develop in them research paper writing skills in three areas – vocabulary, discourse, and style;
- To enhance their awareness of the referencing conventions vis-à-vis scholarly communication;
- To develop in them an understanding of the knowledge-constructing practices of their disciplines (under the guidance of a research mentor on an apprenticeship programme) and sharpen that understanding so as to enable them to identify research issues, investigate them, and then present and publish papers on them.

Course Outcomes

Upon successful completion of the course, the students will be able to

- craft research issues into researchable questions;
- write appropriate introductions and conclusions to academic / research texts;
- review research literature using the skills of analysis, synthesis, critical evaluation, paraphrasing, and summarising and avoiding the risk of plagiarism;
- use the right vocabulary for different research communication purposes, such as stating study aims, reviewing sources, describing research designs, presenting arguments, evaluating and emphasizing, and analysing and discussing results.
- organise texts following the discourse rules of coherence and cohesion;
- write research paper abstracts; and
- communicate their research in academic style with grammatical accuracy.

Course Content

UNIT–I:

Understanding Researchability: Evaluating research questions in order to gain awareness of researchability - Identifying research issues, developing research questions from them, and crafting them into researchable questions

Academic Vocabulary: Neutral, and formal vocabulary - Nominalisation - Phrases commonly used in research communication

UNIT–II:

Writing and Rhetorical Conventions: Writing introductions - Writing conclusions - Discourse organization

Academic Vocabulary: Research and Study aims.

UNIT–III:

Writing and Rhetorical Conventions: Summarising - Paraphrasing -

Academic Vocabulary: Evaluating and critiquing

UNIT–IV:

Writing and Ahetorical Conventions: Writing abstracts - Varying sentence length and structure

Remedial Grammar

UNIT–V:

Writing and Rhetorical Conventions: Avoiding repetition and redundancy - Style of academic / scholarly communication - Referencing

Academic Vocabulary: Analysing and discussing results

Apprenticeship

The apprenticeship will involve each individual trainee, under the guidance of a research mentor in his/her department, developing and crafting research questions on issues of his/her concern, investigating at least one of those issues during the course of the internship, and writing a paper on it which, before its presentation or publication, will be reviewed or assessed, as part of the internal assessment, by a panel of experts in the trainees' own departments. The entire process could be broken down into the following skills:

a. Identifying research issues
b. Framing the issues – developing research questions from them, refining them, and crafting them
c. Addressing literature
d. Investigating one of those issues by selecting an appropriate research design and data collection procedures and arriving at conclusions
e. Gaining competence in disciplinary specialized discourse conventions
f. Presenting arguments which scholars anticipate
g. Writing a paper on the study, presenting it before a panel of experts, and revising the paper on the basis of feedback from the panel
h. Determining the prestige of journals
i. Establishing a paper-journal fit and submitting the revised paper for publication
j. Learning to negotiate two principal audiences in one's scholarly communication – the community of scholars and journal gate-keepers
k. Negotiating peer review and editorial commentary

Text Books

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Reference Books:

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Professional Elective - V

EARTHQUAKE RESISTANT DESIGN FO STRUCTURES

III Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- impart the knowledge of designing earthquake resistant structures and
- familiarize the codal provisions and carry out an analytical problem.

Course Outcomes

Upon successful completion of the course, the students will be able to

- describe various terms of engineering seismology.
- design earthquake-resistant structures by using different methods.
- gain the knowledge on seismic codal provisions and detailing
- identification of damages and non- damages in masonry buildings
- acquire the knowledge on properties of structural masonry

Course Content

UNIT–I: Engineering Seismology

Introduction, Types of earthquakes, effects and causes of earthquakes, magnitude & intensity, fault rupture parameters, Local site effects.

UNIT–II: Codal Provisions and Design of Lateral Loads

Review of Indian Seismic code IS: 1893 – 2016 (Part- I) provisions- Earthquake design philosophy.

Introduction - Design forces for buildings by Equivalent static method and Response spectrum method.

UNIT–III: Ductility Considerations in Designof RC Buildings

Introduction, impact of ductility, requirements for ductility, assessment of ductility, factors effecting ductility, ductility factors, ductility consideration as per IS:13920:2016.

