ACADEMIC REGULATIONS (R – 15)
COURSE STRUCTURE
AND
DETAILED SYLLABI

FOR

M. Tech Regular Two Year Degree Course
(For the Batches Admitted From 2015-2016)

STRUCTURAL ENGINEERING

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

(Affiliated to JNTUA, Ananthapuramu, Approved by AICTE, New Delhi)

R.V.S. NAGAR, CHITTOOR- 517 127 (AP)

FOREWORD

The autonomy is conferred on Sri Venkateswara College of Engineering and technology by JNT University, Anantapur based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the affiliating University in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own curriculum, examination system and monitoring mechanism, independent of the affiliating University but under its observance.

Sri Venkateswara College of Engineering and Technology is proud to win the confidence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTUA, Anantapur to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications needed are to be sought at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The cooperaton of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

Principal

VISION

Carving the youth as dynamic, competent, valued and knowledgeable professionals who shall lead the Nation to a better future.

MISSION

- ✓ Providing Quality Education, student-centered teaching-learning processes and state-of-art infrastructure for professional aspirants hailing from both rural and urban areas.
- ✓ Imparting technical education that encourages independent thinking, develops strong domain of knowledge, hones contemporary skills and positive attitudes towards holistic growth of young minds.
- ✓ Evolving the Institution into a Center of Academic and Research Excellence.

QUALITY POLICY

Sri Venkateswara College of Engineering and Technology strides towards excellence by adopting a system of quality policies and processes with continued improvements to enhance students' skills and talent for their exemplary contribution to the society, the nation and the world.

SRI VENKATESWARA COLLEGE OF ENGINNERING & TECHNOLOGY

(AUTONOMOUS)

(AFFILIATED TO JNTUA, ANANTAPUR)

ACADEMIC REGULATIONS

M.TECH REGULAR 2 YEAR DEGREE PROGRAMME

(FOR THE BATCHES ADMITTED FROM THE ACADEMIC YEAR 2015-16)

The Jawaharlal Nehru Technological University Anantapur shall confer M.Tech Post Graduate degree to candidates who are admitted to the Master of Technology Programs and fulfill all the requirements for the award of the degree.

1.0 ELIGIBILITY FOR ADMISSIONS:

Admission to the above programme shall be made subject to the eligibility, qualifications and specialization prescribed by the competent authority for each programme, from time to time.

Admissions shall be made either on the basis of merit rank obtained by the qualified candidates at an Entrance Test conducted by the University or on the basis of GATE/PGECET score, subject to reservations and policies prescribed by the Government from time to time.

2.0 ADMISSION PROCEDURE:

As per the existing stipulations of AP State Council for Higher Education (APSCHE), Government of Andhra Pradesh, admissions are made into the first year as follows:

a) Category –A seats are to be filled by Convenor through PGECET/GATE score.
b) Category-B seats are to be filled by Management as per the norms stipulated by Government of A.P.

3.0 Specializations:

Sl. No	Department	Specializations
1.	CE	Structural Engg.
2.	EEE	Power Electronics & Electrical Drives
3.	EEE	Electrical Power Systems
4.	ME	CAD/CAM
5.	ME	Machine Design
6.	ECE	VLSI System Design
7.	ECE	Digital Electronics and Communication System
8.	ECE	Embedded systems
9.	CSE	Computer Science & Engg.
10.	CSE	Computer Science
11.	IT	Software Engg.

4.0 COURSE WORK:

4.1. A Candidate after securing admission must pursue the M.Tech course of study for Four Semesters duration.

4.2. Each semester shall have a minimum of 16 instructional weeks.

4.3. A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.

5.0 ATTENDANCE:

5.1. A candidate shall be deemed to have eligibility to write end semester examinations if he has put in at least 75% of attendance on cumulative basis of all subjects/courses in the semester.

5.2. Condonation of shortage of attendance up to 10% i.e., from 65% and above and less than 75% may be given by the college on the recommendation of the Principal.

5.3. Condonation of shortage of attendance shall be granted only on medical grounds and on representation by the candidate with supporting evidence.

5.4. If the candidate does not satisfy the attendance requirement he is detained for want of attendance and shall reregister for that semester. He shall not be promoted to the next semester.

6.0 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.

6.1. For the theory subjects 60% of the marks will be for the External End Examination. While 40% of the marks will be for Internal Evaluation, based on the average of the marks secured in the two Mid Term-Examinations held, one in the middle of the Semester (first two units) and another immediately after the completion of instruction (last three units) with four questions to be answered out of five in 2 hours, evaluated for 40 marks.

For semester end examination (external paper setting & external evaluation) five questions shall be given for a maximum of 60 marks with one question from each unit with internal choice i.e. either or type. All questions carry equal marks.

6.2. For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day to day performance (25 marks) and practical test at the end of the semester (15 marks).

6.3. Seminar is a continuous assessment process. For Seminar there will be an internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts.

6.4. For comprehensive viva voce there will be an internal evaluation of 100 marks. A candidate has to secure a minimum of 50% to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts.

6.5. 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 Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

6.6. In case the candidate does not secure the minimum academic requirement in any of the subjects (as specified in 6.5) he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the subject when next offered or do any other specified subject as may be required.

6.7. **Revaluation / Recounting:**

Students shall be permitted for request for recounting/revaluation of the Semester-End examination answer scripts within a stipulated period after payment of prescribed fee. After recounting or revaluation, records are updated with changes if any and the student will be issued a revised grade sheet. If there are no changes, the same will be intimated to the students.

6.8 **Supplementary Examination:**

In addition to the regular Semester- End examinations conducted, the College may also schedule and conduct supplementary examinations for all the subjects of other semesters when feasible for the benefit of students. Such of the candidates writing supplementary examinations may have to write more than one examination per day.

7.0 RE-REGISTRATION:

Following are the conditions to avail the benefit of improvement of internal evaluation marks

7.1. The candidate should have completed the course work and obtained examinations results for I & II semesters.

7.2. He should have passed all the subjects for which the Internal evaluation marks secured are more than or equal to 50%.

7.3. Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.

7.4. The candidate has to re-register for the chosen subjects and fulfill the academic requirements.

7.5. For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the along with the requisition to the Principal of the college.

7.6. In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

8.0 EVALUATION OF PROJECT WORK:

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ institute.

8.1. Registration of Project work: A candidate is permitted to register for the project work after satisfying the attendance requirement of I & II Semesters.

8.2. An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor and one internal senior teacher shall monitor the progress of the project work.

8.3. The work on the project shall be initiated in the penultimate semester and continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of I.D.C. after 36 weeks from the date of registration at the earliest. Extension of time within the total permissible limit for completing the programme is to be obtained from the Head of the Institution.

8.4. The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report and award internal assessment marks for 120.

8.5. A candidate shall be allowed to submit the Thesis / Dissertation only after passing in all the prescribed subjects (both theory and practical) and then take viva voce examination of the project. The viva voce examination may be conducted once in two months for all the candidates who have submitted thesis during that period.

8.6. Three copies of the Thesis / Dissertation certified in the prescribed form by the supervisor and HOD shall be presented to the H.OD. One copy is to be forwarded to the Controller Of Examinations and one copy to be sent to the examiner.

8.7. The Dept shall submit a panel of three experts for a maximum of 5 students at a time. However, the Thesis / Dissertation will be adjudicated by one examiner nominated by the Chief Controller Of Examinations.

8.8. If the report of the examiner is favorable viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the thesis / dissertation. The board shall jointly award the marks for 180.

8.9. A candidate shall be deemed to have secured the minimum academic requirement in the project work if he secures a minimum of 50% marks in the end viva-voce examination and a minimum aggregate of 50% of the total marks in the end viva-voce examination and the internal project report taken together. If he fails to get the minimum academic requirement he has to appear for the viva-voce examination again to get the minimum marks. If he fails to get the minimum marks at the second viva-voce examination he will not be eligible for the award of the degree, unless the candidate is asked to revise and

resubmit. If the candidate fails to secure minimum marks again, the project shall be summarily rejected.

9.0 Grades, Grade point Average, Cumulative Grade point Average:

9.1. Grade System: After all the components and sub-components of any subject (including laboratory subjects) are evaluated, the final total marks obtained will be converted to letter grades on a "10 point scale" described below.

% of marks obtained	Grade	Grade Points(GP)
90 to 100	A+	10
80 to 89	A	9
70 to 79	B	8
60 to 69	C	7
50 to 59	D	6
Less than 50 in sum of Int. and Ext. (or) Less than 40 in Ext.	F	0
Not Appeared	N	0

9.2. GPA: Grade Point Average (GPA) will be calculated as given below on a "10 Point scale" as an Index of the student's performance at the end of each semester:

$$\textbf{GPA} = \frac{\sum(CXGP)}{\sum C}$$

Where C denotes the credits assigned to the subjects undertaken in that semester and GP denotes the grade points earned by the student in the respective subjects

9.3. CGPA: At the end of every semester, a Cumulative Grade Point Average (CGPA) on a 10 Point scale is computed considering all the subjects passed up to that point as an index of overall Performance up to that Point as given below:

$$\textbf{CGPA} = \frac{\sum(CXGP)}{\sum C}$$

Where C denotes the credits assigned to subjects undertaken upto the end of the current semester and GP denotes the grade points earned by the student in the respective courses.

9.4. Grade sheet: A grade sheet (Marks Memorandum) will be issued to each student Indicating his performance in all subjects registered in that semester indicating the GPA and CGPA. GPA and CGPA will be rounded off to the second place of decimal.

9.5 Transcripts: After successful completion of the entire Program of study, a transcript containing performance of all semesters will be issued as a final record. Duplicate transcripts will also be issued, if required, after payment of requisite fee.

10.0 Award of Degree: The Degree will be conferred and awarded by Jawaharlal Nehru Technological University Anantapur, Anantapur on the recommendation of The Principal of SVCET (Autonomous).

