RAJEEV GANDHI MEMORIAL

COLLEGE OF ENGINEERING & TECHNOLOGY

AUTONOMOUS

Affiliated to JNTUA -Anantapuramu, Approved by AICTE-New Delhi,
Accredited by NBA-New Delhi, Accredited by NAAC of UGC with A-Grade
NANDYAL-518 501, KURNOOL Dist., A.P.

DEPARTMENT OF
CIVIL ENGINEERING

STRUCTURAL ENGINEERING

ACADEMIC REGULATIONS,
COURSE STRUCTURE AND SYLLABI
APPLICABLE FOR STUDENTS ADMITTED INTO
M.TECH (REGULAR) FROM 2015-16

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

STRUCTURAL ENGINEERING

(Affiliated to J.N.T.U.A, Ananthapuramu)

ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABI

M.Tech. (Regular) from 2015-16

For pursuing Two year Master (post graduate) Degree of study in Engineering (M.Tech.), offered by Rajeev Gandhi Memorial College of Engineering and Technology, Nandyal - 518501 under Autonomous status and herein referred to as RGMCET (Autonomous).

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2015-16 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for Rajeev Gandhi Memorial College of Engineering and Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, Rajeev Gandhi Memorial College of Engineering and Technology shall be the Chairman, Academic Council.

Academic Regulations 2015 for M.Tech. (Regular)
(Effective for the students admitted into first year from the Academic Year 2015-2016)

The M.Tech. Degree of Jawaharlal Nehru Technological University Anantapur, Ananthapuramu shall be conferred on candidates who are admitted to the M.Tech. program at RGMCET, Nandyal and they shall fulfil all the requirements for the award of the Degree.

1.0 Eligibility for Admissions:

Admission to the above program shall be made subject to the eligibility, qualifications and specialization prescribed by Andhra Pradesh State Council of Higher Education (APSCHE) from time to time.

Admissions shall be made on the basis of merit rank obtained in GATE examination or PGCET conducted by any University of Andhra Pradesh designated by Govt. of A. P., or on the basis of any other order of merit prescribed by APSCHE, subject to the reservations prescribed by the Government of A. P. from time to time.

2.0 Award of M.Tech. Degree:

2.1 The student shall be declared eligible for the award of the M.Tech. degree, if he/she pursues a course of study and completes it successfully for not less than prescribed course work duration and not more than double the prescribed course work duration.

2.2 The student, who fails to fulfil all the academic requirements for the award of the degree within double the course work duration from the year of his admission, shall forfeit his seat in M.Tech. course.

2.3 The minimum clear instruction days for each semester shall be 95.

3.0 Courses of Study:

The following specializations are offered at present for the M.Tech. course of study.

1. Computer Science (CSE)
2. Digital Systems and Computer Electronics (ECE)

3. Embedded Systems (ECE)
4. Machine Design (Mechanical Engineering)
5. Power Electronics (EEE)
6. Software Engineering (IT)
7. Structural Engineering (CE)

and any other course as approved by the appropriate authorities from time to time.

4.0 Course pattern:

4.1 The entire course of study is of four semesters. During the first and second semesters the student has to undergo course work and during the third and fourth semesters the student has to carry out project work.

4.2 The student shall be eligible to appear for the End Examination in a subject, but absent at it or has failed in the End Examination may appear for that subject at the supplementary examination.

Table 1: Credits

Subject	Semester			
	Periods /Week	Credits	Internal marks	External marks
Theory	04	04	40 (25 Internal Test+15 Assignment)	70
Practical	03	02	50	50
Seminar		02	100	
Comprehensive Viva – voce 1		02		50
Comprehensive Viva - voce 2		02		50
Project		12		

Table2: Course pattern

Semester	No.of Subjects	Number of Labs	Total credits	
First	04-Subjects 01-Elective 01-MOOC/Elective	 02 Comprehensive Viva 1	04X4=16 01X4=04 01X4=04 02X2=04 01X2=02	30
Second	04-Subjects 01-Elective 01-MOOC/Elective	 02 Comprehensive Viva 2	04X4=16 01X4=04 01X4=04 02X2=04 01X2=02	30
Third	Seminar(3rd semester) Intermediate Evaluation of Project work(3rd semester)			02 04
Fourth	Project Work			08
			Total credits	**74**

5.0 Attendance:

5.1 The candidate shall be deemed to have eligibility to write end semester examinations, if he has secured a minimum of 75% of attendance in aggregate of all the subjects.

5.2 Condonation of shortage of attendance up to 10%, i. e. 65% and above and below 75% may be given by the College academic committee consisting of Principal, Head of the Department and a senior faculty member.

5.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.

5.4 Shortage of attendance below 65% shall in no case be condoned.

5.5 The candidate shall not be promoted to the next semester unless he fulfils the attendance requirements of the previous semester.

5.6 Attendance in each subject will be recorded in the marks memo.

5.7 The attendance in each subject will be recorded in the Marks memo.

6.0 Evaluation:

6.1 For theory subjects the distribution shall be 40 marks for Internal Evaluation (25 marks for Internal test and 15 marks for assignments/ field work) and 60 marks for the End-Examination.

6.2 Each Internal Test question paper shall contain 5 questions, of which the First question is compulsory and three questions are to be answered from the remaining four. Compulsory question carries 10 marks (It contains 5 short answer questions). The remaining 3 questions carry 5 marks each. Each question shall have a,b,c.... parts. The duration of internal test will be for 2 hours. First test to be conducted in 3 units in the middle of the semester and second test to be conducted in the remaining 3 units of each subject at end the semester. There shall be two assignments in each subject (problem based/ field work) for the award of 15 marks so that internal component (marks) will be 40 marks (25 marks for internal test+15 marks for assignments / field work). For awarding of 25 Internal marks the performance of the student in two internal examinations conducted will be considered by giving a weightage of 0.75 for the better score and 0.25 for the other score.

6.3 The End Examination question paper will have 7 questions and students have to answer 5 questions. However, the first question is compulsory and it consists of 6 short answer questions, each carrying 2 marks. The next 4 questions are to be answered from the remaining 6 questions and each carries 12 marks. Each 12 marks question shall have a, b, c ..parts.

6.4 Elective subjects will commence from 1st semester. Out of the electives offered in 1st / 2nd semester, one elective will be MOOC / Electives offered by the department. Any student who is interested can opt for the MOOC/ Electives offered by the department and acquire the required credits. Even if the student opts MOOC, he has to write two internal tests besides the end examination conducted by the institute like other subjects. However, he has to obtain the certificate from the organization in which he has registered. Any MOOC selected

by the student should be of more than 45 hours duration and also from the reputed organization. Attendance of the student who has opted for MOOC will be taken from the remaining subjects and labs only in that semester while finalizing the attendance for fulfilling the minimum requirements of attendance for promotion to next semester. Attendance will not be recorded for MOOC. Where ever MOOC is opted by the student, the evaluation procedure will be similar to any subject offered by the department.

6.5 For practical subjects, 50 marks shall be for the End Semester Examinations and 50 marks will be for internal evaluation based on the day-to-day performance.Laboratory examination for M.Tech.. Course shall be conducted with two Examiners, one of them being Laboratory Class Teacher and second Examiner shall be outside from the institute (External examiner).

6.6 Student has to undergo a comprehensive viva pertaining to his specialization which carries 50 marks in each semester. He has to secure 50% marks to obtain required credits.Comprehensive viva will be conducted at the end of 1st and 2nd semester by the committee consisting of HOD, senior faculty member and external Examiner from outside the institute. For this, HOD of the Department shall submit a panel of 4 Examiners, who are eminent in that field. One from the panel will be selected by the principal of the institute as external Examiner for comprehensive viva.