UNIT–IV: Damages and Non-Damages in Masonary Buildings and Properties of Structural Masonary

Introduction, past Indian earthquakes, Features of damages and non-damages- Bhuj earthquake, Chamoli earthquake, Bihar –Nepal earthquake, Uttarkashi earthquake.

Introduction, materials for masonry construction-unit, mortar, grout, reinforcement.

UNIT – V: Masonry Buildings

Introduction, determination of design lateral loads, distribution of lateral forces, determination of rigidity of shear force, determination of direct shear force and torsional shear forces.

Text Books

1. "Earthquake Resistant Design of Structures" by pankaj Agarwal &shrikhandeManish ,Eswar Press.
2. "Earthquake Resistant Design of Structures", by Duggal S.K., Oxford UniversityPress,2nd Edition.

Reference Books

1. "Dynamics of Structures by Anil K. Chopra, Theory and Applications to Earthquake Engineering", 4 th Edition, Prentice Hall of India.
2. Elements of Earthquake Engineering", Jai Krishna AR Chandrasekharan,andBrijesh Chandra 3rd Edition, SarithaPrakasham, Meerut.
3. "Relevant Indian Standard Codes: IS-875, IS-1893, IS -4326, IS- 13920.

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Professional Elective - V

DESIGN OF SUB-STRUCTURES

III Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- impart the knowledge on soil exploration and design principles of shallow and pile foundations.
- introduce vibration concept in soils.

Course Outcomes

Upon successful completion of the course, the students will be able to

- gain the knowledge on method of soil exploration.
- evaluate the bearing capacity of soil.
- gain the knowledge on mode of vibration and analysis of machine foundation.
- gain the knowledge on concept of load carrying capacity of pile group.

Course Content

UNIT–I: Soil Exploration

Soil Exploration – Importance, terminology, methods of boring. Soil sampling – Types of samples, design considerations of open drive samplers.

UNIT–II: Shallow Foundations

Shallow Foundations –Bearing capacity – Terzaghi's, Meyerhof's, Hansen's, Vesic's and IS code methods- Bearing capacity based on standard penetration.

UNIT–III: Footings

Principle of design of footing, proportioning footings for equal settlement, mat foundation - Rectangular and trapezoidal combined footings, common type of Raft foundations, bearing capacity and differential settlement of mat foundation.

UNIT–IV: Pile Foundations

Pile foundations-Classification of piles-factors influencing choice-Load carrying capacity of single pile in clayey and sandy soils using static & dynamic pile formulae- Group of piles – Pile cap - Efficiency of pile groups- load carrying capacity and settlement of pile groups in cohesive and non-cohesive soils.

UNIT–V: Vibrations in Soils

Fundamentals of Vibration; Free and Forced Vibration with and without damping; Natural frequency of foundation; Types of machine foundation; I.S. Code of practice for design and construction of block foundation for reciprocating and impact type machines for high-speed rotary machines.

Text Books

1. Braja M. Das," Principles of Foundation Engineering", CengageLearing.
2. J.E. Bowles," Foundation Analysis and Design", McGraw Hill Publishing Co.,

Reference Books

1. K. R. Arora,"Soil Mechanics and Foundation Engineering", standard publishers and Distributors, Delhi.
2. Terzagi and Peck, "Soil Mechanics in Engineering Practice", John wiley & sons.
3. Wayne C. Teng, "Foundation Design", Prentice – Hall. Swami Saran, "Analysis and Design of sub structures", Oxford & IBH.

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Open Elective

SUSTAINABLE DEVELOPMENT

III Semester

Lecture	: 4	Internal Marks	: 40
Credits	: 3	External Marks	: 60

Course Objectives

To make the students

- understand the students understand the fundamental key concepts on Sustainable Development (SD),suchasintra-andinter-generational equity, economic, social and environmental,sustainability, strong and weak sustainability, natural capitalism, steady state and green economy.
- to identify and discuss in detail the key empiricalissues on sustainable development, such as renewable energy transitions, urban agriculture and green architecture.
- expertise to distinguish between “greeneconomy” and “sustainability” and various efforts at multiple levels ofgovernance:from individual to governments.
- expose to awide varietyof research areas to apply and therefore appropriate the oretical knowledge on public policy and international relations to the issue area of sustainable development, insuch aspects as international aid, global climate change negotiations, the importance of international regimes as opposed to voluntary private governance.
- empower to make their own lives more sustainable and join social movements to bring about more of sustainable development.

