



Vice-Chancellor (Head)
MV
20/12

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20/12/23

Department of Civil Engineering
University college of Engineering Kakinada
Jawaharlal Nehru Technological University Kakinada

M.Tech(Structural Engineering)

R23 Regulations

BOS Meeting Held on 8th 9th and 10th September 2023

1. $\frac{1}{2}$ inch
2. $\frac{1}{4}$ inch
3. $\frac{1}{8}$ inch

4. $\frac{1}{16}$ inch
5. $\frac{1}{32}$ inch

6. $\frac{1}{64}$ inch
7. $\frac{1}{128}$ inch
8. $\frac{1}{256}$ inch

9. $\frac{1}{512}$ inch
10. $\frac{1}{1024}$ inch

11. $\frac{1}{2048}$ inch

12. $\frac{1}{4096}$ inch
13. $\frac{1}{8192}$ inch

ACADEMIC REGULATIONS (R23)
COURSE STRUCTURE

For

M.Tech Two Year Programme

(Applicable for the batches admitted from the A.Y. 2023-24)



UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA – 533003, ANDHRA PRADESH, INDIA



UNIVERSITY COLLEGE OF ENGINEERING KAKINADA (A)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
(Established by Andhra Pradesh Act No.30 of 2008)
Kakinada – 533 003, Andhra Pradesh (India)

ACADEMIC REGULATIONS R23 FOR M. Tech (REGULAR) DEGREE COURSE

Applicable for the students of M. Tech (Regular) Course from the Academic Year 2023-24 onwards. The M. Tech Degree of Jawaharlal Nehru Technological University Kakinada shall be conferred on candidates who are admitted to the program and who fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

2.0 AWARD OF M. Tech DEGREE

2.1 A student shall be declared eligible for the award of the M. Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

2.2 The student shall register for all 68 credits and secure all the 68 credits.

2.3 The minimum instruction days in each semester are 90.

3.0 PROGRAMMES OF STUDY

The following specializations are offered by various departments at present for the M. Tech Programme of study.

Department	Programme
Civil Engg.	1. M.Tech- Structural Engineering 2. M. Tech- Soil Mechanics and Foundation Engineering 3. M.Tech-Water Resource Engineering (UA)
EEE	1. M.Tech- High Voltage Engineering 2. M.Tech- Advanced Electrical Power System 3. M.Tech- Power Electronics and Drives

ME	1. M.Tech- CAD/CAM 2. M.Tech- Machine Design 3. M.Tech-Thermal Engineering
ECE	1. M.Tech- Computer and Communication 2. M.Tech- VLSI and Embedded Systems 3. M.Tech- Instrumentation and Control Engineering (UA)
CSE	1. M.Tech- Computer Science and Engineering 2. M.Tech- Artificial Intelligence and Machine Learning 3. M.Tech-Cyber Security

4.0 ATTENDANCE

- 4.1 The faculty handling the course will finalise the attendance as per schedule / before the last instructional day of the course and submit to the Principal through the head of the department.
- 4.2 A student with less than 75% of consolidated attendance (and/or less than 50% in each and every course), will not be permitted to appear for the end- semester examinations, irrespective of the reason for the shortfall of the attendance. Further, a student with less than 75% of attendance in Dissertation Phase-2 (IV Semester) will not be permitted to submit his project work.
- 4.3 The student is however permitted to avail Academic/Medical Leave/ NCC / NSS / Cultural / Sports/ Minor Medical exigencies etc., up to 10% for attending academic related activities like, Industrial Visits, Seminars, Conferences, Competitions etc., with the prior approval of the HoD. After the event, the student should submit the relevant documents for proof to the HoD for approval of the Academic Leave.
- 4.4 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%, and minimum of 50% in each and every course including laboratory, Dissertation phase-1, Dissertation Phase-2) for a maximum of **ONE time** shall be granted by the College Academic Committee. A prescribed fee shall be payable towards condonation of shortage of attendance.
- 4.5 Shortage of Attendance below 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that class.
- 4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next.
- 4.7 If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical's, on the basis of Internal Evaluation and End Semester Examination.

- 5.0 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The weightage of Internal marks for 40 consists of Descriptive – 32 and Assignment –

08 (open book exam). Descriptive exam shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 8 marks. The descriptive examination conducted for 32 marks are to be added to the assignment 8 marks for finalizing internal marks for 40. The internal evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Semester End Exam Paper contains FIVE mandatory questions (one question from one unit) with internal choice, each carrying 12 marks for a total of 60marks.

- 5.1 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded as internal marks, based on the day to day work-10 marks, Record-10 marks and the remaining 20 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup marks of Procedure-15, Experimentation-25, Results-10 , Viva-voce-10.
- 5.2 For **Mini Project with seminar**, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For Mini Project with seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. Out of 100 marks, supervisor awards 40% marks and remaining 60% marks are awarded by the project review committee.
- 5.3 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together. For integrated courses, student should secure the minimum academic requirements in both theory and practical together.
- 5.4 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to reappear for the End semester Examination in that subject. A candidate shall be given a chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled. For re-registration the candidates have to apply to the college by paying the requisite fees before the start of the semester in which re-registration is required.
- 5.5 In case the candidate secures less than the required attendance in any re registered subject (s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.
- 5.6 Laboratory examination for M. Tech. programmes must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher from the same

department and the second examiner shall be appointed by the Principal from the panel of examiners submitted by the respective HoD.

- 5.7 Student is allowed to register for 12 week SWAYAM / NPTEL MOOC courses (recommended by HoD/BoS) and can obtain required credits during II Semester itself. In any case, if a student fails in obtaining credits, he is allowed to repeat the initially opted course / change to another MOOC course or regular course and will be considered as regular candidate only. After successful completion, by end of III/IV Semester, he needs to submit the course certificate (through HoD) to the exam section to perform credit transfer.
- 5.8 In addition to credit courses, for completing the programme and obtaining degree, a student needs to complete audit courses. Audit courses will be conducted, evaluated as normal credit courses, and the assessment will be graded as Pass/Fail.
- 5.9 Students shall undergo mandatory summer internship (2 credits) for a minimum of eight weeks duration at the end of second semester of the Programme/Summer Break. A student will be required to submit a summer internship report to the concerned department and appear for an oral presentation before the committee. The Committee comprises of Head of the Department and two faculty. The report and the oral presentation shall carry 40% and 60% weightages respectively. For internship, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

6.0 EVALUATION OF PROJECT/DISSERTATION (Phase-I and II):

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

- 6.1 A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members in the department.
- 6.2 Registration of Dissertation / Project Work: The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters.
- 6.3 A candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work (published base paper(s) / real time project / industry oriented) for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).
- 6.4 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the Project Review Committee (PRC) shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.
- 6.5 A candidate shall present seminar on his project work status in two stages at least with a gap of **THREE** months between them. If the candidate is absent to any of these two seminars, he should again attend the seminar within two weeks by providing proper evidence to the Project Review Committee regarding his absence.
- 6.6 A candidate is permitted to submit Project Thesis (Dissertation) only after successful completion of theory and practical course **with the approval of PRC** not earlier than

- 40 weeks from the date of registration of the project work.
- 6.7 Continuous assessment of Dissertation-I and Dissertation-II during the Semester will be monitored by the PRC.
- 6.8 There will be pre-submission seminar at the end of academic term. **After the approval the student has to submit the detail report.**
- 6.9 **The candidate may be allowed to submit the project report if the project work is published or accepted in a reputable national or international journal or conference.**
- 6.10 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College along with plagiarism report (<40%).
- 6.11 The thesis shall be adjudicated by one examiner selected by the Principal, from the panel of 5 examiners, eminent in that field, submitted by the guide concerned and head of the department.
- 6.12 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected. The candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the Principal.
- 6.13 If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor/ Internal examiner, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work for a maximum of 100 Marks. **Out of 100 marks, supervisor awards 30 marks and remaining 70 marks are awarded by the board.**
- 6.14 The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.
- 6.15 If the report of the Viva-Voce is unsatisfactory (i.e., <50 marks), the candidate shall retake the Viva-Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the Institution.

7.0 CUMULATIVE GRADE POINT AVERAGE (CGPA)

Marks Range (Max – 100)	Letter Grade	Level (G)	Grade Point
≥ 90	>90	Outstanding (O)	10
≥80 to <90	90-80	Excellent (S)	9
≥70 to <80	80-70	Very Good (A)	8
≥60 to <70	70-60	Good (B)	7
≥50 to <60	60-50	Fair (C)	6
<50	<50	Fail (F)	0
		Absent	0

Computation of SGPA

The following procedure is to be adopted to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

$$SGPA (S_i) = \sum (C_i \times G_i) / \sum C_i$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

Computation of CGPA

The CGPA is also calculated in the same manner taking into account all the courses undergone by a student over all the semester of a programme, i.e.

$$CGPA = \sum (C_i \times S_i) / \sum C_i$$

Where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester. The SGPA and CGPA shall be rounded off to TWO decimal points and reported in the transcripts.

8.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	From the CGPA secured from 68 Credits.
First Class with Distinction	≥ 7.75 without backlog history	
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	

The secured grade, grade points, status and credits obtained will be shown separately in the memorandum of marks.

Withholding Of Results

If the student has not paid the dues, if any, 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.