6.7 For Seminar 100 marks shall be for internal evaluation. The candidate has to secure a minimum of 50 marks to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts at the end of 3rd semester.

6.8 The 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 Examination and Internal evaluation taken together.

6.9 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.0), he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the course when next offered or do any other specified subject as may be required.

7.0 Re-registration for improvement of Internal marks:

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

7.1 The candidate should have completed the course work and obtained examinations results for 1st&2nd semesters.

7.2 He should have passed all the subjects for which the internal marks secured are more than 50%.

7.3 Out of the subjects the candidate has failed in the examination due to Internal 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 marks.

7.4 The candidate has to re-register for the chosen subjects and fulfil the academic requirements as and when they are offered.

7.5 For each subject, the candidate has to pay a fee equivalent to one tenth of the semester tuition fee and the amount is to be remitted in the form of D. D. in favour of the Principal, RGMCET payable at RGMCET, Nandyal branch along with the requisition through the HOD of the respective Department.

7.6 In case of availing the Improvement of Internal marks, the internal marks as well as the End Examinations marks secured in the previous attempt (s) for the re-registered subjects stand cancelled.

8.0 Evaluation of Project / Dissertation work :

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

8.1 Registration of Project work: The candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses of 1st& 2ndSem)

8.2 An Internal Department Committee (I.D.C.) consisting of HOD, Supervisor and One Internal senior expert 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.

8.5 The 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 submitted during that period.

8.6 Three copies of the Thesis/Dissertation certified in the prescribed form by the supervisor & HOD shall be submitted to the institute.

8.7 The Department shall submit a panel of 4 experts for a maximum of 4 students at a time. However, the thesis/dissertation will be adjudicated by the board consists of HOD, concerned supervisor and one external Examiner from other institute nominated by the principal from a panel of Examiners submitted by the Department HOD to the Controller of Examinations.

8.8 If the report of the board is favourable in viva voce examination, the board shall jointly report candidates work as:

1. Good
2. Satisfactory
3. Not satisfactory

If the report of the viva voce is not satisfactory the candidate will retake the viva voce examination after three months. If he fails to get a satisfactory report at the second viva voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit the thesis.

9.0 Award of Degree and Class:

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

Table 3: Award of division

Class Awarded	**% of marks to be secured**	Division/ Class	CGPA	From the aggregate marks secured from the 74 Credits.
First Class with Distinction	70% and above	First Class With Distinction	≥ 7.5	
First Class	Below 70% but not less than 60%	First Class	6.5 *and* < 7.5	
Second Class	Below 60% but not less than 50%	Second Class	≥ 5.5 *and* < 6.5	

(The marks in internal evaluation and End Examination shall be shown separately in the marks memorandum)

10.0 *Grading:*

After each subject is evaluated for 100 marks, the marks obtained in each subject will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student falls.

Table 4: Conversion into Grades and Grade points assigned

Range in which the % of marks in the subject fall	Grade	Grade point Assigned	Performance
90 to 100	O	10	Outstanding
80 to 89.9	A^+	09	Excellent
70 to 79.9	A	08	Very good
60 to 69.9	B^+	07	good
50 to 59.9	B	06	Pass
<50	F	00	Fail
Ab	AB	00	Fail

10.1 Requirement for clearing any subject: The students have to obtain a minimum of 40% in End Examination and they have to score minimum of 50% marks from Internal and external exam marks put together to clear the subject. Otherwise they will be awarded fail grade.

10.2 F is considered as a fail grade indicating that the student has to reappear for the end supplementary examination in that subject and obtain a non fail grade for clearing that subject.

10.3 To become eligible for the award of degree the student must obtain a minimum CGPA of 6.0.

11.0 Supplementary Examinations:

Apart from the regular End Examinations the institute may also schedule and conduct supplementary examinations for all subjects for the benefit of students with backlogs. Such students writing supplementary examinations as supplementary candidates may have to write more than one examination per day. The student is not permitted to improve his performance in any subject in which he has obtained pass grade.

12.0 *Grade Point Average (GPA) and Cumulative Grade Point Average(CGPA)*

The Grade Point Average (GPA) for each semester and Cumulative Grade Point Average (CGPA) up to any semester are calculated as follows:

i) Semester Grade Point Average will be computed as follows:

$$GPA = \frac{\sum_1^n C_i \times GP_i}{\sum_1^n C_i}$$

Where, n is the number of subjects in that semester. C_i is Credits for the subjects. GP_i is the grade point obtained for the subject and the summation is over all the subjects in that semester.

ii) A Cumulative Grade Point Average (CGPA) will be computed for

every student at the end of each semester. The CGPA would give the cumulative performance of The student from the first semester up to the end of the semester to which it refers and is calculated as follows

$$CGPA = \frac{\sum_1^m GPA_j \times TC_i}{\sum_1^m TC_j}$$

Where 'm' is the number of semester under consideration.TC_j the total number of credits for a j^{th}semester and GPA_j is the Grade Point Average of the j^{th} semester. Both GPA and CGPA will be rounded off to the second digit after decimal and recorded as such.

While computing the GPA / CGPA the subjects in which the student is awarded zero grade points will also be included.

13.0 Grade Sheet:

A grade sheet (Memorandum) will be issued to each student indicating his performance in all subjects of that semester in the form of grades and also indicating the GPA and CGPA.

14.0 Transcripts:

After successful completion of prerequisite credits for the award of degree a Transcript containing performance of all academic years will be issued as a final record. Duplicate transcripts will also be issued if required after the payment of requisite fee and also as per norms in vogue.

15.0 Minimum Instruction Days:

The minimum instruction days for each semestershall be 95 clear instruction days excluding the days allotted for tests/examinations and preparation holidays declared if any.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

STRUCTURAL ENGINEERING

16.0 Amendment of Regulations:

The college may, from time to time, revise, amend or change the regulations, scheme of examinations and syllabi. However the academic regulations of any student will be same throughout the course of study in which the student has been admitted.

17.0 Transfers

There shall be no branch transfers after the completion of admission process.

18.0 Withholding of results:

If the candidate has not paid any dues to the institute or if any case of in-discipline is pending against him, the result of the candidate will be withheld and he will not be allowed for the next semester. The issue of the degree is liable to be withheld in such cases.

19.0 Transitory Regulations:

Candidates who have discontinued or have been detained for want of attendance are eligible for admission to the same or equivalent subjects as and when subjects are offered, subject to 2.0 and 5.0.

20.0 Rules of Discipline:

20.1 Any attempt by any student to influence the teachers, Examiners, faculty and staff of Examination section for undue favours in the exams, and bribing them either for marks or attendance will be treated as malpractice cases and the student can be debarred from the college.

20.2 When the student absents himself, he is treated as to have appeared and obtained zero marks in that subject (s) and grading is done accordingly.

20.3 When the performance of the student in any subject (s) is cancelled as a punishment for indiscipline, he is awarded zero marks in that subject (s).

20.4 When the student's answer book is confiscated for any kind of attempted or suspected malpractice, the decision of the Chief Superintendent is final.