Course Outcomes

Upon successful completion of the course, the students will be able to

- gain knowledge of sustain ability and bio diversity
- study about greenhouse gases
- learn dynamics of sustainability
- gain Knowledge on socio-economic systems
- study about the conventions on sustainable development
- learn concept of Sustainable Development and itsrole in building of environment

Course Content

UNIT–I: Concept of Sustainable Development

Definition of sustainability - History and emergence of the concept of Sustainable development – Our Common Future - Objectives of Sustainable Development - Millennium Development Goals - Environment and Development linkages – Glo

balization and environment - Population, Poverty and Pollution –Global, Regional and Local environmental issues–Resource Degradation–Greenhouse gases and climate Change – Desertification – Industrialization –Socialinsecurity.

UNIT–II: Sustainability and thetriple bottom line

Components of sustainability–Complexity of growth and equity-Social, economic and environmental dimensions of sustainable development–Environment–Biodiversity–Natural Resources–Ecosystem integrity–Clean air and water–Carrying capacity–Equity, Quality of Life, Prevention, Precaution, Preservation and Public participation. - Structural and functional linking of developmental dimensions – Sustainability in national and regional context..

UNIT–III: Sustainable Development and International Response

Role of developed countries in the development of developing countries–International summits–Stock holm to Johannes burg–Rio Principles–Agenda 21-Conventions–Agreements–Tokyo Declaration-Doubling Statement - Trans boundary issues – Integrated approach for resource protection and management.

UNIT–IV: Sustainable Development of Socio-Economic Systems

Demographic dynamics of sustainability – Policies for socio-economic development –Strategies for implementing eco-development programmes – Sustainable development through trade – Economic growth – Action plan forimplementing sustainable development – Urbanization and Sustainable Cities –Sustainable Energy and Agriculture –Sustainable Livelihoods – Ecotourism.

UNIT–V: Framework for Achieving Sustainability

Sustainability indicators - Hurdles to Sustainability - Operational guidelines – Inter connected pre-requisites for sustainable development – Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities, Business and Industry-Science and Technology for sustainable development – Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.

Text Books

1. Austin, James and Tomas Kohn. 1990. Strategic Management in DevelopingCountries.TheFreePress.
2. Berger. 1994. “The Environment and the Economy.” In Smelser and Swedberg(eds.)
3. TheHandbookofEconomicSociology.RusselSageFoundation.D’Arcy,David. Transcript of broadcast, Dec. 5, 2002, “In Houston, a Treasure of ExiledAfghanArt,”National PublicRadio,

Reference Books

1. Elkington, John. Cannibals with Forks:TheTriple Bottom Line for 21stCenturyBusiness Oxford:Capstone Publishing,October 1997.
2. Guillen, Mauro and Sandra L. Suarez. 2002. “The Institutional Context of Multinational Activity.”In Organization Theory and the Multinational Corporation” .2ndedition. New York: St.Martin’s Press.

Open Elective

ENERGY AUDIT, CONSERVATION & MANAGEMENT

III Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- To learn principle of energy audit as well as management for industries and utilities and buildings.
- To study the energy efficient motors and lighting.
- To learn power factor improvement methods and operation of different energy instruments.
- To compute depreciation methods of equipment for energy saving.

Course Outcomes

Upon successful completion of the course, the students will be able to

- understand the principle of energy audit and their economic aspects.
- recommend energy efficient motors and design good lighting system.
- understand advantages to improve the power factor.
- evaluate the depreciation of equipment.

Course Content

UNIT–I: Basic Principles of Energy Audit

Energy audit- definitions, concept , types of audit, energy index, cost index ,pie charts, Sankey diagrams and load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

UNIT–II: Energy Management

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting. Energy manager, qualities and functions, language,Questionnaire – check list for top management.

UNIT–III: Energy Efficient Motors and Lighting

Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics – variable speed , variable duty cycle systems, RMS - voltage variation-voltage unbalanceover motoring-motor energy audit. lighting system design and practice, lighting control, lighting energy audit.