9.0 TRANSITORY REGULATIONS

9.1 Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

10.0 GENERAL

10.1 Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

- 10.2** The academic regulation should be read as a whole for the purpose of any interpretation.
- 10.3** In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- 10.4** The College may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the College.

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	<i>If the candidate:</i>	
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.
1. (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 candidate 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.
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 examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter 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 additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the 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. The candidate is also debarred for two consecutive semesters from class work and all External 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 the 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 and around the examination hall or organizes a walk out or instigates others to walk out, 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 or any of his relations, or indulges in any other act of misconduct or mischief which result 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.	In case of students of the college, they shall be expelled from examination halls 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 performance in that subject and all the 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. The candidate is also debarred for two consecutive semesters from class work and all External 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 for the remaining examinations of the subjects of that semester/year. 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.	<p>Student of the colleges 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. The candidate is also debarred and forfeits the seat.</p> <p>Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.</p>
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 reported to the University for further action to award suitable punishment.	

*Examination Branch Appointment of Subject
Expert for QP Setting*

From

*Dr UV Ratna Kumari
Vice-Principal*

Date: 01.10.2023.

To

I am advised to inform you that you are appointed as subject expert to set the question paper(s) as per the details noted below. You are requested to set the question paper(s) in MS word document format and send a soft copy oiel.ucek@jntucek.ac.in. The hard copies of the question paper(s) shall be sent along with the remuneration bill.

You are requested to set the Question Paper(s) by following OBE pattern, as per the revised Bloom's Taxonomy herewith enclosed. Keep this appointment strictly confidential.

1. You are requested to prepare a balanced question paper within the prescribed syllabus covering the entire syllabus. The duration of the examination is **3-hours** and you are requested to prepare the questions in such a way that student must be able to answer each question for about 35-45 minutes time.
2. It is informed that the question paper covering the topics of all FIVE units for 60 marks. Also the question paper shall be set as per the format enclosed, containing ten main questions (two from each unit) over FIVE-units of syllabus with internal choice and **12marks** for each question. The main question shall contain sub questions like 1(a), 1(b) etc.
3. The student has to answer FIVE mandatory questions (One question from one unit).
4. The requirement of data books, codes, graphs etc. may please be indicated on the question paper.
5. You are requested to give the distribution of the marks for each question.
6. **You are requested not to reproduce questions from previous question papers.**
7. Remuneration for setting of one question paper for M.Tech(PG) programme is **Rs. 1,200/-** per set.
8. You are requested to confirm your acceptance through e-mail.

You are requested to reject the offer and intimate the same to the Vice Principal, if any of your relatives are writing the examination or if you are involved in any extra assignment in any tutorial/coaching centers. Please send the question paper in the enclosed model (model is attached for reference).

Question Paper Details		R19 OBE Pattern			
Course	M.Tech (PG)	Question No.	Unit/CO's	Bloom's Taxonomy Level	Marks
Name of the Examination	I-M.Tech, I-Sem (R23) Regular End Exams, Dec-2023	I	U1/CO1	L2/L3/L4	12
Subjects	XXXXXXX	II	U2/CO2	L2/L3/L4	12
Branch	XXXXXXXXXX	III	U3/CO3	L2/L3/L4	12
No of Question Paper Sets	1 (Ono)	IV	U4/CO4	L2/L3/L4	12
Last Date for submission	14/11/2023	V	U5/CO5	L2/L3/L4	12

Note: U1: Unit 1, CO1: Course Outcome 1

L1: Level 1(Bloom's Cognitive Level) **L2:** Understanding Level; **L3:** Apply Level; **L4:** Analyze Level.

VICE-PRINCIPAL

Course Code:

R23

**University College of Engineering Kakinada (Autonomous)
Jawaharlal Nehru Technological University Kakinada**

() B. Tech. () Semester (R23) Regular Examinations, ()

*COURSE NAME (NAME
OF BRACH)*

Time: 3 hrs.

Max Marks: 60

Answer all five questions

5X12=70

Q.No	Question	Marks	CO	BL
UNIT-1				
1(a)				
1(b)				
(OR)				
2(a)				
2(b)				
UNIT-2				
3(a)				
3(b)				
(OR)				
4(a)				
4(b)				
UNIT-3				
5(a)				
5(b)				
(OR)				
6(a)				
6(b)				
UNIT-4				

7(a)				
7(b)				
(OR)				
8(a)				
8(b)				
UNIT-5				
9(a)				
9(b)				
(OR)				
10(a)				
10(b)				

Note: CO: Course Outcome, BL: Bloom's Cognitive Level;



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA-533003, Andhra Pradesh (India)
For Constituent Colleges and Affiliated Colleges of JNTUK

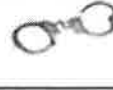
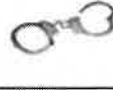


Ragging

Prohibition of ragging in educational institutions Act 26 of 1997

Salient Features

- ⇒ Ragging within or outside any educational institution is prohibited.
- ⇒ Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	 6 Months	+	Rs. 1,000/-
Assaulting or Using Criminal force or Criminal intimidation	 1 Year	+	Rs. 2,000/-
Wrongfully restraining or confining or causing hurt	 2 Years	+	Rs. 5,000/-
Causing grievous hurt, kidnapping or Abducts or rape or committing unnatural offence	 5 Years	+	Rs. 10,000/-
Causing death or abetting suicide	 10 Months	+	Rs. 50,000/-

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA-533003, Andhra Pradesh (India)
For Constituent Colleges and Affiliated Colleges of JNTUK



Ragging

ABSOLUTELY

NO TO RAGGING

1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.



Jawaharlal Nehru Technological University Kakinada
For Constituent Colleges and Affiliated Colleges of JNTUK

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 - 1288

LET US MAKE JNTUK A RAGGING FREE UNIVERSITY

COURSE STRUCTURE AND SYLLABUS
R23 Regulations
M.Tech (Structural Engineering) Programme

(BOS- 8th, 9th and 10th September 2023)

Revised on 23rd September 2023



DEPARTMENT OF CIVIL ENGINEERING
(Autonomous)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA
KAKINADA

I Semester

Sl. No.	Course No.	Category	Course Name	POs	L	T	P	C	Marks
1	MSEI-1	Core -1	Theory of Elasticity		3	0	--	3	100
2	MSEI-2	Core -1	Structural Dynamics		3	0	1.5	4.5	100
3	MSEI-3	Elective I			3	0	--	3	100
			a). Matrix Analysis of Structures						
			b). Experimental Stress Analysis						
			c). Sub StructureDesign						
			d). Structural Optimization						
4	MSEI-4	Elective II			3	0	--	3	100
			a) Bridge Engineering						
			b) Structural Audit & Retrofitting of Structures						
			c) Analysis and Design of Tall Structures						
			d) Advanced Reinforced Concrete Design						
5	MSEMC		Research Methodology and IPR		2	0	0	2	100
6	MSEPI-1	Lab-I	Advanced Concrete Laboratory		-	--	4	2	100
7	MSEPI-2	Lab -II	Advanced Structural Engineering Laboratory & NDT		-	--	4	2	100
8	MSEA-1	Audit Course -1	Audit Course -1		2	0	0	0	100
			Total Credits /Marks					18	800

II Semester

S.No	Course No	Category	Course Name	POs	L	T	P	C	Marks
1	MSEII-1	Core -1	Finite Element Method		3	0	1.5	4.5	100
2	MSEII-2	Core -1	Stability of Structures		3	0	--	3	100
3	MSEII-3	Elective I			3	0	--	3	100
			a) Earthquake Resistant Design						
			b) Mechanics of Composite Materials						
			c) Fracture Mechanics						
			d) Advanced BIM						
4	MSEII-4	Elective II			3	0	--	3	100
			a) Theory of Plates and Shells						
			b) Precast and Prefabricated Structures						
			c) Earth Retaining Structures						
			d) Design of Advanced Concretes						
5	MSEMC		Computer Aided Design Laboratory		2	0	0	2	100
6	MSEPII-1	Lab-I	Structural Design Laboratory		-	--	4	2	100
7	MSEPII-2	Lab -II	Mini Project and Innovations with Seminar		-	--	4	2	100
8	MSEA-2	Audit Course -2	Audit Course -1		2	0	0	0	100
Total Credits /Marks								18	800

III Semester

S. No.	CourseNo	Category	Course Name	PO's	L	T	P	C	Marks
1	MSEIII-1	Elective-V	Elective 5: Program Elective /MOOCS		3	0	--	3	100
			a) Plastic Analysis and Design						
			b) Prestressed Concrete						
			c) Analysis Design and Applications on Industrial Structures						
2			Open Elective / MOOCS		3	0	--	3	100
3	Project related to Industry Application		Dissertation Phase-I / IndustrialProject (To be continued and Evaluated next Semester)*		--	--	20	10	
			Total Credits / Marks					16	200

* Evaluated and displayed in 4th Semester marks list

** Students Going for Industrial Project / Thesis will complete these courses through MOOCS

IV Semester

Sl. No.	Course No.	Category	Course Name	Po's	L	T	P	C	Marks
1	Dissertation	Core	Project/ Dissertation Phase II (Continued from III Semester)		0	0	32	16	100
			Total Credits / Marks					16	100