21.0 General:

21.1 The Academic Regulations should be read as a whole for the purpose of any interpretation.

21.2 In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the College Academic Council is final.

21.3 The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

21.4 *Where the w*ords "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

STRUCTURAL ENGINEERING

COURSE STRUCTURE

M.TECH, I-SEMESTER

Code	Subject	Scheme of instruction periods/week		Credits	Scheme of Examination		
		Theory	Practical		Internal	External	Total
D2001151	Advanced Engineering Mathematics	4	-	4	40	60	100
D2002151	Theory of Elasticity & Plasticity	4	-	4	40	60	100
D2003151	Matrix Analysis of Structures	4	-	4	40	60	100
D2004151	Advanced Concrete Technology	4	-	4	40	60	100
	ELECTIVE-I/MOOCS	4	-	4	40	60	100
D2005151	Experimental Stress Analysis						
D2006151	Design of Bridge Structures						
D2007151	Optimization in Structural Design						
D2008151	Foundation Engineering						
	ELECTIVE-II	4	-	4	40	60	100
D2009151	Plastic Analysis and Design						
D2010151	Structural Health Monitoring						
D2011151	Rehabilitation Of Structures						
D2012151	Pavement Analysis And Design						
D2013151	Structural EngineeringLab-1	-	3	2	50	50	100
D2014151	Cad Lab-I	-	3	2	50	50	100
D2015151	Comprehensive Viva-I	-	-	2	-	50	50
	Total	24	6	30	340	510	850

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

AUTONOMOUS

STRUCTURAL ENGINEERING

COURSE STRUCTURE

M.TECH, II-SEMESTER

Code	Subject	Scheme of instruction periods/week		Credits	Scheme of Examination		
		Theory	Practical		Internal	External	Total
D2016152	Finite Element Method in Structural Engineering	4	-	4	40	60	100
D2017152	Theory Plates & Shells	4	-	4	40	60	100
D2018152	Structural Dynamics and Earthquake Resistant Design	4	-	4	40	60	100
D2019152	Advanced Design of RCC & Steel	4	-	4	40	60	100
	ELECTIVE-III/MOOCS	4	-	4	40	60	100
D2020152	Stability of Structures.						
D2021152	Fracture Mechanics						
D2022152	Pre-stressed Concrete						
D2023152	Composite Materials.						
	ELECTIVE-IV	4	-	4	40	60	100
D2024152	Pre-fabricated Concrete Structures						
D2025152	Strategic Management						
D2026152	Soil-Structure Interaction						
D2027152	Smart Structures And Applications						
D2028152	Structural Engineering Lab-II	-	3	2	50	50	100
D2029152	CAD Lab-II	-	3	2	50	50	100
D2030152	Core Comprehensive Viva-II	-	-	2	-	50	50
	Total	24	6	30	340	510	850

M.TECH, III-SEMESTER & IV-SEMESTER

Code	Subject	Credits	Internal Marks	External Marks	Total
D2031153	Seminar (End of III Semester)	2	100	-	100
D2032153	Project work	12	-	-	-

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech I-Sem(SE) T 4 C 4

(D2001151) ADVANCED ENGINEERING MATHEMATICS

Pre-requisites: Mathematics,

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Students are able to understand and apply partial differential equations in solving hydrodynamics and fluid mechanics problems.
- Students shall apply numerical solutions in engineering, science and also in many branches of applied mathematics, e.g in fluid dynamics; boundary layer theory and heat transfer quantum mechanics.
- Students are able to understand and apply Fourier Transforms in many fields of learning such as mathematics, physical sciences and engineering

UNIT I

Matrices and Linear System of Equations: Solutions of linear systems - Direct methods - Gauss Jordan elimination method - Triangularisation method - Choleskey method - Jacobi iteration method - Gauss Siedel iteration method

UNIT II

Eigen values and Eigen vectors - Problems on Eigen values of symmetric tri -diagonal matrix- Jacobi's method.

UNIT III

Applied partial Differential Equations: One-dimensional Heat equation and two-dimensional Laplace Equation in Cartesian, cylindrical and spherical coordinates (problems having axi-symmetry – Analytical solution by separation of variables technique.

UNIT IV

Applied Statistics: Regression and correlation analysis – Curvilinear Regression – Non-linear curves – correlation coefficient – correlation of grouped bivariate data – coefficient of determination Multiple Regression – partial Regression coefficients. Analysis - Tests of significance – Analysis of variance for regression – Multiple correlation coefficients – Multiple linear regression with two independent variables

UNIT V

Complex Variables: Complex variables - Cauchy-Riemann equations - Laplace equation - Conformal transformations including Joukowski's and Schwarz and Christoffel transformations.

UNIT VI

Numerical Methods: Numerical solutions of partial differential equations - Laplace and Poisson equations by iteration method, heat equation by Schmidt method.Fast Fourier Transforms: Theory and Applications.

READING:

1. Dr.B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi.
2. N.P. Bali and M. Goyal, "Engineering Mathematics", Laxmi Publishers, New Delhi
3. "Basic Statistics" – Agarval, B.L., Wiley 1991, 2nd edition
4. "Numerical Algorithms" – Krishnamurthy &Sen, Affiliated East-West Press, 1991, 2nd edition

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2002151) THEORY OF ELASTICITY AND PLASTICITY

Prerequisites: Mathematics, Strength ofMaterialsandMechanicsofsolids.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Apply principles of elastic theory to estimate stresses and strains of structural engineering problems.
- Solve engineering problems such as thick cylinders, rotating discs, shafts and complex loading on structural members.
- Model and analyze homogenous and isotropic elastic plane problems.
- Apply strain energy principles to solve engineering problems.

UNIT I

Introduction: Elasticity – Notation for forces and stresses – Components of stress – 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

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.

UNIT III

Analysis of Stress and Strain in Three Dimensions: Introduction – Principal stresses – Stress ellipsoid and stress-director surface – Determination of the principal stresses – Determination of the maximum shearing stress – Homogeneous deformation – Principal axes of strain rotation – Differential equations of equilibrium – Conditions of compatibility.

UNIT IV

Strain Energy Methods: Total strain energy- complementary energy- principle of virtual work and total potential energy-Theorem of minimum potential energy, Theorem of minimum complementary energy, Griffith's theory of rupture- Castigliano's theorem-principle of least work. General Theorems**:** General Theorems Differential equations of equilibrium – Conditions of Compatibility Determination of Displacement – Equations of Equilibrium in Terms of Displacements – Principle of Superposition – Uniqueness of Solution –Reciprocal theorem.

UNIT V

Theory of Plasticity: Introduction- concepts and assumptions –Basic equations, Similarites and differences when compared with elasticity, idealized material behavior, various empirical stress-strain relationships, theories of plastic flow, yield criterions.

UNIT VI

Elastic perfectly plastic materials-thick cylinders, thick spheres, plastic hinge formation in beams of rectangular, T, circular cross sections, shape factors, reserved strength of Beam, elasto-plastic deflections of beams of rectangular cross sections, residual stresses, Introduction to strain hardening problems.

READING:

1. Timoshenko, S &Goodier*"Theory of Elasticity"*, McGraw Hill Book Company.
2. Sadhu Singh *"Theory of Elasticity and Plasticity*", Khanna Publishers.
3. Theory of Plasticity by Johnson & Mellor
4. Theory of Plasticity by Chakraborty

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T C
4 4

(D2003151) ADVANCED DSP & APPLICATIONS

Pre-requisites: Mathematics, Structure Analysis and Strength of materials

CourseOutcomes: At the end of thecourse, thestudentwill be able to

- Graduates will develop an insight in Matrix methods in analyzing the structures.
- Able to analyze different civil engineering structures using Matrix methods

UNIT I

Introduction of matrix methods of analysis – Static Indeterminacy and kinematic indeterminacy – Degree of freedom co-ordinate system – Structure idealization stiffness and flexibility matrices – Stability. Element stiffness matrix for truss element, beam element - Element force - displacement equations Element flexibility matrix – Truss, Beam, frame element – force Displacement equations.