UNIT–IV: Power Factor Improvement and Energy Instruments

Power factor – methods of improvement, location of capacitors, Power factor with non-linear loads, effect of harmonics on p.f, p.f motor controllers – Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers,application of PLC s.

UNIT–V: Economic Aspects and their Computation

Economics Analysis depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, lifecycle costing analysis – Energy efficient motors. Calculation of simple payback method, net present value method-Power factor correction, lighting – Applications of life cycle costing analysis, return on investment.

Text Books

1. Energy management by W.R.Murphy&G.Mckay Butter worth, Heinemann publications, 1982.
2. Energy management hand book by W.CTurner, John Wiley and sons, 1982.

Reference Books

1. Energy efficient electric motors by John.C.Andreas, Marcel Dekker Inc Ltd-2nd edition,1995
2. Energy management by Paul o Callaghan, Mc-graw Hill Book company-1st edition, 1998
3. Energy management and good lighting practice : fuel efficiency- booklet12-EEO.

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Open Elective

RAPID PROTOTYPING

III Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- familiarize with Rapid Prototype tools and techniques for design and Manufacturing.

Course Outcomes

Upon successful completion of the course, the students will be able to

- assess the need of RPT in Product development.
- use appropriate RT Software for development of Prototype model.
- judge the correct RP Process for Product/Prototype development.
- predict the technical challenges in 3D printing.
- list the applications of RPT.

Course Content

UNIT–I: Introduction to Rapid Prototyping

Introduction to prototyping, traditional prototyping Vs. rapid prototyping (RP), need for time compression in product development, usage of RP parts, generic RP process, distinction between RP and CNC, other related technologies, classification of RP.

UNIT–II: RP Software and Software Issues of RP

RP Software: Need for RP software, MIMICS, magics, surgiGuide, 3D-doctor, simplant, velocity2, voxim, solidView, 3Dview, etc., software.

Software Issues of RP: Preparation of CAD models, problems with STI, files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

UNIT–III: Photopolymerization RP Processes, Powder Bed Fusion RP Processes and Extrusion-Based RP Systems

Photopolymerization RP Processes: Sterolighography (SL), SL resin curing process, SL scan patterns, microstereolithography, applications of photopolymerization processes.

Powder Bed Fusion RP Processes: Selective laser sintering (SLS), powder fusion mechanism and powder handling, SLS metal and ceramic part creation, electron beam melting (EBM), applications of powder bed fusion processes.

Extrusion-Based RP Systems: Fused deposition modelling (FDM), principles, plotting and path control, applications of extrusion-based processes..

UNIT–IV: Printing RP Processes, Sheet Lamination RP Processes and Beam Deposition RP Processes

Printing RP Processes: 3D printing (3DP), research achievements in printing deposition, technical challenges in printing, printing process modeling, applications of printing processes.

Sheet Lamination RP Processes: Laminated Object Manufacturing (LOM), ultrasonic consolidation (UC), gluing, thermal bonding, LOM and UC applications.

Beam Deposition RP Processes: Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), processing – structure - properties, relationships, benefits and drawbacks.

UNIT–V: Rapid Tooling, Errors in RP Processes and RP Applications

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, classification of rapid tooling, direct and indirect tooling methods, soft and hard tooling methods.

Errors in RP Processes: Pre-processing, processing, post-processing errors, part building errors in SLA, SLS, etc.,

RP Applications: Design, engineering analysis and planning applications, rapid tooling, reverse engineering, medical applications of RP.

Text Books

1. Chua Chee Kai., Leong KahFai., Chu Sing Lim, “Rapid Prototyping: Principles and Applications in Manufacturing”, World Scientific

Reference Books

1. Ian Gibsn., David W Rosen., Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010
2. Pham, D.T, Dimov, S.S, Rapid Manufacturing, Springer, 2001.

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Open Elective

AUTOMOTIVE ELECTRONICS

III Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- familiarize with the electronic systems inside automotive vehicle.
- introduce with the concepts of advanced safety systems

Course Outcomes

Upon successful completion of the course, the students will be able to

- learn the fundamentals of automotive technology.
- describe the operation of microcomputer systems.
- acquire knowledge in automotive sensors and control systems.
- develop communications & navigation/routing in automotive vehicles.