PROGRAM OUTCOMES

PO 1	Able to solve continuum problems in 3D 2D through close form analytical solutions
PO 2	Reduce 3D problems to 2D and to impart Solutions
PO 3	Able to Analyze problems with different forces and displacement boundary conditions
PO 4	Design Structures to contribute in development of the society
PO 5	Take up Applications on Experimental Techniques on Structural Evaluation
PO 6	Able to analyze and design of structure under different types of conditions
PO 7	Optimization of structures and presentation of the project considering ethics

PROGRAM EDUCATIONAL OBJECTIVES

PEO1	Impart advanced technical knowledge and skills for specialized careers in structural Engineering and related fields that caters to the Global needs.
PEO2	Provide expertise in carrying out project works in advanced structural engineering by using state -of -art computing, numerical and experimental techniques and to develop interdisciplinary research.
PEO3	Train the students to possess good communication and presentation skills with ability to work in teams and contributing significantly to the technological development of the Nation

PROGRAM SPECIFIC OBJECTIVES

PSO1	Ability to recognize the importance of Civil Engineering Professional development by pursuing post graduate studies
PSO2	An ability to face competitive exams that offer challenging and rewarding careers
PSO3	An ability to apply develop and execution of projects in the construction of various Civil engineering discipline. Ability to become an entrepreneur and to improve the management skills

MSEI-1 – THEORY OF ELASTICITY

Course Outcomes: At the end of the course, the student will be able to

CO1	Comprehend the basic concepts of continuum mechanics of solids like stresses strains compatibility and equations of equilibrium, understand how to utilize the constitutive equations and generalized hooks' law
CO2	Ability to solve 2D problems in rectangular coordinates and application to bending of simple beams.
CO3	Applying polar coordinates in analyzing stressed and strains in circular section
CO4	Applications of 3D continuum mechanics to solve for stresses and strains, compatibility conditions
CO5	Solving torsion in prismatic and non prismatic sections through energy principles

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	1	2	1	--	2	--
CO2	2	2	3	1	--	2	--
CO3	2	3	3	1	2	2	--
CO4	2	3	3	1	--	2	--
CO5	2	1	1	1	--	2	--

1. Slightly 2. Moderately 3. Substantially

Unit	Contents	Contact Hours
Unit-1	Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke's Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations - Stress function – Boundary Conditions	12
Unit-2	Two dimensional problems in rectangular co-ordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading	12
Unit-3	Two dimensional problems in polar co-ordinates - General equations in	12

	polar co-ordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar co-ordinates– Displacements for symmetrical stress distributions - Stresses for plates with circular holes subjected to far field tension – stress concentration factor.	
Unit-4	Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution –Reciprocal theorem..	6
Unit-5	Torsion of Prismatic bars – Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of Torsional problems by energy method	6

TEXT BOOKS

1	Theory of Elasticity- Stephen Timoshenko & J. N. Goodier, Mc. Grawhill Publishers
2	Advanced Mechanics of Solids L.S. Srinath, McGraw Hill Publishers

REFERENCES

1	Elasticity: Theory, Applications and Numeric- Martin H. Sadd, Wiley Publishers
2	Theory of Elasticity - Sadhu Singh 3 rd Edition, Khanna Publishers

MSEI- 2 – STRUCTURAL DYNAMICS

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand fundamental objectives, types of loadings and degrees of freedom
CO2	Understand SDOF systems and behavior of structures under SDOF systems
CO3	Understand MDOF systems and response to various types of loading
CO4	Evaluation of response of structures considering continuous systems
CO5	Understand earthquake forces and design of earthquake resistant structures

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	3	1	--	1	1
CO2	--	--	3	1	2	1	1
CO3	--	--	3	1	2	1	1
CO4	--	--	3	1	2	2	2
CO5	1	--	3	3	3	2	2

1. Slightly 2. Moderately 3. Substantially

Unit	Contents	Contact Hours
Unit-1	Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Victorian representation of S.H.M.	6
Unit-2	Single Degree of Freedom Systems: Free vibrations of single degree of freedom system – un-damped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation - Vibration Isolation -Dynamic magnification factor – Phase angle. Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral	12
Unit-3	Multi Degree of Freedom Systems : Selection of the degrees of	12

	Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion –Un-damped 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 procedure	
Unit-4	Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of un-damped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.	12
Unit-5	Introduction to Earthquake Resistant Design: Seismology- Seismic waves and propagation-Measurement scales- Seismic Resistant architecture- Objective of ERD- Codal provisions	6

TEXT BOOKS	
1	Structural Dynamics Anil K Chopra, 4edition, Prentice Hall Publishers
2	Structural Dynamics Theory & Computation – Mario Paz, CBS Publishes and Distributors
	Dynamics of Structures by Clough & Penzien 3e, Computers & Structures Inc.
REFERENCES	
1	Theory of Vibration -William T Thomson, Springer Science
2	Earthquake Resistant Design of Structures- Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India New Delhi

MSEI-3-a) – MATRIX ANALYSIS OF STRUCTURES

Course Outcomes: At the end of the course, the student will be able to

CO1	Perform the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent displacements, force and equilibrium Methods
CO2	Understand stiffness Method with applications on pin jointed truss, continuous beams and rigid jointed plane frames
CO3	Perform structural analysis using the stiffness method and apply on solving different complex application problems
CO4	Understand effective finite element analysis techniques to reduce computational efforts
CO5	Solve multiple degree of freedom plane frames including side sway single storey single bay gable frames using flexibility method

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	3	2	1	--	1	1
CO2	--	3	2	1	--	2	1
CO3	1	3	2	2	--	2	1
CO4	--	3	2	2	--	3	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction of matrix methods of analysis – Static and kinematic indeterminacy – Degree of freedom– Structure idealization–stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element- Element force - displacement equations.	6
Unit-2	Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames	12

Unit-3	Stiffness method for Grid elements – development of stiffness matrix – coordinates transformation. Examples of grid problems – tapered and curved beams	6
Unit-4	Additional topics in stiffness methods – discussion of band width – semi band width – static condensation – sub structuring –Loads between joints-Support displacements- inertial and thermal stresses-Beams on elastic foundation by stiffness method.	12
Unit-5	Analysis of plane truss - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using <i>system approach</i>	12

TEXT BOOKS

1	Matrix analysis of structures, Robert E Sennet- Prentice Hall-Englewood cliffs-New Jersey
2	Advanced structural analysis, P. Dayaratnam- Tata McGraw hill publishing company limited.
3	Structural Analysis Matrix Approach - Pandit and Guptha, Mc Graw hill Education

REFERENCES

1	Indeterminate Structural analysis, C K Wang, Amazon Publications
2	Analysis of Tall buildings by force – displacement – Method M. Smolira Mc. Graw Hill.
3	Foundation Analysis and design, J.E. Bowls, 5e, Amazon Publications

MSEI-3-b) EXPERIMENTAL STRESS ANALYSIS

(Elective-I)

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the fundamentals of the theory of elasticity and Obtain the principles and techniques of strain gauge measurement
CO2	Adopt the principles and techniques of electrical resistant gauges
CO3	Understand non destructive techniques of assessing concrete quality
CO4	Implement the principles and techniques of photo elastic measurement
CO5	Apply the principles and techniques of 2D photo elasticity

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	1	1	2	1	1
CO2	1	--	1	--	2	1	--
CO3	1	--	1	--	3	1	--
CO4	1	--	1	--	3	2	--
CO5	1	--	1	--	3	2	--

1. Slightly 2.Moderately 3.Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction and Strain measurement methods – Model & Prototype – Dimensional analysis-Factors influencing model design– Scale factors and Model material properties– Methods of model design. Definition of strain and its relation to experimental determinations-properties of strain gauge systems –Mechanical, Optical, Acoustic and Pneumatic types	12
Unit-2	Electrical resistance strain gages: Introduction – gauge construction – strain gauge adhesives - mounting methods – gauge sensitivities and gage factor – performance characteristics of wire and foil strain gauges – environmental effects. Analysis of strain gauge data – the three element rectangular rosette – the delta rosette – correction for	12

	transverse sensitivity	
Unit-3	Non-destructive testing: Introduction-objectives of non-destructive testing. Ultrasonic pulse velocity method – Rebound Hammer method (Concrete hammer) – Acoustic Emission- application to assessment of concrete quality.	6
Unit-4	Theory of photo elasticity: Introduction– temporary double refraction –Index ellipsoid and stress ellipsoid–the stress optic law–effects of stressed model in a Polariscope for various arrangements-fringe sharpening.	12
Unit-5	Two dimensional photo elasticity: Introduction –Iso-chromatic fringe patterns–isoclinic fringe patterns–compensation techniques–calibration methods –separation methods– materials for photo-elasticity–properties of photo-elastic materials.	6

TEXT BOOKS

1	Experimental Stress Analysis-William F. Riley and James W. Dally, McGraw Hill Publications
2	Advanced Mechanics of Solids 3e- L.S. Srinath, Tata McGraw Hill Publications

REFERENCES

1	An Introduction to Experimental Stress Analysis– George Hamor Lee, Wiley Publishers
2	Experimental Stress Analysis -Sadhu Singh, Khanna Publishers
3	Solid Mechanics–S.M.A.Kazimi, McGraw Hill Publications

MSEI-3-c) SUB STRUCTURE DESIGN

(Elective-I)