10.1 Eligibility: A student shall be eligible for the award of M.Tech. Degree if he fulfills all the following conditions:

- Registered and successfully completed all the components prescribed in the program of study for which he is admitted.
- Successfully acquired the minimum required credits as specified in the curriculum corresponding to the specialization of study within the stipulated time.
- Obtained CGPA greater than or equal to 6.0 (Minimum requirement for declaring as passed.)

10.2 Award of Class: Declaration of Class is based on CGPA.

Cumulative Grade Point Average	Class
≥7.75	First Class with Distinction
≥6.75 and<7.75	First Class
≥6.0 and <6.75	Second Class

11.0 WITH – HOLDING OF RESULTS: If the candidate has not paid dues to the university or If any case of in-discipline is pending against him, the result of the candidate shall be withheld and he will not be allowed / promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

12.0 TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to 6.5 and 4.3 sections. Whereas they continue to be in the academic regulations of the batch they join later.

13.0 GENERAL:

i. The academic regulations should be read as a whole for purpose of any interpretation.
ii. Disciplinary action for Malpractice/improper conduct in examinations is appended.
iii. Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
iv. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
v. The college may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the college.

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Sri Venkateswara College of Engineering And Technology (Autonomous)

R.V.S. Nagar, Chittoor

Identification of Courses

M. Tech

Each course shall be uniquely identified by an alphanumeric code of width 7 characters as given below.

No. of digits	Description
First two digits	Year of regulations Ex:15
Next one letter	Type of program: A: B. Tech B: M. Tech C: M.B.A D: M.C.A
Next two letters	Code of program: ST: Structural Engineering, P.E: Power Electronics & Electric Drives, PS: Electrical Power Systems, CM: CAD/CAM, MD: Machine Design, VL: VLSI, DE: DECS, EM: Embedded Systems, CS: Computer Science and Engineering, CO: Computer Science, SE: Software Engineering,
Last two digits	Indicate serial numbers: ≥ 01

Ex:

15BST01

15BPE01

15BPS01

15BCM01

15BMD01

15BVL01

15BDE01

15BEM01

15BCS01

15BCO01

15BSE01

SRI VENKATESWARA COLLEGE OF ENGINNERING & TECHNOLOGY

(AUTONOMOUS)

(AFFILIATED TO JNTUA, ANANTAPUR)

RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices / Improper conduct	**Punishment**
	If the candidate	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any 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. The Hall Ticket of the candidate is to be cancelled.

3.	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 to appear for the remaining examinations of the subjects of that Semester/year.
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 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 for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted 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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.

6.	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 of seat.
7.	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 University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he will be handed over to the police and a case is registered against him.

8.	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 or 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.
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.	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. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.

10.	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.
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 Examination committee for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)
R.V.S. NAGAR, CHITTOOR- 517 127 ANDHRA PRADESH
DEPARTMENT OF CIVIL ENGINEERING

Scheme of Instruction and Examination under R15 Regulations

I-M.TECH., I-SEMESTER

S.No	Course Code	Subject	Hours/Week			Credits	Maximum Marks		
			L	T	P/D		Internal	External	Total
1	15BST01	HIGHER ENGINEERING MATHEMATICS	4	1	-	4	40	60	100
2	15BST02	ADVANCED STRUCTURAL ANALYSIS	4	1	-	4	40	60	100
3	15BST03	THEORY OF ELASTICITY AND PLASTICITY	4	1	-	4	40	60	100
4	15BST04	THEORY AND ANALYSIS OF PLATES	4	1	-	4	40	60	100
5	15BST05 15BST06 15BST07	ELECTIVE-I EXPERIMENTAL STRESS ANALYSIS GREEN BUILDING CONSTRUCTION ADVANCED STEEL STRUCTURES	4	1	-	4	40	60	100
6	15BST08 15BST09 15BST10	ELECTIVE-II CONCRETE TECHNOLOGY MAINTENANCE AND REHABILITATION OF STRUCTURES DISASTER RESISTANT STRUCTURES	4	1	-	4	40	60	100
7	15BST11	CONCRETE LABORATORY - I	-	-	3	2	40	60	100
8	15BST12	CAD LAB-I	-	-	3	2	40	60	100
9	15BST13	SEMINAR-I	-	-	-	2	50	-	50
		TOTAL	**24**	**6**	**6**	**30**	**370**	**480**	**850**

I-M.TECH., II-SEMESTER

S.No	Course Code	Subject	Hours/Week			Credits	Maximum Marks		
			L	T	P/D		Internal	External	Total
1	15BST14	FINITE ELEMENT METHODS IN ENGINEERING	4	1	-	4	40	60	100
2	15BST15	STABILITY OF STRUCTURES	4	1	-	4	40	60	100
3	15BST16	ADVANCED STRUCTURAL DESIGN	4	1	-	4	40	60	100
4	15BST17	STRUCTURAL DYNAMICS	4	1	-	4	40	60	100
5	15BST18 15BST19 15BST20	ELECTIVE-III DESIGN OF BRIDGES PRESTRESSED CONCRETE EARTHQUAKE RESISTANT STRUCTURES	4	1	-	4	40	60	100
6	15BST21 15BST22 15BST23	ELECTIVE-IV DESIGN OF TALL BUILDINGS ANALYSIS OF SHELLS AND FOLDED PLATES DESIGN OF OFF SHORE STRUCTURES	4	1	-	4	40	60	100
7	15BST24	CONCRETE LABORATORY - II	-	-	3	2	40	60	100
8	15BST25	CAD LAB-II	-	-	3	2	40	60	100
9	15BST26	SEMINAR-II	-	-	-	2	50	-	50
10	15BST27	COMPREHENSIVE VIVA VOICE	-	-	-	2	100	-	100
		TOTAL	**24**	**6**	**6**	**32**	**470**	**480**	**950**

II-M.TECH., III & IV-SEMESTER

S.No	Course Code	Subject	Hours/Week			Credits	Maximum Marks		
			L	T	P		Internal	External	Total
1	15BST28	Project Work	-	-	-	12	120	180	300
		TOTAL	-	-	-	**12**	**120**	**180**	**300**

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

M.Tech. (STRUCTURAL ENGINEERING)

M.Tech – I-Semester

L	T	P	C
4	1	0	4

(15BST01) HIGHER ENGINEERING MATHEMATICS

Objectives: *The main objectives of this course are to*

1. *Assimilate the concepts of maxima and minima of the functions and Lagrange's equation.*
2. *Know the Elliptical equation and its solutions.*
3. *Conceptualise parabolic equations, Schmidt method and to know Eigen values and vectors trough different methods.*
4. *To understand eigen values and eigen vectors, Galerkin method etc.,*

Expected Outcomes: *After completion of the course the student will be able to*

1. *understand the maxima and minima of the functions and Euler'sequations.*
2. *comprehend modified Euler's method and elliptical equations with diagonal five point formula.*
3. *analyse parabolic equations by Nicholson difference method and apply different methods for Eigen values and Eigen vectors.*
4. analyse problems by Weighted Residual methods, least square method, Galerkin's method

UNIT-I

CALCULUS OF VARIATION: Concepts of maxima and minima of functions – constraints and Lagrange's multipliers – Extreme value of functional – Euler's equations – Solutions of Euler's equation.

HAMILTON PRINCIPLE: Lagrange's equations generalized dynamic excitations- constraints in dynamical systems.

UNIT-II

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS: Taylor series method, Picard's method, Euler's method modified Euler's method & R.K. method.

UNIT-III

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Elliptical equations standard five point formula, diagonal five point formula – solution of Laplace equation by Leibmann's iteration method, Poisson's equation.

UNIT-IV

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS: Parabolic equations Bender – Schmidt method – Bender – Schmidt recurrence equation, crank – Nicholson difference method.

UNIT-V

EIGEN VALUES AND EIGEN VECTORS: General method – Power method, Spectral method.

FINITE ELEMENT METHOD: Weighted Residual methods, least square method, Galerkin's method – Finite elements – Interpolating over the whole domain – one dimensional case, two dimensional case – application to boundary value problems.

Text Books:

1. B.S.Grewal, *Higher Engineering Mathematics*, Khanna Publishers.
2. S.S.Sastry*, I*ntroductory Methods of Numerical Methods", Prentice Hall of India Pvt. Ltd.

Reference Books

1. Steven C.Chapra and Raymond P.Canale, *Numerical methods for Engineers*, McGraw Hill Book company.
2. Curtis.F.Gerald, *Applied Numerical Analysis*, Pearson India Publishers.
3. C-Xavier, *C – Language and numerical methods*, New Age International publishers.
4. M.K.Jain, SKR Iyengar, R.K.Jain, *Computational methods for partial differential equations,* New Age International publishers

SRI VENKATESWARA COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

M.Tech. (STRUCTURAL ENGINEERING)

M.Tech – I-Semester

L	T	P	C
4	1	0	4

(15BST02) ADVANCED STRUCTURAL ANALYSIS

Objectives:

1. *To understand the static and kinematic indeterminacy of the structures*
2. *To understand the concepts of matrix methods of analysis of structures*
3. *To understand the analysis of continuous beams.*
4. *To understand the analysis of rigid and pin jointed frames*

Expected Outcomes: *After completion of the course the students will be able to*

1. *distinguish determinate and indeterminate structures.*
2. *identify the method of analysis for indeterminate structures.*
3. *apply matrix methods of analysis for continuous beams.*
4. *apply matrix methods of analysis for rigid and pin jointed frames.*

UNIT-I

INTRODUCTION TO MATRIX METHODS OF ANALYSIS: Determination of static and kinematic indeterminacies of two-dimensional and three-dimensional portal frames, pin jointed trusses and hybrid frames-coordinate systems –structural idealization-Flexibility and stiffness matrices-Force displacement relationships for axial force, couple, torsional moments – stiffness method of analysis and flexibility method of analysis.

UNIT-II

ANALYSIS OF CONTINUOUS BEAMS: Stiffness method and flexibility method of analysis – continuous beams of two and three spans with different end conditions-internal hinges.