UNIT II

Flexibility method – Strain energy and member forces – Deformation of a Structure Compatibility condition – Analysis of plane pin – jointed truss – continuous beams.

UNIT III

Stiffness method – member and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames direct stiffness method for continuous beams and simple frames.

UNIT IV

Stiffness method – development of grid elemental stiffness matrix – coordinates transformation. Examples of grid problems - curved beams – idealizing the beam stiffness solutions – curved beam element stiffness matrix. Additional topics in stiffness methods – discussion of band width – semi band width – static condensation.

UNIT V

Multi-storied frames – shear walls necessity – structural behavior of large frames with and without shear wall – approximate methods of analysis of shear walls – tall structures – limitation of rigid frames with and without shear walls Different types of very tall frames.

UNIT VI

Space frames – Analysis of in filled frames in tall building – Secondary effects in the analysis of tall building - effects of axial deformations – effect of shearing forces in the analysis of shear wall.

READING:

1. Matrix analysis of structures- Pandit& Gupta.
2. Matrix analysis of structures- Robert E Sennet- Prentice Hall- Englewood cliffs-New Jercy.
3. Advanced structural analysis-Dr. P. Dayaratnam- Tata McGraw hill publishing company limited.
4. Analysis of tall buildings by force – displacement – Method M.Smolira – Mc. Graw Hill

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2004151) ADVANCED CONCRETE TECHNOLOGY

Pre-requisites: ConcreteTechnology.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Understand the influence of constituents on the properties of concrete.
- Asses the performance of special concretes and also repairs and strengthening techniques of the elements of the structures.
- Assess the properties of concrete using Rebound Hammer and Ultrasonic Pulse Velocity instruments.

UNIT I

Materials- Cement, Aggregates, mixing water soundness of aggregate- Fresh and hardened concrete: Admixtures- types of admixtures- purposes of using admixtures- chemical composition- effect of admixtures on fresh and hardened concretes.

UNIT II

Non destructive Testing Methods - Concrete behavior in sea water- moisture effects and thermal effects-Methods of controlling Sulphate Attack- Corrosion activity measurement-chloride content in concrete– Depth of carbonation.

UNIT III

Repair and rehabilitation of structural elements: Analysis, strategy and design- Material requirement- Material selection- Surface preparation- Reinforcing steel cleaning, repair and protection- Bonding repair materials to existing concrete- placement methods- Strengthening-Techniques- design considerations- Beam shear capacity strengthening- Shear Transfer strengthening- stress reduction techniques- Column strengthening-flexural strengthening.

UNIT IV

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes

UNIT V

Light weight concrete- Introduction- properties of light weight concrete- No fines concrete-design of light weight concrete.

UNIT VI

Fly-ash concrete- Introduction- classification of fly-ash- properties and reaction mechanism of fly-ash- Properties of fly-ash concrete in fresh state and hardened state- Durability of fly-ash concretes. High performance concretes- Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes.

READING:

1. Concrete technology- Neville & Brooks.
2. Special Structural concrete- RafatSiddique.
3. Concrete repair and maintenance illustrated- Peter H Emmons
4. Concrete technology-M S Shetty.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2005151) EXPERIMENTAL STRESS ANALYSIS

(ELECTIVE-I/MOOCS)

Pre-requisites: None

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Have an idea to select and design the suitable experimental technique based on the problem
- Understand the crack pattern of the structural members by brittle coating technique

UNIT I

Strain measurement methods: Definition of strain and its relation to experimental determinations - properties of strain – Gauge systems – Mechanical, Optical, Acoustic and Pneumatic types. Electrical resistance strain gages: Introduction – Wheatstone Bidge-gauge construction – strain gauge adhesives - mounting methods – gauge sensitivities and gage factor – performance characteristics of wire and foil strain gauges – environmental effects.

UNIT II

Analysis of strain gauge data: Introduction – the three element rectangular rosette – the delta rosette – correction for transverse sensitivity.

UNIT III

Non – destructive testing: Introduction – objective of non destructive testing. Ultrasonic pulse velocity method – Rebound Hardness method (Concrete hammer) – application to assessment of concrete quality.

UNIT IV

Brittle coating methods: Introduction – coating stresses – failure theories – brittle coating crack patterns – crack detection – types of brittle coatings – test procedures for brittle coating analysis – calibration procedures – analysis of brittle coating, data interpretation.

UNIT V

Theory of photo elasticity: Introduction – temporary double refraction – Index ellipsoid and stress ellipsoid – the stress optic law – effects of stressed model in a polariscope for various arrangements - fringe sharpening.

UNIT VI

Two dimensional photo elasticity: Introduction – Iso-chromatic fringe patterns – isoclinic fringe patterns – compensation techniques – calibration methods – separation methods – materials for photo-elasticity – properties of photo-elastic materials. Model design: Introduction – Model & Prototype - Factors influencing model design – scale factors and Model material properties – Methods of model design.

READING:

1. Experimental Stress Analysis- Riley and Dally
2. Experimental Stress Analysis – Lee
3. Experimental Stress Analysis- Sadhu Singh

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2006151) DESIGN OF BRIDGE STRUCTURES

(ELECTIVE-I/MOOCS)

Pre-requisites: Design of steel structures and Design of concrete structures

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Design the slab Culvert, Box culvert
- Design of T-beam bridge and substructures

UNIT I

Hydraulic Design: Importance of hydraulic factors in Bridge Design – Methods for computation of peak flood flow – empirical methods – envelope curves – flood flows and catchment scale. Small, midsize and large catchments – their characteristics – types of catchment responses – their analysis. River Channels – Peak discharge determination – effect of bridge on river regime – linear waterways – economic span – efflux- scouring.

UNIT II

Design load for Bridges: Types of loads on bridges. Dead – vehicle live load according to IRC – Impact effect – wind loading – longitudinal – centrifugal – Buoyant forces – water current forces – determination of forces and stresses on bridges according IS code – Seismic forces.

UNIT III

Box culverts: Introduction; Design of box culverts by vector's method – Design problems.

UNIT IV

Beam and slab bridges: Introduction – Design of Interior panel of slabs- Piegaud's Method. Design of longitudinal girders – Guyon –Massonet Method – Calculation of longitudinal moment – Henry jaegar Method – Courbon's Theory – Design problems.

UNIT V

Composite bridges: Introduction: Composite action – shear connectors – designs requirements of shear connectors – Transformed sections - Design problems.

UNIT VI

Prestressed concrete Bridge Decks: Introduction – Principles of prestressing – pretensioning and post tensioning – strands, tendons and bars – anchorages and end blocks – steps for design of post tensioned prestressed desk slabs and design example – Steps for design of post tensioned concrete T beam bridge desk and Design problems.