Pre-Requisites: Soil Mechanics, Mathematics

Course Outcomes: At the end of the course, the student will be able to

CO1	Attain the perception of site investigation to select suitable type of foundation based on soil category
CO2	Understand soil sampling and types of equipment and procedures for sampling
CO3	Understand shallow foundations and design concept and bearing capacity estimation
CO4	Differentiate and identify requirements of isolated and combined footing and design components of combined footing
CO5	Can be efficient in selecting suitable type of pile for different soil stratum and in evaluation of group capacity by formulation study need to soils structure interaction problems

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	--	--	1	--	1	--
CO2	1	2	2	1	1	3	--
CO3	1	1	2	1	--	3	1
CO4	1	1	2	2	1	3	2
CO5	1	2	3	2	2	3	2

1. Slightly 2.Moderately 3.Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Soil Exploration – Importance, Terminology, planning - Geophysical methods. Borings, location, spacing and depth, methods of boring including stabilization of boreholes, boring records. Soil sampling – Methods of sampling -Types of samples and samplers-cleaning of bore holes, preservation, labeling and shipment of samples-Design considerations of open drive samplers	6

Unit-2	Shallow Foundations–Bearing capacity–General bearing capacity equation, Meyerhof's, Hansen's and Vesic's bearing capacity factors–Bearing capacity of stratified soils–Bearing capacity based on penetration resistance- safe bearing capacity and allowable bearing pressure. (Ref:IS-2131&IS6403)	6
Unit-3	Types and choice of type. Design considerations including location and depth, Proportioning of shallow foundations - isolated and combined footings and mats–Design procedure for Combined footings mats. Floating foundation- Fundamentals of beams on Elastic foundations. (Ref: IS -456 & N.B.C. relevant volume)	12
Unit-4	Pile Foundations- Classification of piles- factors influencing choice loads Carrying capacity single piles in clays and sands using static pile formulae- α - β -and λ -methods–Dynamic pile formulae- limitations- Monotonic and cyclic pile load tests–Under reamed piles. Pile groups -Efficiency of pile groups- Different formulae-load carrying capacity of pile groups in clays and sands–settlement of pile groups in clays and sands–Computation of load on each pile in a group	12
Unit-5	Soil Structure Interaction: Understand the importance of Soil Structure Interaction and applications that mandate considering interaction of soil and structure- Modeling aspects	12

TEXT BOOKS

1	Principles of Foundation Engineering, 7e- Braja M. Das, Cengage Learning
2	Analysis and Design of Sub Structures- Swami Saran, Amazon
3	Soil Mechanics in Engineering Practice by Terzaghi and Peck, John Wiley Publications
4	Design Aids in Soil Mechanics and Foundation Engineering-Shanbaga R. Kaniraj, Tata Mc. Graw Hill.

REFERENCES

1	Foundation Design- Wayne C. Teng, John Wiley & Co.,
2	Foundation Analysis and Design- J.E. Bowles McGraw Hill Publishing Co.,
3	Foundation Design and Construction – M.J. Tomlinson–Longman Scientific
4	A short course in Foundation Engineering- Simmons and Menzies–ELBS

MSEI-3-d) STRUCTURAL OPTMIZATION

(Elective-I)

Course Outcomes: At the end of the course, the student will be able to

CO1	Basic theoretical principles in optimization
CO2	Formulation of optimization models Solution methods in optimization classical optimization applications
CO3	Understand non linear programming and applications Methods of sensitivity analysis and post processing of results
CO4	Understand linear programming and carryout minimization weight design application
CO5	Applications to a wide range of engineering problems adopting quadratic programming and application problems

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	--	--	--	--	1	2
CO2	1	--	---	--	1	1	1
CO3	1	--	--	1	--	1	1
CO4	1	--	--	1	1	1	1
CO5	1	--	--	1	1	1	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction: Need and scope for optimization – statements of optimization problems- Objective function and its surface design variables- constraints and constraint surface- Classification of optimization problems (various functions continuous, discontinuous and discrete) and function behavior (monotonic and unimodal)	12
Unit-2	Classical Optimization techniques: Differential calculus method, multivariable optimization by method of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality -Fully stressed design and optimality criterion based algorithms- Introduction, Characteristics of fully stressed design	12

	theoretical basis examples	
Unit-3	Non-Linear programming: Unconstrained minimization- Fibonacci, golden search, Quadratic and cubic interpolation methods for a one dimensional minimization and univariate method, Powel's method, Newton's method and Davidon Fletcher Powell's method for multivariable optimization- Constraint minimization- cutting plane method- Zoutendjik's method- Penalty function methods	12
Unit-4	Linear programming: Definitions and theorems- Simplex method-Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame.	6
Unit-5	Introduction to quadratic programming: Geometric programming-and dynamic programming- Design of beams and frames using dynamic programming techniques	6

TEXT BOOKS

1	Engineering Optimization Theory and Applications – S. S. Rao, Wiley Eastern Limited, New Delhi
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REFERENCES

1	Optimization Concepts and Application in Engineering- Belegundu A.D Chandrupatla T.R, Cambridge University Press
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Elective III – BRIDGE ENGINEERING

Course Outcomes: At the end of the course, the student will be able to

CO1	Design theories Masonry Arch Bridges
CO2	Design of RCC slab and T beams bridges
CO3	Understand the behaviour of plate girder bridge
CO4	Posses the knowledge to design prestressed concrete bridges
CO5	Analyze the abutments piers and design of pipe culvert

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	2	1	--	1	--
CO2	1	1	2	2	1	2	2
CO3	2	1	3	2	2	2	1
CO4	2	1	3	2	2	3	1
CO5	2	1	3	2	2	3	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads-Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.	6
Unit-2	Pigeaud's method-design of longitudinal girders- Guyon-Messonet method- Hendry Jaegar method- Courbon's theory. (Ref: IRC-21), voided slabs, Super Structure: Slab bridge- Wheel load on slab-effective width method- slabs supported on two edges- cantilever slabs-dispersion length- Design of interior panel of slab- T-Beam bridges.	6
Unit-3	Box Culverts- Single Cell Box Culvert – Design Loads, Design	12

	Moments, Shears and Thrusts. Design of Critical sections.	
Unit-4	Plate girder bridges- Elements of plate girder and their design-web-flange- intermediate stiffener- vertical stiffeners- bearing stiffener- design problem	12
Unit-5	Sub structure- Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers- Design problem(Ref: IRC-13, IRC-21, IRC-78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment- culvert entrance structure- Hydraulic design and structural design of pipe culverts- reinforcements in pipes .(Ref: IRC: SP-13)	12

TEXT BOOKS

1	Essentials of Bridge Engineering- Jhonson Victor D, 7e, Oxford IBH Publications
2	Design of Concrete Bridges- M.G. Aswini, V.N. Vazirani, M.M Ratwani, Khanna Publishers
3	Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications

REFERENCES

1	Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2	Concrete Bridge Design and Practice- V.K. Raina, Tata McGraw- Hill Publishing Company Limited
3	IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
4	IRC 21-2009 Standard Specifications and code of practice for Road Bridges Section III

MSEI-4 - STRUCTURAL AUDIT & RETROFITTING OF STRUCTURES

Course Outcomes: At the end of the course, the student will be able to

CO1	Identify the materials suitable for repair and rehabilitation
CO2	Understand the methods of strengthening methods for concrete structures
	Conduct field monitoring and non-destructive evaluation of concrete structures.
CO3	To identify the bonded installation techniques
CO4	Design and suggest repair strategies for deteriorated concrete structures including repairing with special concretes
CO5	To identify the High performance concrete for repair and rehabilitation

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	1	1	1	2	1	--
CO2	--	1	2	1	2	1	1
CO3	--	1	2	2	2	1	1
CO4	--	--	3	2	2	1	1
CO5	--	--	3	2	3	1	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Structural Health, factors affecting health of structures, effect of leakage, age, creep, corrosion, fatigue on life of structure. Structural health monitoring. Various measures, regular maintenance, structural safety in alteration. Quality control & assurance of materials of structure, durability of concrete, Factors affecting durability of concrete, Corrosion in structures, Testing and prevention of corrosion	12
Unit-2	Structural Audit, Assessment of health of structure, study of structural drawings, nature of distress, visual observations, Collapse and investigation, limitations on investigator, tools for investigation,	12

Unit-3	Various NDT Methods for assessing strength of distressed materials, investigation management, review of assimilated information, interviews and statements, evaluation and reporting, presentation of report, communication gap among client, architect, consulting engineer & contractor.	6
Unit-4	Retrofitting of Structures, parameters for assessment for restoration strategies, selection of construction chemicals during restoration, Specification for important items of work in restoration, Structural detailing for restoration and various techniques of retrofitting.	12
Unit-5	Safety during construction, formwork and staging, Modular formwork, Structural aspects for formwork in buildings & bridges. Fire safety. Demolition of Structure, study of structural system and structural drawings, outline of various demolition methods and their evaluation, partial and controlled demolition, role of safety measures, temporary support structures in demolition. Recycling of demolished materials.	6

TEXT BOOKS

1	Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHI Publications
2	Handbook of material management by Dean Anmmmer, McGraw Hills
3	Properties of Concrete by AM Neville, Longman
4	Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, Shroff Publishers and Distributors.
5	Design & Construction of Formwork For Concrete Structures, by Wynn. A. E.