UNIT-III

ANALYSIS OF TWO DIMENSIONAL PORTAL FRAMES: Stiffness and flexibility method of analysis of 2D portal frames with different end conditions-plotting of bending moment diagrams

UNIT-IV

ANALYSIS OF TWO-DIMENSIONAL PIN-JOINTED TRUSSES: Stiffness and flexibility methods-computation of joint displacement and member forces.

UNIT-V

TRANSFORMATION OF COORDINATES: Local and Global co-ordinate systems-transformation of matrices from local to global coordinates of element stiffness matrix-direct stiffness method of analysis-assembly of global stiffness matrix from element stiffness matrices – static condensation-sub-structuring.

Text Books:

1. Pundit & Gupta, *Structural Analysis,* Tata McGraw Hill Publications
2. C.S.Reddy, *Structural Analysis,* Tata McGraw Hill Publications

Reference Books:

1. Cotes, R.C., Couties, M.G., and Kong, F.K., *Structural Analysis*, Chapman & Hall India, Madras
2. John L.Meek., *Matrix Structural Analysis*, MC Graw Hill Book Company.
3. R.C.Hibbeler, *Structural Analysis,* Pearson Education
4. C.K.Wang, *Indeterminate Structural Analysis*, McGraw Hill Publishers

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M.Tech – I-Semester

L	T	P	C
4	1	0	4

(15BST03) THEORY OF ELASTICITY AND PLASTICITY

Objectives:

1. *To make the students understand the concepts of elasticity and equip them with the knowledge to independently handle the problems of elasticity.*
2. *To enhance the competency level and develop the self confidence through quality assignments in theory of Elasticity.*
3. *To inculcate the habit of researching and practicing in the field of elasticity.*
4. *To understand the concepts of plasticity, yield criteria, plastic flow etc.,*

Expected Outcomes: *After the completion of the course the students will be able to*

1. *able to solve the problems of 3-D elasticity with confidence.*
2. *can independently work with the problems of 2-D elasticity in Cartesian/Polar Coordinates.*
3. *familiarized with the use of airy's stress function in 2-D problems of elasticity in Cartesian/Polar Coordinates.*
4. *equipped with the knowledge of various theories of torsion of prismatic bars of various cross sections and can solve the problems of torsion*.

UNIT-I

INTRODUCTION: Elasticity –Notation for forces and stresses-Components of stresses – components of strain –Hooke's law.

PLANE STRESS AND PLANE STRAIN ANALYSIS: Plane stress-plane strain-Differential equations of equilibrium- Boundary conditions- Compatibility equations-stress function-Boundary conditions.

UNIT-II

TWO DIMENSIONAL PROBLEMS IN RECTANGULAR COORDINATES: Solution by polynomials-Saint Venant's principle-Determination of displacements-bending of simple beams-application of Fourier series for two dimensional problems - gravity loading.

TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES : General Equation in polar co-ordinates - stress distribution symmetrical about an axis –Pure bending of curved bars-strain components in polar coordinates-Displacements for symmetrical stress distributions-simple symmetric and asymmetric problems-General solution of two dimensional problem in polar coordinates-Application of the general solution of two dimensional problem in polar coordinates-Application of the general solution in polar coordinates.

UNIT-III

ANALYSIS OF STRESS AND STRAIN IN THREE DIMENSIONS: Principle stress - ellipsoid and stress-director surface-Determination of principle stresses- Maximum shear stresses-Homogeneous deformation-principle axis of strain rotation.

GENERAL THEOREMS: Balance laws - Differential equations of equilibrium- conditions of compatibility - Determination of displacement-Equations of equilibrium in terms of displacements-principle of superposition-Uniqueness of solution –the Reciprocal theorem.

UNIT-IV

TORSION OF PRISMATIC BARS: General solution of problems by displacement (St. Venant's warping function) & force (Prandtl's stress function) approaches - Membrane analogy - Torsion of circular and non-circular (elliptic and rectangular) sections - Torsion of thin rectangular section and hollow thin walled section - Single and multi-celled sections.

UNIT-V

THEORY OF PLASTICITY: Stress-strain curve - Theories of strength and failure –Yield Criteria - Yield Surface – Plastic Flow – Plastic Work – Plastic Potential – Strain hardening

Text Books:

1. Timoshenko, S., *Theory of Elasticity and Plasticity*, MC Graw Hill Book company.
2. Sadhu Singh, *Theory of Elasticity and Plasticity,* Khanna Publishers.

Reference Books:

1. Papov, *Advanced Strength of materials*, MC Graw Hill Book Company.
2. Chen, W.F. and Han, D.J, *Plasticity for structural Engineers*, Springer-Verlag, New York.
3. Lubliner, J., *Plasticity Theory*, Mac Millan Publishing Co., New York.
4. Y.C.Fung., *Foundations of Solid Mechanics,* Prentice Hall India

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M.Tech – I-Semester

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4	1	0	4

(15BST04) THEORY AND ANALYSIS OF PLATES

Objectives:

1. *To understand the basic equations, bending effects of plates.*
2. *To understand the symmetrical loading and various loading conditions of circular and annular plates.*
3. *To understand the simultaneous bending and stretching of plates and to develop governing equation.*
4. *To study the concepts of orthotropic plates, numerical, approximate methods, large deflection theory of plates.*

Expected Outcomes: *After completion of the course the student will be able to*

1. *understand behaviour of plates for UDL, hydrostatic, concentrated load cases.*
2. *perform cylindrical bending of long rectangular plates, pure bending of rectangular and circular plates, and deflection theories.*
3. *understand bending theory for structural behaviour of plates.*
4. *implement numerical and approximate methods for plate problems.*

UNIT-I

DIFFERENTIAL EQUATION OF THIN PLATES :

Theory of bending of thin plates with lateral loads- Governing differential equation and various boundary conditions - in Cartesian and Polar coordination.

UNIT-II

RECTANGULAR PLATES: Classical solution for rectangular plates with different types of loads and boundary conditions - Navier's and Levy's solution methods.

UNIT-III

CIRCULAR PLATES: Symmetrically loaded, circular plates under various loading conditions, annular plates.

UNIT-IV

ORTHOTROPIC PLATES: Derivation of the governing equation, applications to grillage problems as equivalent orthotropic plates.

NUMERICAL AND APPROXIMATE METHODS: Energy solutions by variational methods, finite difference and finite element methods of analysis for plate problems.

UNIT-V

LARGE DEFLECTION THEORY OF PLATES: Study of few simple cases.

Text books:

1. Timoshenko, S., and Krieger, S.W., *Theory Of Plates and Shells*, Mc Graw Hill Book company.
2. N.K.Bairagi, *Plate Analysis*, Khanna Publishers, Delhi, 1986.

Reference books:

1. Szilard, R., *Theory and Analysis of Plates*, Prentice Hall Inc

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(15BST05) EXPERIMENTAL STRESS ANALYSIS (ELECTIVE-I)

Objectives:

1. *To understand working principle of strain gauges.*
2. *To understand various strain measuring devices.*
3. *To know the concepts of photo elasticity and its applications.*
4. *To learn various Non-destructive testing methods*

Expected Outcomes: *After the completion of the course the students will be able to*

1. *to work with strain gauges.*
2. *do the model analysis using different theorems.*
3. *apply the concepts of photo elasticity and its applications.*
4. *use the various Non-destructive testing methods*

UNIT-I

BASIC EQUATIONS AND PLANE ELASTICITY THEORY: Introduction, Strain equations of Transformation, Compatibility, Stress-Strain Relations-Two dimensional State of Stress. The Plane-Elastic problem, The Plane-Strain Approach, Plane Stress, Airy's Stress function-Cartesian Co-ordinates-Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms.

PRINCIPLES OF EXPERIMENTAL APPROACH: Merits of Experimental Analysis Introduction, uses of experimental stress analysis advantages of experimental stress analysis, Different methods –Simplification of problems.

UNIT-II

STRAIN MEASUREMENT USING STRAIN GAUGES: Definition of strain and its relation of experimental Determinations Properties of Strain-Gauge Systems-Types of Strain Gauges – Mechanical, Acoustic and Optical Strain Gauges.

ELECTRICAL STRAIN GAUGES: Inductance strain gauges – LVDT – Resistance strain gauges – various types –Gauge factor – Materials of adhesion base etc…

UNIT-III

STRAIN ROSETTES:Introduction – The three element Rectangular Rosette – The Delta Rosette – Corrections for Transverse Strain Gauge.

NON – DESTRUCTIVE TESTING: Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

UNIT-IV

BRITTLE COATING METHODS : Introduction –Coating Stress – Failure Theories –Brittle Coating Crack Patterns – Crack Detection –Types of Brittle Coating – Test Procedures for Brittle Coating Analysis – Calibration Procedures – Analysis of Brittle Coating Data.

UNIT-V

THEORY OF PHOTO-ELASTICITY: Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polariscope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law

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

Text Books:

1. J.W.Dally and W.F.Riley, *Experimental Stress Analysis*
2. Dr.Sadhu Singh, *Experimental Stress Analysis, Khanna Publishers*

Reference Books :

3. L.S.Srinath, *Experimental Stress Analysis*, MC.Graw Hill Company Publishers.

4. Dove and Adams, *Experimental Stress Analysis*

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(15BST06) GREEN BUILDING CONSTRUCTION

(ELECTIVE-I)

Objectives:

1. *To acquaint with basic principles relating to building components of green building.*
2. *To help the students to learn about phases of sustainable development of a green building.*
3. *To train students in dealing with materials, energy systems, design of a green building.*
4. *To understand the conservation and recycling of water and solid waste management*

Expected Outcomes: *After the completion of the course the students will be able to*

1. *learn about basics involved in Green building Bye-laws & town planning Act*
2. *demonstrate skills in designing a Green building with eco friendly material and energy system.*
3. *develop skills relating to conservation of water and efficient management of solid waste*
4. *use the sustainable green building materials effectively and to make effective use of non-conventional energy sources*

UNIT-I

HISTORICAL BACK GROUND: Evaluation of Green Building movement in various parts of the world, Human real needs V_s goals/dreams. Green building fundamentals and background. Human interation with the home site services, Need for green building shelter, General building Bye laws & town planning Act. Planning and development of building sites. Soil erosion control.