Course Content

UNIT–I: Automotive Fundamentals

Use of electronics in the automobile, evolution of automotive electronics, the automobile physical configuration, evolution of electronics in the automobile, survey of major automotive systems, engine control or electronic control unit, ignition system.

UNIT–II: Automotive Micro-Computer System

Binary number system, binary counters, Microcomputer fundamentals-digital versus analog computers, basic computer block diagram, microcomputer operations, CPU registers, accumulator registers, condition code register-branching; microprocessor architecture, memory-ROM, RAM; I/O parallel interface, digital to analog converter and analog to digital converters with block diagram.

UNIT–III: Basics of Electronics Engine Control

Motivation for electronic engine control, exhaust emissions, fuel economy, concept of an electronic engine control system, engine functions and control, electronic fuel control configuration, electronic ignition with sensors.

UNIT–IV: Sensors and Actuators

Introduction; basic sensor arrangement; types of sensors such as oxygen sensors, crank angle position sensors, fuel metering/vehicle speed sensors and detonation sensors, altitude sensors, flow sensors, throttle position sensors, solenoids, stepper motors, actuators – fuel metering actuator, fuel injector, and ignition actuator.

UNIT–V: Electronic Vehicle Management System and Automotive Instrumentation System

Cruise control system, antilock braking system, electronic suspension system, electronic steering control, and transmission control, safety: air bags, collision avoidance radar warning system with block diagram, low tire pressure warning system, advanced cruise control system.

Speech synthesis, sensor multiplexing, control signal multiplexing with block diagram, fibre optics inside the car, automotive internal navigation system, GPS navigation system, voice recognition cell phone dialling.

Text Books

1. William B. Ribbens, "Understanding Automotive Electronics", SAMS/Elsevier Publishing, 6th Edition. (UNITS I -V).
2. Robert Bosch Gambh, "Automotive Electrics Automotive Electronics Systems and Components", John Wiley& Sons Ltd., 5th edition, 2007.

Reference Books

1. Ronald K Jurgen, "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2. G. Meyer, J. Valldorf and W. Gessner, "Advanced Microsystems for Automotive Applications", Springer, 2009.
3. Robert Bosch, "Automotive Hand Book" SAE, 5th Edition, 2000.

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Open Elective

SOFT COMPUTING TECHNIQUES

III Semester

Lecture	: 3	Internal Marks	: 30
Credits	: 3	External Marks	: 70

Course Objectives

To make the students

- Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
- Introduce students to artificial neural networks and fuzzy theory from an engineering perspective

Course Outcomes

Upon successful completion of the course, the students will be able to

- comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
- understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic
- understand the fundamental theory and concepts of neural networks, Identify different neural network architectures, algorithms, applications and their limitations
- understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications
- reveal different applications of these models to solve engineering and other problems.

Course Content

UNIT–I: Fuzzy Set Theory

Introduction to Neuro – Fuzzy and Soft Computing, Fuzzy Sets, Basic Definition and Terminology, Set-theoretic Operations, Member Function Formulation and Parameterization, Fuzzy Rules and Fuzzy Reasoning, Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzy Inference Systems, Mamdani Fuzzy Models, Surgeon Fuzzy Models, Tsukamoto Fuzzy Models, Input Space Partitioning and Fuzzy Modeling.

UNIT–II: Optimization

Derivative based Optimization, Descent Methods, The Method of Steepest Descent, Classical Newton's Method, Step Size Determination, Derivative-free Optimization, Genetic Algorithms, Simulated Annealing and Random Search – Downhill Simplex Search..

UNIT–III: Artificial Intelligence

Introduction, Knowledge Representation, Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning under Uncertainty Basic knowledge Representation Issues Knowledge acquisition, Heuristic Search: Techniques for Heuristic search Heuristic Classification State Space Search: Strategies Implementation of Graph Search based on Recursion Patent directed Search Production System and Learning.

UNIT–IV: Neuro Fuzzy Modeling

Adaptive Neuro-Fuzzy Inference Systems, Architecture – Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

UNIT–V: Applications of Computational Intelligence

Printed Character Recognition, Inverse Kinematics Problems, Automobile Fuel Efficiency Prediction, Soft Computing for Color Recipe Prediction.

Text Books

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006.

Reference Books

1. Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

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