REFERENCES

1	R.N. Raikar, Learning from Failures, R&D Centre,(SDCPL).
	Demolition of Structures, Report by Mr. Girish Kulkarni, Mumbai
2	Concrete Repair and Maintenance illustrated- Peter H Emmons
3	Concrete Chemical Theory and Applications- Santa Kumar A.R. , Indian Society for Construction Engineering and Technology, Madras
4	Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi
5	Structural Audit, Report by Mr. Umesh Dhargalkar, Mumbai

MSEI-4-c) ANALYSIS AND DESIGN OF TALL STRUCTURES

(Elective-II)

Course Outcomes: At the end of the course, the student will be able to

CO1	Know design principles and different types of loading
CO2	Understand various structural systems used for Tall structures.
CO3	Capable of analyzing the tall structures and design of structural elements for secondary Effects
CO4	Execute stability analysis, overall buckling analysis of frames, Analysis for various secondary effects – such as Creep, Shrinkage and Temperature

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	3	1	--	1	1
CO2	--	2	2	1	--	1	--
CO3	1	2	2	2	--	2	--
CO4	1	2	2	2	--	2	--

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Design Criteria Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self Compacting Concrete	6
Unit-2	Gravity Loading– Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel Experimental methods. Earthquake Loading– Equivalent lateral Load analysis, Response Spectrum method. Combination of Loads	12
Unit-3	Behavior of Structural Systems-Factors affecting the growth, height and structural form, Behaviour of Braced frames, Rigid Frames, In-filled frames, Shear walls, Coupled Shear walls, Wall-Frames, Tubular, Outrigger braced, Hybrid systems	6
Unit-4	Analysis and Design-Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of structures as an integral UNIT, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage	12

	effects, Temperature Effects and Fire Resistance.	
Unit-5	Stability Analysis- Overall buckling analysis of frames, wall- frames, Approximate methods, Second order effect of gravity loading, P-Delta Effects, Simultaneous first order and P-Delta analysis, Transmissibility, translational instability, Torsional Instability out of plumb effects effect of stiffness of members and foundation rotation instability of structures.	12
TEXT BOOKS		
1	Bryan Stafford Smith and Alex Coull, "Tall Building Structures -Analysis and Design", John Wiley and Sons Inc, 1991	
2	Structural Design of Multistoried Buildings U. H. Varyaani, South Asian Publishers	
REFERENCES		
1	Structural Analysis and Design of Tall Buildings Bunge S.Taranath,McGraw-Hill,1988	
2	High Rise Building Structures Wolfgang Shcueller, John Wiley & Sons Inc	
3	Art of the Skyscraper: The Genius of Fazlur R Khan- Ali Mir, Rizzoli International Publications	

Elective II: DESIGN OF ADVANCED REINFORCED CONCRETE STRUCTURES

Course Outcomes: At the end of the course, the student will be able to

CO1	Estimate the deflection of Concrete beams and slabs
CO2	Estimate crack width and its affects
CO3	Design flat slabs, bunkers, silos and chimneys
CO4	Understand the thermal effect on concrete members

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	1	2	--	2	1
CO2	1	1	2	3	--	2	1
CO3	1	1	2	3	1	2	1
CO4	1	1	2	2	2	2	1
CO5	1	1	1	2	3	2	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Limit Analysis of R C Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams. Inelastic Analysis of Slabs, Moment Redistribution in Columns, Limit Analysis with Torsional Hinges.	12
Unit-2	Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions.	12
Unit-3	Ribbed slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements. Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns	12

	– Shear in Flat slabs-Check for one way and two way shears-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.	
Unit-4	Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456. Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels, Design of Nibs.	6
Unit-5	Design of Slender Columns – Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns. Eccentrically Loaded columns- development of interaction Diagrams	6

TEXT BOOKS

1	Advanced Reinforced Concrete Design, by P.C. Varghese Prentice Hall India Limited
2	Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
3	Reinforced Concrete Design, by S. Unnikrishna Pillai & Devdas Menon Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.
4	Design Reinforced Concrete Foundations P.C. Varghese Prentice Hall of INDIA Private Ltd.

REFERENCES

1	Limit State Theory and Design of Reinforced Concrete S. R. Karve and V.L Shah. Standard Publishers
2	Reinforced concrete structural elements – behavior, Analysis and design by P. Purushotham, Tata Mc.Graw-Hill, 1994
3	Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3 rd Edition, 2005.
4	Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2 nd edition, 1991
5	IS 456-2000 Plain and Reinforced concrete book of Practice.
6	SP 16- Design Aids for Reinforced Concrete to IS 456
7	SP 34 - Hand Book as Concrete Reinforcement and retaining

MSEMC- RESEARCH METHODOLOGY AND IPR

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand research problem formulation.
CO2	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO3	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO4	Analyze research related information
CO5	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Mapping of course outcomes with program outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8
CO1	-	-	-	-	-	-	-	1
CO2	-	-	-	-	-	-	-	1
CO3	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	1
CO5	-	-	-	-	-	-	-	3

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Meaning of research problem, Sources of research problem,	6

	Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations	
Unit-2	Effective literature studies approaches, analysis Plagiarism, Research ethics	6
Unit-3	Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	12
Unit-4	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.	12
Unit-5	Patent Rights-Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications, New Developments in IPR-Administration of Patent System, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.	12

TEXT BOOKS

1	Research methodology: an introduction for science & engineering students, 1 st Edition, <u>Stuart Melville</u> , <u>Wayne Goddard</u> , 1996
2	“Research Methodology: An Introduction”, Wayne Goddard and Stuart Melville

REFERENCES

1	“Research Methodology: A Step by Step Guide for beginners”, 2 nd Edition, Ranjit Kumar
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MSEPI-1ADVANCED CONCRETE LABORATORY

Course Outcomes: At the end of the course, the student will be able to able to

CO1	Comprehend hydration mechanism in cement
CO2	Analyze the water cement ratio and strength of cement
CO3	Analyze the impact of Coarse and Fine aggregates on workability
CO4	Analyze the impact of Coarse and Fine aggregates on strength
CO5	To perform NDT on concrete structures
CO6	To perform properties of Self compacting concrete

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	--	--	3	1	1
CO2	--	--	--	--	3	1	1
CO3	--	--	--	--	3	1	1
CO4	--	--	--	--	3	1	1
CO5							

1. Slightly 2.Moderately 3.Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Expt 1	Study on Water/Cement Ratios Vs Workability of different concrete mixes	
Expt 2	Study on Water/Cement Ratios Vs Strength of different concrete Mixes	
Expt 3	Study of variation of Coarse Aggregate to Fine Aggregates on Workability	
Expt 4	Study of variation of Coarse Aggregate to Fine Aggregates on Strength	
Expt 5	Non destructive testing-Rebound Hammer test, UPV test	
Expt 6	Confirmatory tests on Self Compacting Concrete- L Box, U Box, J Box and V funnel	

NOTE: A minimum of five experiments from the above set have to be conducted

MSEPI-2ADVANCED STRUCTURAL ENGINEERING LABORATORY

Course Outcomes: At the end of the course, the student will be

CO1	Characterize the behavior of deflection and cracks in UR, OR and Balanced Sections
CO2	Analyze the behavior of RCC beams under bending stresses
CO3	Analyze the behavior of RCC beams under Shear stresses
CO4	Calculate Modulus of Elasticity of Concrete
CO5	Extract and study the core samples from concrete

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	--	--	3	1	1
CO2	--	--	--	--	3	1	1
CO3	--	--	--	--	3	1	1
CO4	--	--	--	--	3	1	1
CO5							

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Expt 1	Study on Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced Sections	
Expt 2	Study on Performance of RCC Beams designed for Bending and failing in Shear	
Expt 3	Study on Performance of RCC Beams designed for Shear and failing in Bending	
Expt 4	Extraction and Study of Concrete Core samples from pavements	

NOTE: A minimum of five experiments from the above set have to be conducted as demonstration to entire class.

MSEA-1 - CONSTITUTION OF INDIA

(Audit Course- 1)

Course Outcomes: After the completion of the course, student will be able to

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.
CO5	

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO 5	PO 6	PO7	PO8
CO1	-	-	-	-	-	-	-	1
CO2	-	-	-	-	-	-	-	1
CO3	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	1
CO5	-	-	-	-	-	-	-	1

1.Slightly 2.Moderately 3.Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution: Preamble, Salient, Features.	12
Unit-2	Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive	12

	Principles of State Policy, Fundamental Duties	
Unit-3	Election Commission: 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.	6
Unit-4	Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive: President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions	12
Unit-5	Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. 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. Software etc. Traditional knowledge Case Studies, IPR and IITs.	6

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

II Semester

Core 3 - FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING

Course Outcomes: At the end of the course, the student will be able to

CO1	Develop finite element formulations of 1 degree of freedom problems and solve them
CO2	Understand any Finite Element software to perform stress, thermal and modal analysis
CO3	Compute the stiffness matrices of different elements and system
CO4	Interpret displacements, strains and stress resultants
CO5	

Mapping of Course Outcomes with Program Outcomes

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	2	3	--	--	2	1
CO2	1	2	3	--	--	2	1
CO3	1	2	3	--	--	2	1
CO4	1	2	3	--	--	2	--
CO4	1	2	3	--	--	2	--

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction: Review of stiffness method- Principle of Stationary potential energy-Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation - variational approaches -weighted residual methods	6
Unit-2	Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix –Selection of approximate displacement functions- solution of a plane truss- transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports- Galerkin's method for 1-D truss – Computation of stress in a truss element.	12