BUILDING COMPONENTS: How building components, systems and materials affect human performance and well being - foundations: standard foundations, slab on grade, below grade walls, basement; **structure**: floor and roof structure; shell: exterior walls, wall penetrations windows, doors, indoor air quality –sick building syndrome, mold; **core:** vertical communication, building systems; **roof:** green roofs, white roofs, roof membranes; interiors: interior architecture (partitions) interior decoration: finishes, walls, ceiling, floor; Green roofs and construction practices.

UNIT-II

PHASES OF SUSTAINABLE DEVELOPMENT: Site planning and evaluation, construction, commissioning, and occupancy phases; site selection and location of building on site;

BUILDING DESIGN: Orientation, components, systems, integrated design, scale, material building design: orientation, orientation, components, systems, integrated design, scale; material selection, historic, present, properties, how they work, efficiency; construction: phasing sequencing, minimization of erosion; occupancy- proper use; reuse; building lifecycle.

UNIT-III

SUSTAINABLE GREEN BUILDING MATERIALS: Traditional building materials. Green concrete and Green Paints, varnishes Substitute for scarce materials – Ferro cement – Gypsum boards – Timber substitutions – Industrial Wastes (Fly ash, rice husk, Silica fume, Phosphogysum, waste glass, Industrial granulated blast-furnace slag, waste steel slag, rubber, Tire Quarry dust, construction and demolition industrial debris.) – Agricultural wastes. Minimization of Ozone depleting substances in building use.

INTEGRATING BUILDING ENERGY SYSTEMS: Management of energy – use of energy saving materials, insulation; solar energy for lighting and hot water system; use of alternate energy- wind mill, and energy through waste; Passive solar architectural features.

UNIT-IV

WATER CONSERVATION AND RECYCLING: Water conservation in building operations; Rain water harvesting practices; Management of storm water and slide wastes collection treatment and recycle of wastewater in building utilities. Gray water usage in gradening purposes.

MANAGEMENT OF SOLID WASTE: Efficient waste segregation; resource recovering from household solid waste; storage and efficient disposal of waste.
INDOOR ENVIRONMENTAL QUALITY AND THE HEALTH AND PRODUCTIVITY OF SUSTAINABLE DESIGN: Sources of pollution in buildings and standards. Control of mold and moisture and, radon. Tobacco smoke control. Construction indoor air quality management plan low emitting materials, thermal comfort, natural lighting and ventilation design. Noise and odour control, Design and build structural pest controls, indoor air quality modelling.

UNIT-V
GREEN BUILDING RATING SYSTEM: Introduction and brief description of existing rating systems for sustainable design and construction (both new construction and renovation) Scope of green building rating systems BEES, LEED, CHPS, Green Spec Directory, ASHRAE Green Guide, Energy Star Homes, international: BREEAM, BEPAC, GRIHA, Green Star Certification, CASBEE, World Green Building Council; Mass Energy code, other codes
STUDIES OF SUSTAINABLE FEATURES IN BUILDING: - Case studies of existing integrated building design through green building concept of **any one** corporate school, hospital, IT Park, Airport and Railway stations and corporate offices. The economics of Green Building and the future of sustainability. Building operations and maintenance.

Text Books:

1. A.G.Madhava Rao, D.S.Ramachandra Murthy & G.Annamalai. *Modern trends in housing in developing countries,* English Book, Illustrated edition, 1984
2. Dejan Mumovic and Mat Santamouris, *A Handbook Of Sustainable Building Design And Engineering-An integrated Approach to Energy, Health and Operational Performance*

Reference books:

1. Mat Santamouris, *Environmental Design Of Urban Buildings,* Routledge , 2006
2. Mat Santamouris, *Energy Performance Of Residential Buildings,* Routledge , 2004
3. Richard Hyde, *Biclimatic Housing,* Earthscan publishes in association with the International Institute for Environment and Development
4. Francis Allard and Cristian Ghiaus, *Natural Ventilation In The Urban Environment,* Routledge
5. Simos Yannas, Evyatar Erell and Jose Luis Molina, *Roof Cooling Techniques,* Routledge
6. Bill Addis, *Building With Reclaimed Components And Materials,* Earthscan, 2006

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M.Tech – I -Semester

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4	1	0	4

(15BST07) ADVANCED STEEL STRUCTURES (ELECTIVE-I)

Objectives:
1. To learn the preliminary design of industrial requirements.
2. To learn the procedures of cantilever, portal frame methods of analyses.
3. To understand about types gantry girders and its design methodologies.
4. To understand theorems of plastic analysis and principles of optimization in structural design.

Expected Outcomes: After completion of the course the student will be able to
1. Design self-supporting stacks and chimneys for industrial buildings.
2. Analyse multi-storey frames using approximate methods and able to design gantry girder to resist all types of loads.
3. Analyse portal frames by using plastic design methodologies.
4. Apply principles of optimization in structural design.

UNIT-I
DESIGN OF SELF SUPPORTING STACKS/CHIMNEYS: Considerations for preliminary design (industrial requirements – thermal requirement – mechanical force requirement – wind load and dead load estimation) – Detailed estimation of wind; dead-and other accidental – loads; Analysis; Detailed design including provision of stakes /spoilers – Design of super structure only.

UNIT-II
ANALYSIS OF MULTI-STOREY FRAMES USING APPROXIMATE METHODS: Cantilever method - Portal method - Analysis of multi-storey frames using substitute frame method.

UNIT-III
INDUSTRIAL BUILDINGS: Industrial buildings-braced and unbraced - Gable frames with gantry-Rigid industrial frames-Fire resistant design-Fatigue resistant design.

UNIT-IV
TOWERS: Basic structural configurations - free standing and guyed towers **-**Loads on towers - wind loads - foundation design - design criteria for different configurations and transmission line towers.

UNIT-V
PRINCIPLES OF OPTIMIZATION IN STRUCTURAL DESIGN: Application to simple – rectangular portal frame – minimum weight design.

Text books:
1. Vazarani and Ratwani, *Design of Steel Structures*, Khanna Publishers
2. Punmia, B.C., Analysis of Steel Structure,

Reference books:
1. B.G.Neal, *Plastic analysis of structures,* John Wiley & Sons, Inc.
2. Baker, Steel *Skeleton V.I and II, the Cambridge University Press*
3. Timoshenko, *Strength of materials (Vol-II), CBS Publications*
4. Pinfold, *Analysis of Steel Structure*
5. Analysis of Steel Structure by Relevant IS codes

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4	1	0	4

(15BST08) CONCRETE TECHNOLOGY
(ELECTIVE-II)

Objectives:

1. *To know the types of cement, mineral and chemical admixtures, aggregates*
2. *To understand the properties of concrete.*
3. *To understand the methodology of mix design.*
4. *To understand the properties of various special concretes*

Expected Outcomes: *After the completion of the course the students will be able to*

1. *determine the properties of concrete ingredients i.e. cement. Sand. Coarse aggregate*
2. *use different types of cement as per their properties for different field applications.*
3. *design economic mix proportion.*
4. *use different types of admixtures to improve the properties of concrete for different field applications.*

UNIT-I

CONCRETE MAKING MATERIALS: Cement - Bogue's compounds – Hydration Process– Types of cement – Aggregates – Gradation Charts – Combined aggregate-Alkali Silica Reaction - Admixtures – Chemical and Mineral admixtures.

UNIT-II

FRESH CONCRETE: Workability – factors affecting workability – measurement of workability by different tests – Effect of time and temperature on workability – segregation and bleeding – mixing and vibration of concrete – quality of mixing water.

HARDENED CONCRETE: Water/cement ratio-Abram's law – Gel space ratio – effective water in mix – Nature of strength of concrete – strength in tension and compression- Griffith's hypothesis – factors affecting strength – auto-geneous healing –Relation between compression and tensile strength – curing and maturity of concrete Influence of temperature on strength – Steam curing – testing of Hardened concrete – compression tests – tension tests – factors affecting strength – flexure tests – splitting tests – Non destructive testing methods.

UNIT-III

HIGH STRENGTH CONCRETE: Micro structure – Manufacturing and Properties- Design 0s HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete. High Performance Concrete - Requirements and properties of High Performance Concrete- Design Considerations.

UNIT-IV

ELASTICITY, SHRINKAGE AND CREEP: Modulus of elasticity – dynamic modulus of elasticity – poison's ratio – Early volume changes – swelling – Draying shrinkage - Mechanism of shrinkage – factors affecting shrinkage – Differential shrinkage – moisture movement carbonation shrinkage-creep of concrete – factors influencing creep – relation between creep and time – Nature of creep – Effect of creep.

MIX DESIGN: Proportioning of concrete mixes by various methods – fineness modulus, trial and error, mix density, Road Note. No. 4, ACI and ISI code methods – factors in the choice of mix proportions – Durability of concrete – quality control of concrete – Statistical methods – High strength concrete mix design

UNIT-V

SPECIAL CONCRETES: Light weight concretes –light weight aggregate concrete- Mix design- Cellular concrete - No fines concrete – High density concrete – Fiber reinforced concrete – Different types of fibers - factories affecting properties of FRC – Applications polymer Concrete – types of polymer concrete properties of polymer concrete applications

Text books:

1. A. M. Neville, 'Properties of concrete ', Pitman Publishing Limited, London.
2. M.S.Shetty, *Concrete Technology*, S.Chand & Co.

Reference Books :

1. F.M.Lea, 'Chemistry of cement and concrete' 3rd ed., 1970 Edward Arnold.
2. PD Kulkarni, R.K.Ghosh, Y.R. Phull, *Text book of Concrete Technology,* Newage international
3. Rajat Siddique, *Special Structural concretes* , Galgotia Publications
4. ML Gambhir, *Concrete Technology*, 3rd edition, TATA Mc Graw Hill Publishing Company.