READING:

1. Design of Bridge structure s by T R Jagadeesh& M AJayaram, PHI Learning Private limited, New Delhi.
2. Design of concrete bridges- Aswini, Vazirani, Ratwani
3. Essentials of bridge engineering- Jhonson Victor D
4. Design of bridges- Krishna Raju

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2007151) OPTIMIZATION IN STRUCTURAL DESIGN

(ELECTIVE-I/MOOCS)

Pre-requisites: Design of steel structures and Design of concrete structures

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

- To know Application of Optimization techniques for simple structures of homogeneous materials
- To Know application simplex methods and dynamic programming technique to design of beams and frames**.**

UNIT I

Introduction:Introduction to optimization techniques - Problem formation and objective function - Linear optimization - Geometry of linear programming - Simple algorithm - Duality in Linear Programming. Classical optimization techniques: Differential calculus method, multi variable optimization by method of constrained variation and Lagrange multipliers (generalized problem) Khun-Tucker conditions of optimality.

UNIT II

Fully stressed design and optimality criterion based algorithms- introduction, characteristics of fully stressed design theoretical basis- examples.

UNIT III

Non- Linear Optimization-I**:** One dimensional minimization methods - Exhaustic search, Dichotomous search and direct root methods.

UNIT IV

Non- Linear Optimization-II: Direct search method - Random search methods - Descent method – Steepest descent methods - Fletcher- Reeaves' method, Davidon – Fletcher - Powell method.

UNIT V:

Linear programming: Definitions and theorems- Simplex method- Duality in Linear programming- Plastic analysis and Minimum weight design and rigid frame Non- Linear Constrained Optimization: Cutting plane method and penalty function methods -Geometric plane programming - Dynamic Programming and integer programming. Application of Optimization techniques for simple structures of homogeneous materials -Problem formulation for structures of non-homogeneous materials - Minimum weight design of structures using plastic theory

UNIT VI

Introduction to quadratic programming: Geometric programming- and dynamic programming- Design of beams and frames using dynamic programming technique.

READING:

1. Optimization Theory and Applications – S.S. Rao, Wiley Eastern Limited, New Delhi
2. Optimum structural design- Theory and applications- R H Gallergher and O C Zienkiewiez

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T C
4 4

(D2008151) FOUNDATION ENGINEERING

(ELECTIVE – I/MOOCS)

Pre-requisites: Soil Mechanics

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

- Tackle and design foundation for the given structures.
- Knowing the types and characteristic of different soils

UNIT I

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

UNIT II

Shallow Foundations –Bearing capacity – General bearing capacity equation, Meyerhof's, Hansen's and Vesic's bearing capacity factors - Bearing capacity of stratified soils - Bearing capacity based on penetration resistance- safe bearing capacity and allowable bearing pressure. Design considerations including location and depth, Proportioning of shallow foundations- isolated and combined footings and mats - Design procedure for mats (Ref: IS - 2131 & IS 6403).

UNIT III

Deep Foundations-: Pile foundations - Types of pile foundations- Estimation of bearing capacity of pile foundation by dynamic and static formulae - Bearing capacity and settlement analysis of pile groups - Negative skin Friction- Pile load tests.

UNIT IV

Pile foundations: Classification of piles-factors influencing choice-Load -carrying capacity of single piles in clays and sands using static pile formulae- α - β - and λ - methods –Dynamic pile formulae-limitations- Monotonic and cyclic pile load tests – Under reamed piles. Pile groups -Efficiency of pile groups- Different formulae-load carrying capacity of pile groups in clays and sands – settlement of pile groups in clays and sands – Computation of load on each pile in a group.

UNIT V

Introduction-Depth of well foundation and bearing capacity-Analysis of well foundation-Well sinking- Rectifying Tilts and shifts.

UNIT VI

Foundations in Problematic Soils: Foundations in black cotton soils - Basic foundation problems associated with black cotton soils - Lime column techniques – Principles and execution - Under reamed piles – Principle of functioning of under reamed pile - Analysis.

READING:

1. Principles of Foundation Engineering by Braja M. Das.
2. Soil Mechanics in Engineering Practice by Terzagi and Peck
3. Foundation Design by Wayne C. Teng, John Wiley & Co.,

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2009151) PLASTIC ANALYSIS AND DESIGN

(ELECTIVE II)

Pre-requisites: Theory of Plasticity

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

- Understanding the Concepts of stress and strain relation of steel Moment curvature relation- basic difference between elastic and plastic analysis & Limit design Principles etc.
- Design of Continuous Beams by using Plastic analysis
- Perform Minimum weight design of steel structures**.**

UNIT I

Introduction and basic hypothesis: Concepts of stress and strain – relation of steel Moment curvature relation- basic difference between elastic and plastic analysis with examples- Yield condition, idealizations, collapse criteria- Virtual work in the elastic-plastic state- Evaluation of fully plastic moment and shape factors for the various practical sections..

UNIT II

Analysis of structures for Ultimate Load: Fundamental Principles – Statically method of analysis – Mechanism method of analysis – Method of analysis, Moment check – Carry over factor –Moment Balancing Method.

UNIT III

Method of Limit Analysis: Introduction to limit analysis of simply supported fixed beams and continuous beams, Effect of partially fixity and end, invariance of collapse loads..

UNIT IV

Basic theorems of limit analysis, rectangular portal frames, gable frames, grids, superposition of mechanisms, drawing statistical bending moment diagrams for checks. Limit design Principles: Basic principles, limit design theorems, application of limit design theorems, trial and error method, method of combining mechanisms, plastic moment distribution method, load replacement method, continuous beams and simple frames designs using above principles.

UNIT V

Deflection in Plastic beams and frames: Load deflection relations for simply supported beams, deflection of simple pin based and fixed based portal frames, method of computing deflections.

UNIT VI

Minimum weight Design: Introduction to minimum Weight and linear Weight functions- Foulkes theorems and its geometrical analogue and absolute minimum weight design. Design of Continuous Beams: Continuous Beams of uniform section throughout –Continuous Beams with different cross-sections..

READING:

1. Plastic Methods of Structural analysis- B G Neal, Chapman and Rall publications
2. Plastic analysis and Design – C E Messennet, M ASeve.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2010151) STRUCTURAL HEALTH MONITORING

(ELECTIVE II)

Pre-requisites: Concrete Technology.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Understand NDT for condition assessment of structures, identify damages in RC structures
- Formulate guidelines for repair management of deteriorated structures.
- Understand Simulation and loading methods.

UNIT I

Introduction to Structural Health Monitoring (SHM) : Definition &motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design.

UNIT II

Application of SHM in Civil Engineering: Introduction to capacitivemethods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings.

UNIT III

Non Destructive Testing of Concrete Structures: Introduction to NDT- Situations and contexts, where NDT is needed, classification ofNDT procedures, visual Inspection, half-Cell electrical potential methods, Schmidt Rebound Hammer Test, resistivity measurement, electromagnetic methods, radiographic Testing, ultrasonic testing, Infra Red thermography, ground penetrating radar, radio isotope gauges, other methods.

UNIT IV

Condition Survey & NDE of Concrete Structure: Definition andobjective of Condition survey, stages of condition survey (Preliminary, Planning, Inspection and Testing stages), possible defects in concrete structures, quality control of concrete structures - Definition and need,Quality control applications in concrete structures, NDT as an option for Non-Destructive Evaluation (NDE) of Concrete structures, case studies of a few NDT procedures on concrete structures

UNIT V

Static Field Testing: Types of static tests - Simulation and loading methods - Static response measurement.