Unit-3	Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading- Galerkin's method - 2-D Arbitrarily oriented beam element – inclined and skewed supports –rigid plane frame example	12
Unit-4	Finite element formulation for plane stress, plane strain and axi-symmetric problems- Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems- comparison of CST and LST elements –convergence of solution- interpretation of stresses.	12
Unit-5	Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature – element and mesh instabilities – spurious zero energy modes, stress computation- patch test.	6

TEXT BOOKS

1	A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.
2	Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha, John Wiley & Sons Publications

REFERENCES

1	Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D. Belgundu, PHI publications.
2	Finite Element Methods (For Structural Engineers) Wail N Rifaie, Ashok K Govil, New Age International (P) Limited

MSEII-3-a) STABILITY OF STRUCTURES

Course Outcomes: At the end of the course, the student will be able to

CO1	Determine the critical moments and deflection and critical loads for beam columns under different loading and end conditions
CO2	Determine the critical loads in straight column and bulking of frames under different loading and end conditions
CO3	Asses lateral bulking of beams
CO4	Assess the bulking of thin walled bars of open cross section along with flexure

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	3	2	1	--	2	--
CO2	--	3	2	1	--	2	--
CO3	--	3	2	1	--	2	--
CO4	--	3	2	1	--	2	--
CO5	--	3	2	1	--	2	--

1. Slightly 2.Moderately 3.Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Beam columns: Differential equation for beam columns–Beam column with concentrated loads–continuous lateral load– couples–Beam column with built in ends–continuous beams with axial load– application of Trigonometric series–Determination of allowable stresses	12
Unit-2	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 bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section–Effect of shear force on critical load–Builtup columns–Effect of Initial curvature on bars–Buckling of frames–Sway & Non Sway mode	12

Unit-3	In-elastic buckling: Buckling of straight bars–Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram–Empirical formulae of design–various end conditions–Design of columns based on buckling. Mathematical Treatment of stability problems: Buckling problem orthogonality relation–Ritz method Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames	12
Unit-4	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 of Torsion and Flexure	6
Unit-5	Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending	6

TEXT BOOKS

1	Theory of Stability of Structures by Alexander Chajes
2	Theory of Elastic Stability by S.P. Timoshenko & J.M. Gere-Mc graw Hill Publications

REFERENCES

1	Fundamentals of Structural Stability by George J Simitses & Dewey H. Hodges, Elsevier Publications
2	Elastic Stability of Structural Elements, N.G.R. Ayyangar Macmillan Publications

MSEII-2 EARTHQUAKE RESISTANT DESIGN

Pre-Requisites: Soil Mechanics, Advanced Soil Mechanics, foundation engineering-I

Course Outcomes: At the end of the course, the student will be able to

CO1	To learn the fundamentals of seismology and basic earthquake mechanisms, tectonics types of ground motion, and propagation of ground motion. Understand qualitative and quantitative representations of earthquake magnitude
CO2	Determine the natural frequency of a single degree of freedom dynamic system for given mass, stiffness and damping properties.
CO3	Determine the maximum dynamic response of an elastic vibrating structure to a given forcing function. Distribute the static base shear to the structure based on vertical distribution of mass horizontal distribution of mass, and centers of rigidity.
CO4	Learn the fundamentals of building code based structural design
CO5	Recognize special conditions such as irregular buildings, building separation, P-delta

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	2	--	---	--	--
CO2	--	--	2	--	2	2	1
CO3	--	--	3	2	3	2	1
CO4	--	--	3	2	3	2	1
CO5	--	1	1	3	3	2	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Engineering seismology–rebound theory–plate tectonics–seismic waves–earthquake size and various scales–local site effects–Indian seismicity–seismic zones of India– theory of vibrations–near ground and far ground rotation and their effects.	6
Unit-2	Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration–pounding effects–mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS1893&13920)–Building system–frames–shear wall–braced frames–layout design of	6

	Moment Resisting Frames (MRF)–ductility of MRF– Infill wall– Non-structural elements	
Unit-3	Calculation of EQ load–modeling of building systems and analysis (theory only) Evaluation of lateral forces using seismic coefficient method, Response Spectrum method and Dynamic analysis method. Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing	12
Unit-4	Cyclic loading behavior of RC, elements- modern concepts- Base isolation–Adaptive systems–case studies- Codal provision for load calculation	12
Unit-5	Retrofitting and restoration of buildings subjected to damage due to earthquakes-effects of earthquakes–factors related to building damages due to earthquake-methods of seismic retrofitting-restoration of buildings	12

TEXT BOOKS

1	Earthquake Resistant Design of Structures Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India 2007, New Delhi
2	Earthquake Resistant Design of Structures - S.K. Duggal, Oxford Publications

REFERENCES

1	Bullen K.E., Introduction to the Theory of Seismology, Great Britain at the University Printing houses, Cambridge University Press 1996
2	Earthquake Resistant Design and Risk Reduction-David Dowrick
3	IS4326-1998: Earthquake Resistant Design and Construction of Buildings
4	IS1893(Part1 to5)-2002: General Provisions and Building
5	IS 4928–1993: Code of practice for Earthquake Resistant Design and Construction of Buildings
6	IS13920-1997: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
7	IS13935-1993: Guidelines for Repair and Seismic Strengthening of Building

MSEII-3-b) MECHANICS OF COMPOSITE MATERIALS

(Elective III)

Course Outcomes: At the end of the course, the student will be able to

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

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	--	1	--	2	--
CO2	--	1	2	1	--	2	1
CO3	--	--	2	2	--	2	1
CO4	--	--	1	2	--	2	2
CO5	--	--	2	3	--	2	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction to Composite Materials: Introduction ,Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber- Reinforced Composites and nature-made composites, and application- Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetsts, Metal matrix and ceramic composites.- Manufacturing methods: Autoclave, tape production, moulding methods, filament winding Pultrusion RTM	12
Unit-2	Macro mechanical Analysis of a Lamina: Introduction, Definitions: Stress, Strain, Elastic Moduli, Strain Energy. Hooke's Law for Different Types of Materials, Hooke's Law for a Two-Dimensional Unidirectional Lamina, Plane Stress Assumption, Reduction of Hooke's Law in Three Dimensions to Two Dimensions, Relationship of Compliance and	6

	Stiffness Matrix to Engineering Elastic Constants of a Lamina,	
Unit-3	Hooke's Law for a Two-Dimensional Angle Lamina, Engineering Constants of an Angle Lamina, Invariant Form of Stiffness and Compliance Matrices for an Angle Lamina Strength Failure Theories of an Angle Lamina: Maximum Stress Failure Theory Strength Ratio, Failure envelopes, Maximum strain failure theory, Tsai- Hill failure theory Wu Failure Theory, Comparison of Experimental Results with Failure Theories. Hygrothermal Stresses and Strains in a Lamina: Hygrothermal Stress–Strain Relationships for a Unidirectional Lamina, Hygrothermal Stress–Strain Relationships for an Angle Lamina	12
Unit-4	Micromechanical Analysis of a Lamina: Introduction, Volume and Mass Fractions, Density, and Void Content, Evaluation of the Four Elastic Moduli, Strength of Materials Approach, Semi- Empirical Models, Elasticity Approach, Elastic Moduli of Lamina with Transversely Isotropic Fibers, Ultimate Strengths of a Unidirectional Lamina, Coefficients of Thermal Expansion, Coefficients of Moisture Expansion	6
Unit-5	Macro mechanical Analysis of Laminates: Introduction, Laminate Code, Stress–Strain Relations for a Laminate, In-Plane and Flexural Modulus of a Laminate, Hygrothermal Effects in a Laminate, Warpage of Laminates- Failure, Analysis, and Design of Laminates: Introduction, Special Cases of Laminates, Failure Criterion for a Laminate, Design of a Laminated Composite	12

TEXT BOOKS

- | | |
|----------|---|
| 1 | Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press,1994 |
| 2 | B.D. Agarwal and L.J. Broutman, Analysis and performance of fibre Composites, Wiley- Inter science, NewYork,1980. |

REFERENCES

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|----------|--|
| 1 | Mechanics of Composite Material (Mechanical Engineering) 2-ed –Autar K. Kaw Publisher CR |
|----------|--|

MSEII-3-c) FRACTURE MECHANICS

(Elective III)

Course Outcomes: At the end of the course, the student will be able to

CO1	Predict material failure for any combination of applied stresses.
CO2	Estimate failure conditions of a structures
CO3	Determine the stress intensity factor for simple components of simple geometry
CO4	Predict the likelihood of failure of a structure containing a defect
CO5	

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	1	2	2	--	2	1
CO2	--	1	2	2	--	2	1
CO3	--	1	2	2	--	2	1
CO4	--	1	2	2	--	2	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction: Fundamentals of elastic and plastic behavior of materials- stresses in a plate with a hole – Stress Concentration factor-modes of failure- Brittle fracture and ductile fracture- history of fracture mechanics- Griffiths criteria for crack propagation cracks-Energy release rate, G_I , G_{II} and G_{III} -Critical energy release rate G_{Ic} , G_{IIc} and G_{IIIc} -surface energy-R curves-compliance.	12
Unit-2	Principles of Linear Elastic Fracture Mechanics: SOM vs Fracture Mechanics-stressed based Criteria for fracture- Stress Intensity Factors- K_I , K_{II} and K_{III} – Critical stress Intensity Factors, K_{Ic} , K_{IIc} and K_{IIIc} – crack tip plastic zone – Erwin's plastic zone correction– Critical crack length-Load carrying capacity of a cracked component-Design of components based on fracture mechanics.	12