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4	1	0	4

(15BST09) MAINTENANCE AND REHABILITATION OF STRUCTURES (ELECTIVE-II)

Objectives:

1. *To learn the influence of climate, temperature, chemicals on serviceability and durability of structures.*
2. *To acquaint with maintenance and repair strategies of structures*
3. *To know about the different repair techniques and materials for repair works.*
4. *To understand about concept of rehabilitation by referring to different case studies*

Expected Outcomes*: After completion of the course the student will be able to*

1. *possess thorough knowledge of Quality assurance for concrete structures.*
2. *inspect the structures for serviceability and durability.*
3. *assess the durability and serviceability problems of structures and their maintenance works.*
4. *use different construction materials to improve durability of the structure.*

UNIT-I

GENERAL: Quality assurance for concrete construction, as built concrete properties, strength, permeability, and volume changes, thermal properties, and cracking.

INFLUENCE ON SERVICEABILITY AND DURABILITY: Effects due to climate, temperature, chemicals, wear and erosion, design and construction errors, corrosion mechanism, Effects of cover thickness and cracking methods of corrosion protection, inhibitors, resistant steels, coatings and cathodic protection.

UNIT-II

MAINTENANCE AND REPAIR STRATEGIES: Inspection, Structural Appraisal, Economic appraisal, components of equality assurance, and conceptual bases for quality assurance schemes.

REPAIR OF STEEL STRUCTURES: Bridge, building, towers etc, monuments and historical structures, Prevention of water leakage in structures, and under-water repairs

UNIT-III

MATERIALS FOR REPAIR : Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, and Fibre reinforced concrete.

UNIT-IV

TECHNIQUES FOR REPAIR : Rust eliminators and polymers coating for rebar's during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

UNIT-V

CASE STUDIES: Repairs to overcome low member strength, Deflection, cracking, chemical disruption, weathering, wear, fire, leakage, and marine exposure.

Text books:

1. Dension Campbell, Allen and Harold Roper, *Concrete Structures, Materials, Maintenance and Repair*, Longman Scientific and Technical, U.K. 1991.
2. MS. Shetty, *Concrete Technology – Theory and practice*, S.Chand and company, New Delhi, 1992.

Reference books:

1. RT.Allen and S.C. Edwards, *Repair of concrete Structures*, Blakie and sons, UK, 1987.
2. Broomfield John.P , *Corrosion of steel*, Spom Press,New York,1996.
3. Santhakumar, A.R.*Training Course notes on damage assessment and Repair in low cost housing,* RHDC-NBO Anna University, Madras, July, 1992.

4. Raikar, R.N.*Learning from Failures – Deficiencies in Design, Construction and Service,* R&D centre (SDCPL), Raikar Bhavan, Bombay, 1987.
5. N.Palaniappan, *Estate Management*, Anna Institute of Management, Madras Sep. 1992.
6. F.K.Garas, J.L.Clarke, GST Armer, *Structural Assessment*, Butterworths, UK Aporil 1987.
7. A.R. Santhakumar, *Concrete chemicals – Theory and applications*, Indian society for construction Engineering and Technology, Madras. 1993 (In press)

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4	1	0	4

(15BST10) DISASTER RESISTANT STRUCTURES
(ELECTIVE-II)

Objectives:

1 *To understand the behaviour of life line structures.*
2 *To understand the Repairs and retrofitting techniques of community structures.*
3 *To understand the definitions of rehabilitation and retrofitting and different materials for strengthening.*
4 *To understand the materials for disaster reduction and damage assessment.*

Outcomes: *After the completion of the course the students will be able to*

1. *Know about the design philosophy to resist floods and earthquakes.*
2. *Assess the suitable retrofitting technique for different structures in different conditions.*
3. *Know about the methods and materials for strengthening for different disasters.*
4. *Apply the GIS software in disaster management to assess the damage.*

UNIT-I
BEHAVIOUR OF LIFE LINE STRUCTURES
Design philosophy to resist flood, cyclone, and earthquake and fire disasters-National and International Codes of practice - By-laws of urban and semi urban areas - Past history and lessons from disasters - Approach to traditional and Modern Structures - Concept of life period based Design - case studies.

UNIT-II
COMMUNITY STRUCTURES
Safety analysis and rating - Reliability assessment repairs and Retrofitting techniques of Community Structures - Protection of Nuclear Structures -Dams, bridges and buildings.

UNIT-III
REHABILITATION AND RETROFITTING
Testing and evaluation - Classification according to safety level – methods and materials for strengthening for different disasters - qualification test

UNIT-IV
MATERIALS, DESIGN AND DETAILING
Modern Materials for disasters reduction - Detailing aspects of structures subject to probable disasters - Construction techniques – Analysis methodology - Techniques for optimal performance - Provisions for artificial disasters - blast and impact.

UNIT-V
TECHNIQUES OF DAMAGE ASSESSMENT
Damage surveys - Maintenance and modification to improve hazard resistance - application GIS in disaster management – foundation improvement techniques.

Text books:

1Raiker, R.N. *"Learning from failures, Deficiencies in Design, Construction and Service"*, R&D Center, Raiker Bhavan, 1987
2. Allen.R.T., and Edwards.S.C., *"Repairs of Concrete Structure"*;ie and Sons, U.K.1987

Reference books:

1. Moskvin.V *"Concrete and Reinforced Concrete"* - Deterioration andprotection - MIR Publishers - Moscow 1983
2. Lecture notes on the course *"Disasters Management"* - conducted byAnna University, 2000

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(15BST11) CONCRETE LABORATORY - I

Objectives:

1. *To learn the principles of workability in cement concrete.*
2. *To learn the preliminary tests on aggregates like flakiness test, elongation test, specific gravity, bulk density fineness modulus.*
3. *To know the compression test, Young's modulus test procedures*
4. *To learn the mix design procedure*

Expected Outcomes: *After completion of the course the student will be able to*

1. *assess the workability of cement concrete and its suitability, quality of concrete*
2. *assess the quality of fine and coarse aggregates after testing the aggregates according to IS specifications.*
3. *test the quality of cement concrete by conducting compressive strength on concrete cubes.*
4. *design different grades of mix design and also asses the fineness of cement, flash, silica by using blain's apparatus.*

List of Experiments:

1. Workability
   - (a)Slump Test
   - (b)Compaction Factor Test
   - (c)Vee-Bee Test

2. Flakiness Test

3. Elongation Test

4. Specific Gravity of
   - (a) Cement
   - (b) Coarse Aggregate
   - (c) Fine Aggregate

5. Bulk density of
   - (a) Fine Aggregate
   - (b) Coarse Aggregate

6. Fineness Modulus of
   - (a) Fine Aggregate
   - (b) Coarse Aggregate

7. Compressive strength of Cement

8. Mix Design of Concrete and Casting of Specimen.

9. Young's Modulus of Concrete

10. Fineness by Blain's apparatus for cement, fly ash, Silica.

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0	0	3	2

(15BST12) CAD LAB-I

Objectives:

1. *To learn the software applications in structural engineering.*
2. *To learn the CAD commands, dimensioning.*
3. *To draw the plan, elevation and section drawings of structural objects and to learn the DBMS concepts.*
4. *To understand the C programming language.*

Expected Outcomes: *After completion of the course the student will be able to*

1. *draw dimensioning for a given object and able to draw plan, elevation and section of the objects.*
2. *assess the 3D, DBMS concepts related to civil engineering data base.*
3. *analyse regression and matrix inversions.*
4. *develop C programs and to solve problems using numerical techniques.*

- Computer Aided Drafting **-** Basic 2D objects – line, polyline, circle, ellipse – Dimensioning –Preparation of plan, elevation and section drawings of simple structural objects

- Introduction to 3D - DBMS concepts - Civil Eng. Databases – Data entry & Reports.- Spreadsheet concepts – Worksheet calculations in Civil Engineering - Regression & Matrix Inversion.

- Development of C programs to solve problems using numerical techniques
    1. Roots of an equation using Newton – Raphson method.
    2. Solution of linear simultaneous equations using Gauss elimination.
    3. Matrix inversion using GJ method
    4. Linear regression line of given points.
    5. Curve fitting using Polynomial Regression.
    6. Eigen value extraction power method

References

1. Rajaraman, V., Computer Oriented Numerical Methods, Prentice – Hall of India, 2004.

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(15BST14) FINITE ELEMENT METHODS IN ENGINEERING

Objectives:

1 *To provide an overview and basic fundamentals of Finite Element Analysis.*
2 *To introduce basic aspects of finite element theory, including domain discretization, interpolation, application of boundary conditions, assembly of global arrays, and solution of the resulting algebraic systems.*
3 *To explain the underlying concepts behind variational methods and weighted residual methods in FEM.*
4 *Formulate simple structural problems in to finite elements.*

Expected Outcomes: *After the completion of the course the students will be able to*

1 *analyse and build FEA models for various Engineering problems.*
2 *able to identify information requirements and sources for analysis , design and evaluation*
3 *use professional-level finite element software to solve engineering problems.*
4 *interpret results obtained from FEA software solutions, not only in terms of conclusions but also awareness of limitations.*

.

UNIT-I

INTRODUCTION:
Concept of Finite Element Method - Merits and demerits, applications, relevant software's. Steps involved in FEM as applicable to structural mechanics problems. Descritization interpolation model, Convergence and compatibility criteria.

UNIT-II

ONE DIMENSIONAL ANALYSIS: Stiffness Matrix for Beam and Bar elements shape functions for ID elements –static condensation of global stiffness matrix-solution –Initial strain and temperature effects.

UNIT-III

TWO DIMENSIONAL ANALYSIS: Different types of elements for plane stress and plane strain analysis –Displacement models –generalized coordinates-shape functions-convergent and compatibility requirements –Geometric Invariance –Natural coordinate system-area and volume coordinates-Generation of element stiffness and nodal load matrices –static condensation.