UNIT VI

Dynamic Field Testing: Stress history data, types of dynamic field test - Dynamic response methods; Periodic and Continuous Monitoring.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

READING:

1. Daniel Balageas, Claus - Peter FritzenamI Alfredo Guemes, *Structural Health Monitoring,* Published by ISTE Ltd., U.K. 2006.
2. *Guide Book on Non-destructive Testing of Concrete Structures,Training course series No. 17,* International AtomicEnergy Agency,Vienna, 2002.
3. *Hand book on "Repair and Rehabilitation of RCC Buildings*",Published by Director General, CPWD, Govt. of India, 2002.
4. *Hand Book on Seismic Retrofitting of Buildings,* Published byCPWD & Indian Building Congress in Association with IIT, Madras, Narosa Publishing House, 2008
5. Victor Giurglutiu, Structural Health Monitoring with Wafer Active Sensors, Academic Press Inc, 2007.
6. J.P. Ou, H.Li and Z.D. Duan, Structural Health Monitoring and Intelligent Infrastructure, Vol-1, Taylor and Francis Group, London, U.K, 2006.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2011151) REHABILITATION OF STRUCTURES

(ELECTIVE-II)

Pre-requisites: ConcreteTechnology and NeoConstructionMaterials

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Estimate the causes for distress and deterioration of structures.
- Understand NDT for condition assessment of structures, identify damages in RC structures
- Select repair material and retrofitting strategy suitable for distress.
- Formulate guidelines for repair management of deteriorated structures.

DetailedSyllabus:

UNIT I

Failure of Structures: Review of the construction theory – performance problems – responsibility and accountability. Case studies – learning from failures – causes of distress in structural members – Design and material deficiencies – over loading

UNIT II

Diagnosis and Assessment of Distress: Diagnosis and Assessment of Distress: Visual inspection – non destructive tests – ultrasonic pulse velocity method – rebound hammer technique – ASTM classifications – pullout tests – Bremor test – Windsor probe test

UNIT III

Crack patterns- crack detection techniques – case studies – single and multistory buildings – Fiber optic method for prediction of structural weakness assessments

UNIT IV

Environmental Problems: Effect of corrosive environments, chemical and marine environments – pollution and carbonation problems – detection and measurement of corrosion durability of RCC structures.

UNIT V

Natural Hazards Problems: damage due to earthquakes and strengthening of buildings – provisions of BIS 1893 and 4326.

UNIT VI

Modern Techniques of Retrofitting: Structural elements - first aid after a disaster – gunitin, jacketing– use of chemicals in repair – application of polymers – Ferro-cement, fiber composites and fiber reinforced concretes as rehabilitation materials – strengthening by pre-stressing. Case studies Of Retrofitting: s bridges – water tanks – cooling towers – heritage buildings – high rise buildings.

READING:

1. Dovkaminetzky, Design and Construction Failures, Galgotia Publication, New Delhi, 2001
2. Jacob Feld and Kenneth L Carper, Structural Failures, Wiley Europe.
3. Raikar R.N., Diagnosis and treatment of Structures in Distress
4. Raina V.K., Bridge Rehabilitation
5. Ransom W.H., Building Failures – Diagnosis and Avoidance –
6. Kenneth and Carper, Forensic Engineering.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) T 4 C 4

(D2012151) PAVEMENT ANALYSIS AND DESIGN

(ELECTIVE-II)

Pre-requisites: Transportation Engineering.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Evaluation of in-service pavements and design of overlays for in-service pavements will be covered in this course.
- Different methods of analysis and design of bituminous and concrete pavement discussed.

DetailedSyllabus:

UNIT – I

Factors Affecting Pavement Design: Variable Considered in PavementDesign, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane, Directional Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.

UNIT – II

Stresses in Pavements: Vehicle-Pavement Interaction: Transient, Random &Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements.

UNIT –III

Stresses in Flexible Pavements: Visco-Elastic Theory and Assumptions, LayeredSystems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts.

UNIT – IV

STRESSES IN RIGID PAVEMENTS: Westergaard's Theory and Assumptions, Stresses dueto Curling, Stresses and Deflections due to Loading, Frictional Stresses, Stresses in Dowel Bars & Tie Bars.

UNIT – V

Material Charateristics: CBR and Modulus of Subgrade Reaction of Soil,Mineral aggregates – Blending of aggregates, binders, polymer and rubber modified bitumen, Resilient, Diametral Resilient and Complex (Dynamic) Modulie of Bituminous Mixes, Permanent Deformation Parameters and other Properties, Effects and Methods of Stabilization and Use of Geo Synthetics.

UNIT –VI

Design of Flexible Pavements: Flexible Pavement Design Concepts, AsphaltInstitute's Methods with HMA and other Base Combinations, AASHTO, IRC Methods,

READING

1. **Design of Functional Pavements**, Nai C. Yang, McGraw Hill Publications
2. **Concrete Pavements**, AF Stock, Elsevier, Applied Science Publishers
3. **Principles of Pavement Design**, Yoder.J.&Witczat Mathew, W. John Wiley & Sons Inc
4. **Pavement Analysis & Design**, Yang H. Huang, Prentice Hall Inc.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) P C

3 2

(D2013151) STRUCTURAL ENGINEERING LAB - I

Pre-requisites: Concrete technology

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Know how the water cement ratio influence the workability and strength of the concrete
- Know how the fine aggregate/Coarse aggregate ratio influence the strength of the concrete
- Know the idea on Mix Design

DetailedSyllabus:

1) Study of effect of water/cement ratio on workability and strength of concrete.
2) Study of effect of aggregate/cement ratio on strength of concrete.
3) Study of effect of fine aggregate/coarse aggregate ratio on strength and permeability of concrete.
4) Mix Design methods: (a) I.S. Code method (b) ACI Code method.
5) Study of stress-strain curve of concrete for different mixes and different rates of loadings.
6) Study of Correlation between cube strength, cylinder strength, split tensile strength and modulus o rupture..
7) Study of behavior of under reinforced and over-reinforced beam in flexure.
8) Study of behavior of steel beam under flexure.

READING:

1. Structural Engineering Journals.
2. ResearchArticles /Reports available on Internet.
3. A.M.Neville,"PropertiesofConcrete" 5th Edition, Prentice Hall
4. M.S.Shetty, "ConcreteTechnology", S. Chandand Co., 2006

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem(SE) P C
3 2

(D2014152) CAD LAB-I

Pre-requisites: Mathematics, Strength ofMaterials Design of Structures.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Mat Lab Programming to Civil Engineering problems
- Solving Algebraic equations Using Different techniques

DetailedSyllabus:

1. Application of Gauss elimination Technique to solve coupled linear algebraic equations;
2. Application of Newton Raphson Technique to solve coupled non-linear algebraic equations;
3. Finding out the roots of an algebraic equation using “Interval-having”;
4. Integration of ordinary differential equation using “Explicit Euler integration” algorithm;
5. Integration of ordinary differential equation using “Renga-ktta(forth-order)” algorithm;
6. Finding out the Eigen values of a matrix;
7. Finding out the Rank of a matrix; Finding out the Inverse of a matrix;
8. Bubble point calculation using “Interval-having” algorithm.
9. Bubble point calculation using “Newton-Raphson” Technique;
10. Parameter estimation using least-square technique
11. Bending Moment & Shear Force for Simply supported beam with given loading
12. Bending Moment & Shear Force for Cantilever beam with given loading
13. Design of RCC Beam, RCC one way slab, Design of Column

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, I-Sem (SE) P C
0 2

(D2015152) COMPREHENSIVE VIVA-I

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Assimilate knowledge of different courses studied.
- Develop overall comprehension about Structural Engineering.
- Analyze real life Structural Engineering problems with theoretical knowledge learned.
- Interpret and Articulate solutions to real life civil engineering problems in general and structural engineering problems in particular.