Unit-3	Mixed mode crack propagation -Maximum tangential stress criterion–crack propagation angle-Material characterization by Crack Tip Opening Displacements (CTOD)-Crack Mouth Opening Displacement (CMOD)-Critical crack tip opening displacement (CTOD _c)–critical Crack Mouth Opening Displacement (CMOD _c).	12
Unit-4	Fatigue Crack propagation-Fatigue load parameters Fatigue crack growth curve–Threshold stress intensity factor-Parislaw-Retardation effects	6
Unit-5	Applications of fracture Mechanics to concrete- reasons –strain softening behaviour – Bazant’s size effect law.	6

TEXT BOOKS

1	Elementary engineering fracture mechanics–David Broek– Sijthoff & Noordhoff– Netherlands
2	Elements of Fracture Mechanics–Prasanth Kumar, Wiley Eastern Publications

REFERENCES

1	Fracture Mechanics: Fundamentals and applications – T. L. Andrason, PhD, CRC publications
2	Fracture Mechanics of Concrete: Applications of fracture mechanics to concrete, Rock, and other quasi-brittle materials, Surendra P. Shah, StuartE. Swartz, Chengsheng Ouyang, JohnWiley & Son publications

Core 4 -- THEORY OF PLATES AND SHELLS

(Prof. GYR to modify)

Course Outcomes: At the end of the course, the student will be able to

CO1	Have a knowledge about various plate theories due to bending
CO2	Gain the knowledge of Navier's solution, Levy's solution and solve for the rectangular and square plates
CO3	Analyze circular plates with various boundary conditions.
CO4	Focus on the finite difference method of solving plate problems.
CO5	Ability to realize the potential energy principle and find the solution of rectangular plates for various loadings
CO6	Understand the behaviour of folded plates and shells.

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	--	1	1	--		
CO2	--	2	2	--	--		
CO3	--	--	3	--	--		
CO4	--	--	3	1	--		
CO5	--	1	1	--	3		

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Derivation of governing differential equation for plate- in plane bending and transverse bending effects- Rectangular plates: Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier and Levy's type of solutions for various boundary condition.	12
Unit-2	Circular plates: Symmetrically loaded, circular plates under various loading conditions, Annular plates	12

Unit-3	Introduction to Shells- Single and double curvature- Equations of Equilibrium of Shells: Derivation of stress resultants, Principles of membrane theory and bending theory	12
Unit-4	Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.	6
Unit-5	Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms - Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.	6

TEXT BOOKS	
1	Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw-Hill book company, INC, New York.
2	Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications
	Analysis of Thin Concrete Shells by K. Chandrasekhar, New Age International (P) Ltd
REFERENCES	
1	Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press
2	A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.
3	Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill, New York

Elective IV: BUILDING INFORMATION MODELLING

Course Outcomes: At the end of the course, the student will be able to:

CO1	Study the back ground of BIM and its role in construction management
CO2	Apply BIM in construction design, planning and construction phases.
CO3	Comprehend the role of BIM approach in design coordination to aid in decision making
CO4	Apply BIM for case studies
CO5	

Mapping of course outcomes with program outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO6	PO7
CO1	3	-	-	-	-	1		
CO2	2	2	3	3	3	-	2	
CO3	-	2	2	2	2	-	2	
CO4	2	1	-	2	2	2	-	

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction to Building Information Modelling (BIM): Background of Building Information Modelling (BIM); Components of BIM, BIM Focus, Users of BIM information and Project Delivery Methods using BIM.	12
Unit-2	BIM in Pre-Construction Phase: Conceptual Design in Terms Shape, Orientation, Site in Terms of Green Strategy, Architectural BIM, Architectural Drafting, Architecture 3D Rendering. Structural BIM Design: Systems and Materials, Structural Rebar Detailing, Green Design Decisions. BIM Analysis: Day lighting, Energy Analysis and Energy Cost; Documentation.	12
Unit-3	BIM in Planning and Construction Phase: BIM In Fabrication, BIM In Construction Gate keeping, 4DBIM–Construction Scheduling, 5D–Construction Cost Estimation, Quantity Take off, Clash Detection and Construction Logistics.	6

Unit-4	Case studies on BIM: Architectural BIM in Residential Buildings and 3D Rendering Services; Structural BIM Modelling for Multi Storey– Residential Building and BIM Implementation during New Construction.	12
Unit-5	Applications - Designing and detailing of precast UNIT for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, single span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.	6

TEXT BOOKS

1	Building Information Modelling (BIM) in Design, Construction and Operations De Wilde,P., Mahdjoubi, L., & Garrigós, A. G.,WIT Press,2019,Volume192.
2	Building Information Modeling: Planning and Managing Construction Projects with 4DCAD and Simulations, Kymmell,W., Mc Graw-Hill Education, 2008,First Edition.
3	Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.

REFERENCES

1	Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, And Building Information Modelling, Elvin, G., John Wiley & Sons, 2007,First Edition
2	Organization and digitization of information about buildings and civil engineering works, including building information modelling—Information management using building information modelling: Concepts and principles, BSENISO19650-1,The British Standards Institution,2018.
3	Organization and digitization of information about buildings and civil engineering works, including building information modelling—Information management using building information modelling: Delivery phase of the assets. BS EN ISO 19650-2, The British Standards Institution,2018.

Elective IV - EARTH RETAINING STRUCTURES

Course Outcomes: At the end of the course, the student will be able to

CO1	Determine the earth pressures on foundations and retaining structures and uantify the lateral earth pressures associated with different earth systems
CO2	Understand the types, stability and drainage requirements of retaining works and Design of retaining structures using appropriate design methods, factors of safety, earth pressure diagrams and field verification methods
CO3	Design of sheet pipes Using appropriate methods
CO4	Understand the basic mechanisms of soil reinforcement and design principles of reinforced earth
CO5	Analyse the design principles of braced cuts and cofferdams

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	1	1	--	1	1
CO2	--	--	1	1	--	1	1
CO3	--	--	--	1	--	1	1
CO4	--	--	1	1	--	1	1
CO5	--	--	2	3	--	2	2

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Earth pressures – Different types and their coefficients- Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb's Theory in active and passive conditions.	12
Unit-2	Retaining walls – different types - Type of Failures of Retaining Walls – Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.	12
Unit-3	Sheet Pile Structures – Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth	12

	support methods – Rowe’s moment reduction method – Location of anchors and Design of Anchorage system.	
Unit-4	Soil reinforcement – Reinforced earth - Different components – their functions – Design principles of reinforced earth retaining walls.	6
Unit-5	Braced cuts and Cofferdams: Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects – TVA method and Cummins’ methods.	6

TEXT BOOKS

1	Principles of Foundation Engineering 7e by Braja Das, Cengage Learning
2	Foundation analysis and design by Bowles, J.E. – McGraw Hill

REFERENCES

1	Soil Mechanics in Engineering Practice – Terzaghi, K and Ralph, B. Peck 2 nd . – John Wiley & Sons.,
2	Analysis and Design of Foundations and Retaining Structures, Samsher Prakash, Gopal Ranjan and Swami Saran, Saritha Prakashan, New Delhi
3	NPTEL course materials on Geo-synthetics and Earth Retaining Structures

Laboratory 3 – COMPUTER AIDED DESIGN LABORATORY

Course Outcomes: At the end of the course, the student will be able to

CO1	Perform Analysis and Design of Multistoried structures using software tools
CO2	Use different Structural Engineering software's to solve various civil Engineering programs

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	3	3	3	1	3	3
CO2	1	3	2	3	1	3	3

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Expt 1	Programming for beams subject to different loading C Language	
Expt 2	Analysis and Design of reinforced concrete multi-storeyed building	
Expt 3	Analysis of plane and space truss using E Tabs and Staad Pro	
Expt 4	Analysis of plane and space frame	
Expt 5	Determination of mode shapes and frequencies of tall buildings using lumped mass (stick model) approximation	

NOTE: A minimum of Four from the above set have to be conducted.

REFERENCES	
1	Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh

Laboratory 4 – STRUCTURAL DESIGN LABORATORY

Course Outcomes: At the end of the course, the student will be able to

CO1	Develop Computer Programs for Analysis and Design of various Structural Elements
CO2	Use different Structural Engineering software's to solve various civil Engineering programs

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	3	3	3	1	3	3
CO2	1	3	2	3	1	3	3

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Analysis and Design using STADD, STADD FOUNDATION, SAFE, ETABS, ANSYS, REVIT software

Unit	Contents	Contact Hours
Expt 1	Wind analysis on different types of tall structures	
Expt 2	Analysis of pre stressed concrete bridge girder for different loading conditions	
Expt 3	Analysis of Cylindrical shell subjected to different loading conditions	
Expt 4	Analysis of Bridge Pier and Abutment for different loading conditions	
Expt 5	Dynamic Analysis of Multistory structure	

NOTE: A minimum of Four from the above set have to be conducted.