UNIT-IV

ISOPARAMETRIC FORMULATION: Concept, Different isoparametric elements for 2d analysis-Formulation of 4-noded and 8-noded isoparametric quadrilateral elements – Lagrangian elements serendipity elements.
AXI SYMMETRIC ANALYSIS: Bodies of revolution-axi symmetric modelling –strain displacement relationship-formulation of axi symmetric elements.

UNIT-V

THREE DIMENSIONAL FEM: Different 3-D elements, 3D strain –displacement relationship-formulation of hexahedral and isoparametric solid element.

Text books:

1. Finite element analysis _Theory & programming by G.S.Krishna murthy
2. Introduction to finite element method –Triupathi Chandra patla &Belugunudu

Reference books:

1. O.C.Zienkiewicz, *Finite element method*
2. Introduction to finite element method –J.N.Reddy
3. Cook R.D., Concepts and Applications of Finite Element Analysis, John Wiley and Sons Inc., New York, 1989.
4. Bathe K.J.., finite Element Procedures in Engineering Analysis, Prentice Hall,1990.
5. Gallagher R.H., & Wilson Finite Element Analysis Fundamentals, Prentice Hall Inc.,1975.
6. Hinton and Owen, Finite Element Programming, Academic Press, London, 1977.

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(15BST15) STABILITY OF STRUCTURES

Objectives:

1. *To acquaint with basic principles relating to stability of structures*
2. *To help the students to learn about mathematical treatment of stability Problems.*
3. *To train students in dealing with buckling, and torsion developed for different structures under different support and loading conditions.*
4. *To acquaint students with the Elastic and in-elastic Buckling behaviour of structures.*

Expected Outcomes:

After the completion of the course the students will be able to

1. *able to distinguish different types of beam columns and developing differential equations under different loading conditions.*
2. *demonstrate skills in treating both elastic and in-elastic buckling of structures.*
3. *develop skills relating to torsion and lateral buckling of structures.*
4. *identify the difference of Elastic and in-elastic Buckling Behaviour of Structures*

UNIT-I

FORMULATIONS RELATED TO BEAM COLUMNS: Concept of Stability, 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.

UNIT-II

ELASTIC BUCKLING OF BARS: Elastic buckling of straight columns – Method of Neutral Equilibrium-Effect of shear stress on buckling-Eccentrically and laterally loaded columns – energy methods –Buckling of a bar on elastic foundation, Buckling of a bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section –Effect of shear force on critical load –Built up columns

UNIT-III

INELASTIC BUCKLING: Buckling of straight bars-Double modulus theory –Tangent modulus theory

MATHEMATICAL TREATMENT OF STABILITY PROBLEMS: Linear and non Linear Eigen Value problems-Buckling problem orthogonality relation –Ritz method-Timoshenko method, Galerkin method

UNIT-IV

TORSIONAL BUCKLING: Pure torsion of thin walled bar of open cross section-Non –Uniform torsion of thin walled bars of open cross section-Torsion buckling –Buckling under Torsion and Flexure.

LATERAL BUCKLING OF SIMPLY SUPPORTED BEAMS: Beams of rectangular cross section subjected for pure bending

UNIT-V

BUCKLING OF SIMPLY SUPPORTED RECTANGULAR PLATES: Derivation of equation of plate subjected to constant compression in two directions and one direction.

Text books:

1. Bleach, *Stability Of Metallic Structure* , Mc Graw hill
2. Chen & Atsuta, *Theory of Beam Columns* Vol I, Mc.Graw Hill

Reference books:

1. Timoshenko, S., and Gere., Theory *of Elastic Stability*, Mc Graw Hill Book company, 1973.
2. Chajes, A., *Principles of Structural Stability Theory*, Prentice Hall,1974
3. Ashwini Kumar, Stability *Theory of Structures*, TATA Mc Graw Hill publishing company Ltd, New Delhi, 1985.
4. Gambhir, M.L, *Stability Analysis and Design of Structures*, Springer-verlag Berlin Heidal Berg Publishers, 2004.

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(15BST16) ADVANCED STRUCTURAL DESIGN

Objectives:

1. *To understand the short term and long term deflections of beams and slabs.*
2. *To understand the mechanism of flexural cracking and its estimation*
3. *To understand the design of deep beams, plain concrete walls and shear walls.*
4. *To understand the design of beam column joints.*

Expected Outcomes: *After the completion of the course the students will be able to*

1. *design the R.C. beams and slabs to satisfy the limit state of serviceability by determining the short term and long term deflection.*
2. *estimate the crack width in beams for the given load.*
3. *design deep beams, plain and shear walls*
4. *design beam-column join for the given loading system.*

UNIT-I

DEFLECTION OF REINFORCED CONCRETE BEAMS AND SLABS: Introduction -Short-term Deflection of beams and Slabs -Deflection due to -Imposed loads - Short- term deflection of beams due to applied loads- Calculation of deflection by IS 456 - Calculation of deflection by BS 8110 - Deflection calculation by Eurocode - ACI Simplified Method - Deflection of continues beams by IS 456 - Deflection of Cantilevers - Deflection of Slabs

ESTIMATION OF CRACKWIDTH IN REINFORCED CONCRETE MEMBERS: Introduction - Factors affecting Crack width in beams - Mechanism of Flexural cracking Calculation of crack widths - Simple Empirical method - Estimation of Crack width in -beams by IS 456 of BS 8110 - Shrinkage and Thermal Cracking

UNIT-II

DESIGN OF REINFORCED CONCRETE DEEP BEAMS: Introduction - Minimum Thickness - Steps of Designing deep beams - Design by IS 456 - Design according to British Practice - ACI Procedure for design of deep beams - Checking for local failures - Detailing of deep beams

UNIT-III

DESIGN OF PLAIN CONCRETE WALLS: Introduction - Braced and Unbraced walls - Slenderness of walls- Eccentricities of vertical loads at Right angles to wall - Empirical design method for plane concrete walls carrying axial load - Design of walls for Inplane Horizontal forces - Rules for detailing of steel in concrete walls

DESIGN OF SHEAR WALLS: Introduction - Classification of shear walls - Classification according to behaviour - Loads in shear walls - Design of Rectangular and flanged shear walls - Derivation of formula for moment of Resistance of Rectangular shear walls

UNIT-IV

DESIGN OF CAST IN-SITU BEAM-COLUMN JOINTS: Introduction – Types of cast in-situ joints – Joints in multi-storeyed Buildings – Forces acting on Joints – Strength Requirement of Columns – Forces directly acting on joints – Design of joints for strength – Anchorage – Confinement of core of joint – Shear strength of joint – Corner (Knee) joint – Detailing for Anchorage in exterior beam-column joint – Procedure for design of joint.

UNIT-V

DESIGN OF REINFORCED CONCRETE MEMBERS FOR FIRE RESISTANCE: Introduction - ISO 834 standard heating conditions- Grading or classifications - Effect of High temperature on steel and concrete - Effect of high temperatures on different types of structural members - Fire resistance by structural detailing from Tabulated data - Analytical determination of the ultimate bending moment capacity of reinforced concrete beams under fire - Other considerations

Text books:

1. P.C.Verghese, *Advanced Reinforced Concrete Design*, PHI Learning, New Delhi
2. P.Purushothaman, *Reinforced concrete Structural Elements: Behaviour, analysis and Design*, TATA Mc Graw Hill.

Reference Books:

1. C.E. Reynolds and J.C. Steedman, *Reinforced Concrete- Desigers Hand book*, a view point publication.
2. P.Dayaratnam , *Limit State Design of Reinforced Concrete Structures*, Oxford & IBH Publishers, 2004 edition.
3. N.Krishna Raju,*Advanced Reinforced Concrete Design*, CBS Publishers & Distributors.
4. Devadas Menon, Reinforced *cement concrete Structures, Tata McGraw Hill Education*

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(15BST17) STRUCTURAL DYNAMICS

Objectives:

1. *To acquaint with basic principles relating to Dynamics of structures under both damped and undamped condition.*
2. *To understand Impact of degree of freedom on vibration of structures*
3. *To make students learn about mathematical treatment of dynamics of structural Problems both single degree and multi degree of freedom.*
4. *To train students in dealing with vibration and earth quake analysis.*

Expected Outcomes: *After the completion of the course the students will be able to*

1. *identify different types of vibrations under SDOF and MDOF system conditions.*
2. *evaluate impact of degree of freedom on vibration of structures.*
3. *demonstrate skills in treating structures for earthquake analysis.*
4. *develop skills relating to continuous system of structures relating to different loading conditions*

UNIT-I

Equation of Motions, Problem Statement, Solution Methods of Single Degree of Freedom Systems (SDOF)

Basic concepts of structural dynamics: single degree of freedom system, force displacement relationship, damping force, equation of motion, mass-spring-damper system, methods of Solution of differential equation.

Free Vibration (SDOF): Undamped free vibration, viscously damped free vibration, energy in free vibration.

UNIT-II

MULTI DEGREE OF FREEDOM SYSTEM: selection of the degree of freedom –Evaluation of structural property matrices-Formulation of the MDOF equations of motion –Undamped free vibrations Solution of Eigen value problem for natural frequencies and mode shapes-Orthogonality conditions - Approximate methods of extraction of Eigen values.

UNIT-III

DYNAMIC RESPONSE OF MDOF SYSTEMS: Normal co-ordinates - Mode superposition technique - Numerical integration procedures

UNIT-IV

INTRODUCTION TO EARTHQUAKE ANALYSIS: Introduction –Excitation by rigid base translation – Lumped mass approach -SDOF and MDOF system- I.S code methods of analysis.

UNIT-V

CONTINUOUS SYSTEM: Introduction –Flexural vibrations of beams- Elementary case-Equation of motion –Analysis of undammed free shapes of simple beams with different end conditions-principles of application to continuous beams.

Text books:

1. A.K.Chopra, "*Structural Dynamics for Earthquake Engineering*",Prentice Hall,1994
2. S.R DAMODARASAMY & S.KAVITHA,"Basics of*Structural Dynamics and a Seismic Design*", PHI Pvt. Ltd., 2009.