DetailedSyllabus:

Entire courseof study(All the required coursesstudied)upto II Semester ofIYear

Reading:

1. ReadingMaterial of all the courses.
2. CaseStudies/Industrial training reports.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem(SE) T 4 C 4

(D2016152) FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

Pre-requisites: Mathematics andTheory ofstructures –II.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- **Generate Stiffness matrix for bar element and beam element**
- **Develop the shape functions for different elements.**
- **Formulation of 4-node iso-parametric axi-symmetric element**

DetailedSyllabus

UNIT – I

Introduction-Concepts of FEM –steps involved –merits &demerits –energy principles – Discretization –Rayleigh –Ritz method of functional approximate

UNIT – II

Principles of Elasticity: Stress equations-strain displacement relationships in matrix form-plane stress, plane strain and Axi-symmetric bodies of revolution with axi symmetric loading.

UNIT – III

One Dimensional FEM-Stiffness Matrix for Beam and Bar elements shape functions for one-D elements –static condensation of global stiffness matrix-solution –Initial strain and temperature effect. Two Dimensional FEM-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

Iso-parametric formulation-Concept, Different iso-parametric elements for 2-D analysis-Formulation of 4-noded and 8-noded iso-parametric quadrilateral elements –Lagrangian elements-serendipity elements.Axi-symmetric analysis– 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 iso-parametric solid element.

Unit – VI

Non-linear FE analysis – Introduction- Non-linearity – Material Non-linearity – Geometric Non- linearity – various methods of modeling.

READING:

1. Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha, John Wiley & sons Publications.
2. Introduction to Finite Elements in Engineering- Tirupati R. Chandrupatla, Ashok D. Belgunda, PHI publications
3. Fundamentals of Finite Element Analysis- David V. Hutton, Tata McGraw-Hill
4. Finite element Analysis- Theory and programming – C.S. Krishna Murthy, Tata McGra Hill.
5. Finite element Analysis – P.Seshu, PHI

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T C
4 4

(D2017152) THEORY OF PLATES AND SHELLS

Pre-requisites: Mechanicsof Solids andTheoryofElasticity.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Understand behaviour of plates and shells for UDL, hydrostatic, concentrated load cases.
- Perform cylindrical bending of long rectangular plates, pure bending of rectangular and circular plates, and small deflection theories for various boundary conditions.
- Derive the governing differential equations for orthotropic plates and plates subjected to simultaneous bending and stretching

DetailedSyllabus:

UNIT I

Introduction to thin plates: Introduction to thin plates under small deflection theory - Kirchoff's assumptions - Lame's parameters- Development of strain - Displacement relationships - stress-strain relationships - Force-displacement equations and equilibrium equations in curvilinear co-ordinates - Lame's parameters u,v,w equations - variational principles and its applications to plate problems - Study of various boundary conditions.

UNIT II

Derivation of Plate Equations for: In plane bending and transverse bending effects. Rectangular plates: Plates under various loading conditions like concentrated, U.D.L. and hydro static pressure - Navier and Levy's type of solutions for various boundary conditions.

UNIT III

Circular Plates: Symmetrically loaded circular plates under various loading conditions, annular plates.

UNIT IV

Introduction to Shells- Single and double curvature- Equations of Equilibrium of Shells: Derivation of stress resultants, Principles of membrane theory and bending theory

UNIT V

Cylindrical Shells: Derivation of the governing DKJ equation forbending theory, details of Schorer's theory. Application to the analysis and design of short and long shells.Use of ASCE Manual coefficients for the design.

UNIT VI

Beam theory of cylindrical shells: Beam and arch action. Design of Diaphragms - Geometry analysis and design of elliptic ParaboloidConoidal and Hyperbolic Paraboloid shapes by membrane theory.

READING:

1. Szilard, R. "*Theory and Analysis of Plates*", Prentice Hall Inc.
2. N.K.Bairagi, "*Plate Analysis*", Khanna Publishers, Delhi.
3. Timoshenko, S. and Woinowsky, "*Theory of Plates and Shells*", McGraw Hill Book Company

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T 4 C 4

(D2018152) STRUCTURAL DYNAMICS AND EARTHQUAKE RESISTANT DESIGN

Pre-requisites: Design ofConcrete Structuresand Steel Structures.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Model and Formulate dynamic equilibrium equations for SDOF and MDOF systems.
- Analyse SDOF and MDOF systems using classical and numerical methods.
- Draw response of SDOF, MDOF systems and conduct modal analysis of MDOF systems.
- Detail reinforcement for earthquake resistant RC buildings as per IS Code.

DetailedSyllabus:

UNIT I:
Introduction to Structural Dynamics: Fundamental objective of Dynamic analysis – Types of prescribed loadings – methods of Discretization – Formulation of the Equations of Motion.

UNIT II:
Theory of Vibrations: Introduction – Elements of a Vibratory system – Degrees of Freedom of continuous systems - Oscillatory motion – Simple Harmonic Motion – Free Vibrations of Single Degree of Freedom (SDOF) systems – Undamped and Damped – Critical damping – Logarithmic decrement – Forced vibrations of SDOF systems – Harmonic excitation – Dynamic magnification factor – Band width. Single Degree of Freedom System: Formulation and Solution of the equation of Motion – Free vibration response – Response to Harmonic, Periodic, Impulsive and general dynamic loadings – Duhamel integral.

UNIT III:
Multi Degree of Freedom System: Selection of the Degrees 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 – Analysis of dynamic response - Normal coordinates –

UNIT IV:
Continuous Systems: Introduction – Flexural vibrations of beams – Elementary case – Equation of motion – Analysis of undamped free vibration of beams in flexure – Natural frequencies and mode shapes of simple beams with different end conditions.

UNIT V:
Introduction to Earthquake Analysis: Introduction – Excitation by rigid base translation – Lumped mass approach of SDOF and MDOF systems – I.S. Code methods of analysis. Terminology- general principles of design criteria- Seismic coefficient method - Design criteria for various applications- Multistoried buildings- Bridges - Dams and Embankments- Retaining walls.

UNIT VI
Sesmic Evaluation of RC buildings – Condition assessment Field Evaluation Identification and assessment of concrete -.Sesmic retrofitting R.C.C and masonary building – Ductile detailing for earth quake resistant construction. I.S. Codal Provisions

READING

1. Dynamics of Structures by Claugh&Penzien.
2. Structural Dynamics A K Chopra

3. Earth quake resistant Design of Structure – P.Agarwal, M.Shikhande

M.Tech, II-Sem (SE) T C
4 4

(D2019152) ADVANCED DESIGN OF RCC& STEEL

Pre-requisites: None.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Calculate the earth pressure on various earth retaining structures such as Cantiliver retaining wall and counter fort retaining wall and their Design
- Design RCC and Steel Water Tanks
- Understand the codal provisions for loading and design standards of bridges.
- Design of Chimney and Soils
- Design of Deep beams and Estimation of crack width in RC members

DetailedSyllabus:

UNIT I

Design of RCC Retaining walls such as cantilever and counter fort.

UNIT II:

Design of RCC water tanks, Circular and rectangular types.Design of steel water tanks

UNIT III

Introduction to silos concepts of loading and Design

UNIT IV

Introduction to Chimney concept of loading and design**.**Introduction to concrete bridges, IRC loading, slab bridges design concepts.

UNIT V

Estimation of Crack width in R.C.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 IS456 of BS8110- Shrinkage and Thermal Cracking

UNIT VI

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.