REFERENCES	
1	Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh

SEMINAR

Course Outcomes: At the end of the course, the student will be able to

CO1	Collect research material on some topic and to summaries it report and give to present the same
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Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	1	1	2	2	2

1. Slightly 2. Moderately 3. Substantially

DESIGN PROJECT

Course Outcomes: At the end of the course, the student will be able to

CO1	Analyse, design and prepare a report on Special Design topic related to Structural Engineering
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Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1		1	2	3	1	3

1. Slightly 2. Moderately 3. Substantially

MSEA-2- Value Education

(Audit Course- 2)

Course Outcomes: After the completion of the course, student will be able to

CO1	Understand the importance of value based living and value judgments
CO2	Learn the importance of Human values and Discipline
CO3	Developing the overall personality and behavior
CO4	Imbibe good values in student and emerge as responsible citizens with clear conviction to practice values and ethics in life.
CO5	Developing tolerance towards and understanding of different religious faiths, knowing the importance of character, self-management and contribute in building a healthy nation

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	-	-	-	2	2
CO2	-	1	-	1	-	1	1
CO3	1	1	-	-	2	1	1
CO4	1	-	-	-	1	2	2
CO5	-	-	-	-	-	1	1

1. Slightly 2. Moderately 3. Substantial

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Values and self- development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgments.	
Unit-2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance, Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National Unity Patriotism. Love	

	for nature, Discipline.	
Unit-3	Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness. Avoid fault Thinking	
Unit-4	Free from anger, Dignity of labour, Universal brotherhood and religious tolerance. True friendship, Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.	
Unit-5	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, studying effectively	

REFERENCES

1	“Values and Ethics for organizations Theory and practice”, Chakroborty, S.K, Oxford University Press, New Delhi
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DISSERTATION / THESIS

Course Outcomes: At the end of the course, the student will be able to

CO1	Identifying the topic after thorough review of literature on chosen topic and Can able to do the Project either Experimental Work or analytical Work
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Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1		2	2	3	3	3

1. Slightly 2. Moderately 3. Substantially

MSEIII-1-a) PLASTIC ANALYSIS AND DESIGN

(Elective V)

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand Concepts of stress and strain –relation of steel Moment curvature relation.
CO2	Carryout limit analysis of simply supported, fixed beams and continuous beams, Effect of partial fixity and end, invariance of collapse loads.
CO3	Study basic theorems of limit analysis, rectangular portal frames, gable frames, grids, superposition of mechanisms.
CO4	Understand Limit design Principles to solve continuous beams and simple frames designs using above principles.
CO5	Develop Load deflection relations for simply supported beams, deflection of Simple pin based and fixed based portal frames, method of computing deflections.

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	2	1	--	2	1
CO2	1	1	2	2	--	2	1
CO3	1	2	2	2	--	2	1
CO4	--	1	2	3	--	2	1
CO5	1	2	2	3	--	2	1

1. Slightly 2. Moderately
3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Introduction and basic hypothesis: Concepts of stress and strain–relation of steel Moment Curvature relation–basic difference between elastic and plastic analysis with examples- Yield condition, idealizations, collapse criteria- Virtual work in the elastic-plastic State-Evaluation of fully plastic moment and shape factors for the various practical sections	12
Unit-2	Method of Limit Analysis: Introduction to limit analysis of simply supported fixed beams and continuous beams, Effect of partial fixity	12

	and end, invariance of collapse loads, basic theorems of limit analysis, rectangular portal frames, gable frames, grids, super position of mechanisms, drawing statistical bending moment diagrams for checks	
Unit-3	Limit design Principles: Basic principles, limit design theorems, application of limit design theorems, trial and error method, method of combining mechanisms, plastic moment distribution method, load replacement method, continuous beams and simple frames designs using above principles..	12
Unit-4	Deflection in Plastic beams and frames: Load deflection relations for simply supported beams, deflection of simple pin based and fixed based portal frames, method of computing deflections	6
Unit-5	Minimum weight Design: Introduction to minimum Weight and linear Weight functions- Foulkes theorems and its geometrical analogue and absolute minimum weight design.	6

TEXT BOOKS

1	Plastic Methods of Structural Analysis- B. G. Neal, 3e, Chapman and Rall Publications
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REFERENCES

1	Plastic Analysis and Design- CE Messnet MA Seve
2	NPTEL Lecture Material

MSEIII-1b) Elective 5- PRE-STRESSED CONCRETE

Course Outcomes: At the end of the course, the student will be able to

CO1	Determine the flexural strength and design the flexural members, axial tension, compression bending shear and bond
CO2	Analyze the continuous beams o pre-stressed concrete members
CO3	Analyze the end blocks and design the anchorage zone reinforcement
CO4	Design the pre tension and post tensioned flexural members and statically indeterminate structures
CO5	Analyze the composite construction of pre-stressed and in situ concrete structures

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1	1	2	1	--	2	1
CO2	1	1	2	2	--	2	1
CO3	1	2	2	2	--	2	1
CO4	--	1	2	3	--	2	1
CO5	1	2	2	3	--	2	1

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus

Unit	Contents	Contact Hours
Unit-1	Flexural, shear; torsional resistance and design of Pre-stressed concrete section. Types of flexural failure – code procedures-shear and principal stresses – Pre-stressed concrete members in torsion – Design of sections for flexure, Axial Tension, Compression and bending, shear, Bond	12
Unit-2	Analysis of continuous beams –Elastic theory- Linear transformation and Concordant tendons-Deflections of pre-stressed concrete beams: Importance of control of deflections- factors influencing deflections-short term deflections of un-cracked member – prediction of long term deflections	12

Unit-3	Analysis of end blocks: By Guyon's method and Magnel's method, Anchorage zone stresses- Approximate method of design- anchorage zone reinforcement- transfer of pre stresses- pre tensioned members- Composite sections: Introduction-Analysis for stresses- differential shrinkage- general design considerations	6
Unit-4	Statically Indeterminate Structures: Advantages of Continuous Members --Effect of Pre-stressing Indeterminate Structures -- Methods of Achieving Continuity -- Definitions of Common Terms -- Methods of Analysis of Secondary Moments --- Concordant Cable Profile - Guyon's Theorem -- Effect of Axial Deformation and Tertiary Moments --- Ultimate Load Analysis of Continuous Pre-stressed Members ---Determination of Concordant Tendon Profile - - Design of Continuous Pre-stressed Concrete Beams --- Design of Pre-stressed Portal Frames.	12
Unit-5	Composite Construction of Pre-stressed and in situ Concrete: Composite Structural Members- Types of Composite Construction -- Analysis of Stresses -- Differential Shrinkage --Deflection of Composite Members -- Stresses at Serviceability Limit State --- Flexural Strength of Composite Sections -- Shear Strength of Composite Sections -- Design of Composite Sections.	6

TEXT BOOKS

1	Pre-stressed Concrete, 4e by N. Krishna Raju, Mc Graw Hill Publishers
2	Prestressed Concrete by N. Rajagopalan, Narosa Publishing
3	Prestressed Concrete by S. Ramamrutham, Dhanpatrai Publishing Company

REFERENCES

1	Prestressed Concrete Analysis and Design, Antone E. Naaman 2e, Techno Press 3000
2	Design of Prestressed Concrete- T. Y. Lin, Ned H. Burns 3e, Wiley Publications

Program Elective 5 – INDUSTRIAL STRUCTURES

Course Outcomes: At the end of the course, the student will be able to

CO1	Plan the functional requirements of structural systems for various industries.
CO2	Get an idea about the materials used and design of industrial structural elements.
CO3	Realize the basic concepts and design of power plant structures.
CO4	Design power transmission structures.
CO5	Possess the ability to understand the design concepts of Chimneys, bunkers and silos

Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	1	--	--	--	1
CO2	--	--	1	--	--	--	1
CO3	--	--	1	--	--	--	1
CO4	--	--	--	3	--	3	
CO5	--	--	2	3	--	3	2

1. Slightly 2. Moderately 3. Substantially

Detailed Syllabus:

Unit	Contents	Contact Hours
Unit-1	Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations	6
Unit-2	Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations	6
Unit-3	Design of Folded plates- Design considerations- analysis of folded plates- analysis of multi bay folded plates- design of diaphragm beam	12
Unit-4	Power plant structures- Bunkers and silos- chimney and cooling towers-Nuclear containment structures	12

Unit-5	Power transmission structures- transmission line towers- tower foundations- testing towers	12
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TEXT BOOKS	
1	Advanced Reinforced Concrete design by N. Krishnam Raju, CBS Publications & Distributions
2	Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center
3	Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company
REFERENCES	
1	Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2	SP 32: 1986, Handbook on functional requirements of Industrial buildings
	Analysis of Thin Concrete Shells by K. Chandrasekhar, New Age International (P) Ltd

SEMINAR

Course Outcomes: At the end of the course, the student will be able to

CO1	Collect research material on some topic and to summaries it report and give to present the same
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Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	--	--	1	1	2	2	2

1. Slightly 2. Moderately 3. Substantially

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DEPARTMENT OF CHEMISTRY

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DISSERTATION / THESIS

Course Outcomes: At the end of the course, the student will be able to

CO1	Identifying the topic after thorough review of literature on chosen topic and Can able to do the Project either Experimental Work or analytical Work
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Mapping of Course Outcomes with Program Outcomes:

Course Out Comes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	1		2	2	3	3	3

1. Slightly 2. Moderately 3. Substantially