Reference books:

1. Clough & Penziem, *Dynamics of structures*, Mc Graw Hill Publications
2. Mario Paz, *Structural dynamics,* CBS Publications.
3. I.S:1893(latest)" code of practice for earthquakes resistant design of structures"
4. Anderson R.A, *Fundamentals of Vibration*, Amerind Publishing Co., 1972.

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(15BST18) DESIGN OF BRIDGES (ELECTIVE-III)

Objectives:

1. *To acquaint with the different loads and support conditions pertaining to design of Bridges*
2. *To understand the IRC loads and design considerations of bridges*
3. *To understand the design of different types of bridges*
4. *To understand the design of bridge foundations, piers and abutments.*

Expected Outcomes: *after the completion of the course the students will be able to*

1. *identify different loads and support conditions pertaining to design of bridges.*
2. *design foundations for bridges*
3. *design the piers and abutments for bridges.*
4. *design box culverts, T-Beam bridges and prestressed concrete bridges*

UNIT-I

INTRODUCTION: Introduction and selection of type of Bridges- Loads and forces.
BOX CULVERT: General aspects – Design loads – Design moments, shears and thrusts – Design of critical section.

UNIT-II

DESIGN OF SLAB BRIDGES: Effective width of analysis – workings stress design and detailing of slab bridges for IRC loading.
T-BEAM BRIDGES: Introduction – wheel load analysis – B.M. in slab – Pigaud's theory – analysis of longitudinal girders by Courbon's theory working stress design and detailing of reinforced concrete T-beam bridges for IRC loading.

UNIT-III

PRESTRESSED CONCRETE BRIDGES: General features – Advantages of Prestressed concrete bridges – pretensioned prestressed concrete bridges – post tensioned prestressed concrete Bridge decks. Design of post tensioned prestressed concrete slab bridge deck.

UNIT-IV

BRIDGE BEARINGS: General features – Types of bearings – forces on bearings basis for selection of bearings – Design principles of steel rocker and roller bearings and its design – Design of elastometric pad bearing detailing of elastometric pot bearings.

UNIT-V

PIERS AND ABUTMENTS: Design of Abutments, Piers and their foundations.

Text Books:

1. D.Johnson Victor, *Essentials of Bridges Engineering,* Oxford& IBH publisher's Private Ltd.
2. FR Jagadeesh, M.A. jaya Ram*, Design of Bridge Structures*, Eastern Economy edition.

Reference Books :

1. MC Aswanin VN Vazrani, MM Ratwani, *Design of Concrete Bridges*, Khanna publishers.
2. Taylor F.W., Thomson, S.E., and Smulski E., *Reinforced Concrete Bridges*, John wiley and sons, New York, 1955.
3. Derrick Beckett, *An Introduction to Structural Design of Concrete Bridges*, Surrey University; press, Henlely – Thomes, Oxford Shire, 1973
4. S.Ponnuswamy, *Bridge Engineering,* Mc Graw Hill Education.

Text Books:

1. D.Johnson Victor, *Essentials of Bridges Engineering,* Oxford& IBH publisher's Private Ltd.
2. S.Ponnuswamy, *Bridge Engineering,* Mc Graw Hill Education.

Reference Books :

5. MC Aswanin VN Vazrani, MM Ratwani, *Design of Concrete Bridges*, Khanna publishers.
6. Taylor F.W., Thomson, S.E., and Smulski E., *Reinforced Concrete Bridges*, John wiley and sons, New york, 1955.
7. Derrick Beckett, *An Introduction to Structural Design of Concrete Bridges*, Surrey University; press, Henlely – Thomes, Oxford Shire, 1973
8. FR Jagadeesh, M.A. jaya Ram*, Design of Bridge Structures*, Eastern Economy edition.

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(15BST19) PRESTRESSED CONCRETE
(ELECTIVE – III)

Objectives:

5 To understand the concepts of prestressing
6 To understand the behaviour of prestressed members in compression and flexure.
7 To understand the design of prestressed concrete members
8 To understand the transfer of prestress and Anchorage stresses

Expected Outcomes: *After the completion of the course the students will be able to*

5. *evaluate the behaviour, analyze and design of prestressed concrete structures, layout of tendon satisfying strength and serviceability limit states.*
6. *analyze and design for shear in P.S.C members.*
7. *analyze the stresses in anchorage zones and design of end anchorage*
8. *analyze and design prestressed circular concrete pipes and tanks*

UNIT-I

DESIGN FOR FLEXURE: Definition of Type I, II, & III structures – Basic Assumptions- Permissible stresses in steel and concrete as per IS: 1343 – Basic four requirements – Design and choice of sections of Post tensioned beams – Layout of cables – check of limit state of collapse – Location of Position of wires in Pretensioned beams.

UNIT-II

DEFLECTION: Short term deflection of Uncracked Members – Long Term Deflection – Deflection due to creep – Code requirements for Limit State of Deflection.

UNIT-III

TRANSFER OF PRE STRESS: Transmission of Prestressing force by Bond – Transmission length – factors affecting transmission length – check for Transmission length – Anchorage Zone stresses in Post tensioned members – Calculation of Bearing stress and Bursting tensile forces & reinforcement in anchorage zones based on IS 1343 & Guyon's method.

UNIT-IV

STATICALLY INDETERMINATE PRESTRESSED CONCRETE STRUCTURES: Methods of Achieving continuity – Assumptions in elastic analysis – Pressure line – Linear transformation – concordant cables – Guyon's theorem – Analysis and design of continuous beams.

UNIT-V

CIRCULAR PRESTRESSING: Circular prestressing in liquid retaining tanks – Analysis for stresses – Design of tank wall incorporating recommendations of IS: 3370 Part III Code – Types of Prestressed Concrete Pipes – Design of Pipes..

Text books:

1. *Prestressed Concrete by* N. Krishna Raju, Tata Mc Graw- Hill Companies, 4th Edition 2007
2. *Prestressed Concrete* by S. Ramamrutham, Dhanpatrai Publishing Company (P) Ltd, 2006

Reference books:

1. T.Y.Lin, *Design of Prestressed Concrete Structures*, Asian Publishing house, Bombay, 1953.
2. Y.Guyon, *Prestressed Concrete*, Vol.I&II, Wiley and Sons, 1960.
3. F.Leohhardt, *Prestressed Concrete Design And Construction*, Wilhelm Ernst and shon, Berlin, 1964.
4. C.E.Reynolds and J.C. Steedman, *Reinforced Concrete Designers Hand Book*, A view point publication, 1989.
5. Edward P.Nawy, *Prestressed Concrete*, Prentise Hall
6. Raj Gopal, *Prestressed Concrete*, Alpha Science International, 2005

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(15BST20) EARTHQUAKE RESISTANT STRUCTURES (ELECTIVE – III)

Objectives:

1. *To make the students understand the fundamental concepts in the analysis of the structures subjected to seismic forces.*
2. *To understand the vibration of structures during earthquakes.*
3. *To understand the students to do a competent design & detailing of seismic resistant structures.*
4. *To understand the student fundamentals of Seismic Planning.*

Expected Outcomes: *After the completion of the course the students will be able to*

1. *analyse the forces acting on structures due to earthquake.*
2. *computation of design moments and shears for framed structure as per IS:1893 and its detailing*
3. *apply the concepts in the design of structures.*
4. *implementing the Selection process of materials and construction form of super structure.*

UNIT-I

ENGINEERING SEISMOLOGY : Earthquake – causes of earthquake – earthquakes and seismic waves – scale and intensity of earthquakes – seismic activity – Measurements of earth quakes – seismometer- strong motion accelerograph / field observation of ground motion – analysis of earthquakes waves – earth quake motion – amplification of characteristics of surface layers – earthquake motion on the ground surface;

UNIT-II

VIBRATION OF STRUCTURES UNDER GROUND MOTION: Elastic vibration of simple structures – modelling of structures and equations of motion – free vibrations of simple structures – steady state forced vibrations – Non steady state forced vibrations – response spectrum representations; Relation between the nature of the ground motion and structural damage.

UNIT-III

DESIGN APPROACHES: Methods of analysis – selection of analysis – equivalent lateral force procedure seismic base shear – seismic design co-efficient - vertical distribution of seismic forces and horizontal shear – twisting moment - Over turning moment – vertical seismic load and orthogonal effects lateral deflection – P- Δcharacteristics effect – soil structure Interaction Seismic – Graphs study, earthquake records for design – factors affecting accelerogram characteristics - artificial accelerogram – zoning map. Dynamic – analysis procedure: Model analysis – Inelastic – time history analysis Evaluation of the results.

UNIT-IV

EARTHQUAKE – RESISTANT DESIGN OF STRUCTURAL COMPONENTS AND SYSTEMS: Introduction – monolithic reinforced concrete structures – precast concrete structures – Prestressed concrete structures – steel structures – composite structures, masonry structures, Timber structures.

UNIT-V

FUNDAMENTALS OF SEISMIC PLANNING: Selection of materials and types of construction form of superstructure – framing systems and seismic units – devices for reducing. Earthquake loads,

Text books:

1. J.A. Blume, N.M. Newmark, L.H. Corning., *Design of Multi-storeyed Buildings for Earthquake ground motions*', Portland Cement Association, Chicago,1961
2. Pankaj Agarwal, *Earthquake Resistant Design*

Reference books:

1**.** Minoru Wakabayashi, *Design of earthquake resistant structures*
2. A.K.Chopra, *Structural Dynamics for Earthquake Engineering*, PrenticeHall 1995.
3. R.W.Clough, *Dynamics of structures*. Mc GrawHill, 2nd edition, 1992.
4. N.M Newmark and E.Rosenblueth, *Fundamentals of Earthquake Engineering,* PrenticeHall, 1971.

5. David Key, *Earthquake design practice for buildings*. Thomas Telford, London, 1988
6. R.L. Wegel, *Earthquake Engg*; Prentice Hall 12nd edition 1989.
7. I.S.Codes No. 1893,4326,13920.

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(15BST21) DESIGN OF TALL BUILDINGS
(ELECTIVE – IV)

Objectives:

1. To understand the Design philosophy and essential amenities.
2. To understand the Types of loads and Materials for the tall buildings.
3. To understand the load distribution in steel and concrete and different resisting systems
4. To study the concepts of analysis for displacements and member forces for load transfer systems and dynamic analysis
5. To understand the research needs in tall building materials, systems and designs.

Outcomes:

After completion of the course the student will be able to

1. Calculate the loads on the tall buildings like live loads, dead loads, impact loads etc.
2. Know the load distribution in different resisting systems.
3. Analysis and design of the various horizontal load transfer systems.
4. Know the structural systems for future generation buildings.

UNIT-I

INTRODUCTION
Design Philosophy - History - advantages and disadvantages - Vertical city-concepts - essential amenities - fire safety - water supply - drainage and garbage disposal - service systems - structural and foundation systems.Factors affecting height, growth and form - Human comfort criteria.

UNIT-II

LOADS AND MATERIALS
Gravity loading - Dead and Live load - calculation - Impact and construction loads. Wind loading - static and dynamic approach - Analytical and wind tunnel experimental method. Earthquake loading - Equivalent lateral force,Modal analysis - combination of loading in various design philosophies. Materials for tall buildings - High strength concrete - Lightweight concrete - Fiber reinforced concrete Composite Materials.

UNIT-III

STRUCTURAL SYSTEMS
Behavior of High Rise structures - Different system for load distribution in steel and concrete - Vertical and horizontal load resistant systems – Rigid frames - braced frames - infilled frames - shear walls - wall frames – tubular systems - outrigger braced systems - Mega systems.

UNIT-IV

ANALYSIS AND DESIGN
Analysis and Design principles of various horizontal load transfer systems - approximate methods - Modelling for accurate analysis - 3D analysis - Member forces - displacements. Analysis for various secondary effects -Creep, shrinkage and temperature. Stability Analysis - Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, P - effect and various methods of analysis - influence of foundation instability, out of plumb effects - Elastic Deformations. Dynamic Analysis - Principles of design of tall braced frames for earthquake and blastresistant design.

UNIT-V

ADVANCED TOPICS
Structural systems for future generation buildings - Expert systems for consultations - Economics - Research needs in tall building materials, systems and designs.

Text books:

1. Schuller.W.G., *"High Rise Building Structures"*, John Wiley & sons, 1977
2. Lynn.S. Beedle, *"Advances in Tall Buildings"*, CBS Publishers andDistributors, New Delhi, 1996

Reference books

1. LinT.Y. and Burry D.Stotes, " *Structural Concepts and Systems forArchitects and Engineers "*, John Wiley, 1994.
2. Gupta.Y.P.,(Editor), *"Proceedings of National Seminar on High RiseStructures - Design and Construction Practices for Middle Level Cities"*, New Age International Limited, New Delhi,1995.
3. Lecture Notes on *"Tall Buildings"* - Short Term Course organized by Civil Engineering Department, SRM Engg college, Kattankulathur. June 2002
4. Smith .B.S. and Coull .A., *"Tall Building Structure"*, 'Analysis and Design', John Wiley & Sons, Inc., 1991
5**.** Taranath .B.S., *"Structural Analysis and Design of Tall Buildings"*, Mc Graw Hill Co. 1988

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(15BST22) ANALYSIS OF SHELLS AND FOLDED PLATES (ELECTIVE – IV)

Objectives:

1. To learn the principles of membrane theory and bending theory of shells.
2. To learn the governing DKJ equation for bending, Schorer's theory.
3. To develop the geometry and analysis of shells of double curvature.
4. To study the concepts of folded plate theory and Whitney's theory.

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

1. understand the classification and stress resultants of shells.
2. able to apply DKJ equation and schorer's theory for cylindrical shells.
3. able to apply the geometry, analysis of shells subjected to double curvature.
4. able to solve folded plates by using whiney's and Simpson's theories.

UNIT-I

EQUATIONS OF EQUILIBRIUM: Introduction, classification, derivation of stress Resultants, Principles of membrane theory and bending theory.

UNIT-II

CYLINDRICAL SHELLS: Derivation of governing DKJ equation for bending theory, details of Schorer's theory, Applications to the analysis and design of short shells and long shells. Introduction of ASCE manual coefficients for design.

UNIT-III

INTRODUCTION TO SHELLS OF DOUBLE CURVATURE: (other than shells of revolution :) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

UNIT-IV

FOLDED PLATES: Folded plate theory, plate and slab action, Whitney's theory, Simpson's theory for the analysis of different types of folded plates (Design is not included)

UNIT-V

SHELLS OF DOUBLE CURVATURE: Surfaces of revolution .Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

Text books:

1. Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan Bhola Nath Nagar, shahotra, Delhi.
2. Fundamentals of the analysis and design of shell structures by Vasant S.kelkar Robert T.Swell – Prentice hall, Inc., Englewood cliffs, new Jersy -02632.

Reference books:

1. N.k.Bairagi, Shell analysis, Khanna Publishers, Delhi, 1990.
2. Billington, Ithin shell concrete structures, Mc Graw Hill Book company, New york, St. Louis, Sand Francisco, Toronto, London.
3. ASCE Manual of Engineering practice No.31, design of cylindrical concrete shell roofs ASC, Newyork

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(15BST23) DESIGN OF OFFSHORE STRUCTURES (ELECTIVE – IV)

Objectives:

1. *To provide an overview and basics on wave theories.*
2. *To introduce wind forces and wave forces on different structures.*
3. *To introduce the different types of offshore structures and their foundation modelling.*
4. *Introducing Static method of analysis and dynamic analysis of offshore structures.*

Outcomes: *After the completion of the course the students will be able to*

1. *Analyse the wind, Wave and current forces on the structures.*
2. *Able to analyse the different types of offshore structures.*
3. *Conduct the static and dynamic analysis for the structures.*
4. *Design the pipe lines, Helipads, Platforms.*

UNIT 1:

WAVE THEORIES
Wave generation process, small and finite amplitude wave theories.

UNIT 2.

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

UNIT 3.

OFFSHORE SOIL AND STRUCTURE MODELLING
Different types of offshore structures, foundation modelingand structural modeling.

UNIT 4

ANALYSIS OF OFFSHORE STRUCTURES
Static method of analysis, foundation analysis and dynamics of offshore structures.

UNIT 5

DESIGN OF OFFSHORE STRUCTURES
Design of platforms, helipads, Jacket tower and mooring cables and pipe lines.

Text books:

1. Chakrabarti, S.K. "Hydrodynamics of Offshore Structures", Computational Mechanics Publications, 1987.
2. Brebia, C.A and Walker, S., "Dynamic Analysis of Offshore Structures", New Butterworths, U.K. 1979.

Reference books:

1. API, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms, American Petroleum Institute Publication, RP2A, Dalls, Tex,2000.
2. Reddy, D.V. and Arockiasamy, M., "Offshore Structures", Vol.1 and Vol.2, Krieger Publishing Company, Florida, 1991

SRI VENKATESWARA COLLEGE OF ENGINEERING &TECHNOLOGY (AUTONOMOUS)
M.Tech. (STRUCTURAL ENGINEERING)

M.Tech – II-Semester

L	T	P	C
0	0	3	2

(15BST24) CONCRETE LABORATORY-II

Objectives:

1. *To learn the principles of accelerated curing of concrete cubes.*
2. *To learn the Non destructive test techniques.*
3. *To know the effective dosage of super plasticizer and to know the mix design procedures for high strength and fly ash concrete.*
4. *To know the procedures for permeability test, shrinkage of concrete and single, three point loading of RCC beams.*

Expected Outcomes: *After completion of the course the student will be able to*

1. *understand the curing of concrete cubes by using accelerated tank.*
2. *able to test the hardened concrete by using Non destructive test.*
3. *ability to fix super plasticizer dosage and perfection on mix design procedures.*
4. *able to test the concrete for durability and flexural test for RCC beams.*

List of Experiments:

1. Accelerated curing test on Concrete cubes.

2. Non destructive test on concrete.

3. Study of effect of dosage of super plasticizer on Strength and workability of concrete.

4. Mix design of high strength concrete including casting and testing of specimens.

5. Mix design of fly ash concrete including casting and testing of specimens.

6. Determination of coefficient of permeability of concrete.

7. Determination of drying shrinkage of concrete.

8. Bending test on a RCC beam under.
    a) Single point load
    b) Three point load

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(15BST25) CAD LAB-II

Objectives:

1. *To learn the software applications in structural engineering.*
2. *To learn the analysis of plane, space truss and frames subjected to different types of loadings.*
3. *To draw the detailing of RCC members and to learn the estimations.*
4. *To study the design concepts of steel members like truss, beams and columns.*

Expected Outcomes: *After completion of the course the student will be able to*

1. *understand the software usages for structural members.*
2. *able to analyse plane, space frames and dynamic response and natural frequency for beams and frames.*
3. *able to design, detailing and estimations of RC members.*
4. *able to design the steel members like truss, beams and columns.*

List of Experiments:

Software Applications in Structural Engineering (by using STAAD, STRAP, STRUDS, etc.):

- Analysis of reinforced concrete (RCC) and steel structures.
- Analysis of plane and space truss and frames subjected to gravity and lateral loads.
- Determination of natural frequency of a beam.
- Dynamic analysis (Response spectrum) of plane frames.
- Analysis of water tanks by using plate elements.

Design of Reinforced Concrete Members:

- Design, detailing and estimating of beams, slabs, columns and foundations, Shear wall design.

Design of Steel Members:

- Design of truss members.
- Design of beams and columns.

References:

1. Zienkiewicz, *The Finite Element Method*, O.C., McGraw Hill Publications, London.
2. Cook, R.D, *Concepts and Applications of Finite Element Analysis,*
3. Reference Manual for STADD, STRAP, STRUDS,