Reading:

1. Advanced Reinforced concrete structures by Vargheesh, Pranties Hall of India Pvt. Ltd.
2. Design drawing of concrete and steel structures by N.KrishnaRaju University Press 2005.
3. Reinforced concrete structures Vol-2 by byB.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi

Note: Relevant IS: codes and tables are permitted for examination

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T C
4 4

(D2020152) STABILITY OF STRUCTURES

Elective-III/MOOCS

Pre-requisites: Mechanicsof Solids andTheoryofElasticity.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Determine critical loads for straight columns for different loading and end conditions.
- Determine the critical loads for discrete and continuous systems.
- Assess the buckling of thin walled bars and lateral buckling of beams.
- Assess the buckling of rectangular plates.

DetailedSyllabus:

UNIT I

Beam columns: Differential equation for beam columns – Beams 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 – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode - Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode. Inelastic Buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory.

UNIT III

Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling.

UNIT IV

Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method – Timeshinko method, Galerkin method.

UNIT V

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

UNIT VI

Lateral buckling of simply supported Beams and Rectangular plates: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending. Buckling of Simply Supported Rectangular Plates: Derivation of equation of plate subjected to constant compression in two directions and one direction.

READING:

1. Theory of Elastic stability by Timshenko& Gere-McGraw Hill
2. Stability of Metal Structures by Bleinch – McGraw Hill
3. Theory of beam columns Vol I by Chem. &Atsute Mc. Graw Hill.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T C
4 4

(D2021152) FRACTURE MECHANICS

ELECTIVE – III/MOOCS

Pre-requisites: Mathematics andTheory ofElasticity.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Identify and classify cracking in concrete structures based on fracture mechanics principles.
- Understand stress intensity factor and implement to notched members.
- Apply fracture mechanics models to high strength concrete and FRC structures.
- Understand the concepts of LEFM and compute J-Integral for various sections.

DetailedSyllabus:

UNIT I

Introduction: Fundamentals of elastic and plastic behaviour of materials- stresses in a plate with a hole – Stress Concentration factor- modes of failure- Brittle fracture and ductile fracture- history of fracture mechanics-Griffiths criteria of cracks- mode I, mode II and mode III failure.

UNIT II

Principles of Linear Elastic Fracture Mechanics: SOM vs Fracture Mechanics -stressed based Criteria for fracture- Stress Intensity Factors- K_I K_{II} and K_{III} – Critical stress Intensity Factors, $K_{Ic}$$K_{IIc}$ and K_{IIc}– crack tip plastic zone – Erwin's plastic zone correction -Critical crack length- Load carrying capacity of a cracked component- Design of components based on fracture mechanics.

UNIT III

Griffith's criteria- Criteria for crack propagation -Energy release rate , G_I G_{II} and G_{III} - Critical energy release rate G_{Ic} , $G_{IIc}$and G_{IIIc} – surface energy - R curves – compliance- J-Integrals: Material characterisation by Crack Tip Opening Displacements (CTOD)- Crack Mouth Opening Displacement (CMOD)- Critical crack tip opening displacement ($CTOD_c$) –critical Crack Mouth Opening Displacement ($CMOD_c$)-Determination of fracture parameters.

UNIT IV

Experimental determination of fracture parameters- K_{Ic} ,G_{Ic}, $CTOD_c$ and critical J-Integral.-for brittle and quasi brittle materials like concrete and rock- Specimen geometry .

UNIT V

The crack tip plastic zone: The Irwin plastic zone correction- The Dugdale approach- The shape of the plastic zone- Plane stress versus plane strain- Plastic constraint factor- The thickness effect. Nonlinear Fracture Mechanics for mode I quasi- brittle fracture(Concrete): General quasi-brittle fracture-Ficticious crack approach - Hillerborg's Fictitious crack model-Bazanth's crack band model- Effective elastic crack approach-Two Parameter model- Bazanth' Size effect model-effective crack model-softening-

UNIT VI

Applications of Fracture Mechanics to Concrete structures: Size effect on nominal strength-Tension, Bending, Shear and torsion of RRC members-Concrete dams- Interfacial fracture mechanics-

READING

1. Engineering Fracture Mechanics- S.A. Meguid, Elsevier Applied Science Publications.
2. Elementary engineering fracture mechanics – David Broek – Sijthoff&Noordhoff – Alphenaan den Rijn – Netherlands.
3. Elements of Fracture Mechanics – Prasanth Kumar, wiley Eastern Publications
4. Fracture Mechanics: Fundamentals and applications – T. L. Andrason, PhD, CRC publications

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T C
4 4

(D2022152) PRESTRESSED CONCRETE

ELECTIVE – III/MOOCS

Pre-requisites: Reinforced Concrete Design

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Understand the methods & systems of Pre & post tensioned members, Different systems of pre stressing, losses of pres stressing members
- Analysis and design of section of flexure, Shear and Deflection
- Design and testing of pre-stressing and Post tensioning members

DetailedSyllabus:

UNIT I:

Introduction - General principles of Pre-stressing- Pre-tensioning and Post tensioning- Advantages and limitations of Pre-stressing concrete- Materials- High strength concrete and high tensile steel and their characteristics- I S codal provisions- Methods and systems of Pres-stressing- Pre tensioning and Post tensioning methods- Different systems of Pre-stressing like Hoyer systems- Magnel systems, Freyssinet system and Gifford Udall system.

UNIT II:

Analysis of prestress and Bending stresses and losses: Assumptions – Analysis of prestress – Resultant – stress at a section – pressure line – concept of load balancing – stresses in tendons. Losses of Pre-stressing- Loss of Pre-stress in pre-tensioned and post tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage- bending of members and frictional losses

UNIT III

Deflections of pre-stressed concrete beams: Importance of control of deflections- factors influencing deflections- short term deflections of un cracked member – prediction of long term deflections

UNIT IV

Flexural, shear; torsional resistance and design of Prestressed concrete section. Types of flexural failure – code procedures-shear and principal stresses – Prestressed concrete members in torsion – Design of sections for flexure, Axial Tension, Compression and bending, shear, Bond – Introduction to Limit state Design of Prestressed concrete for flexure.

UNIT V

Analysis of end blocks: By Guyon's method and Magnel's method, Anchorage zone stresses- Approximate method of design- anchorage zone reinforcement- transfer of pre stresses- pre tensioned members

UNIT VI

Composite sections: Introduction-Analysis for stresses- differential shrinkage- general design considerations. Statically Indeterminate Structures**:** Introduction - Advantages and disadvantages of continuity - Layouts for continuous beams -Primary and secondary moments - Elastic analysis of continuous beams - Concordant cable profile - Design of continuous beams.

READING:

1. Prestressed Concrete- N. Krishna Raju
2. Prestressed Concrete- S. Ramamrutham
3. Prestressed Concrete- P. Dayaratnam

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T C
4 4

(D2023152) Composite Materials

ELECTIVE – III/MOOCS

Pre-requisites: Concrete technology

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Classify the Composite Materials, MicroMechanics and thermo elastic Properties
- Have a knowledge of Composite materials
- Fabrication techniques and structural applications of different composites

DetailedSyllabus:

UNIT I

Polymer Matrix Composites (PMC's) Metal Matrix Composites (MMC's) Ceramic Matrix Composites (CMC's)

UNIT II

Elastic properties and stress-strain relations –fracture behavior -Dispersion strengthened particle reinforced and fiber reinforced composite laminates - elastic anisotopic properties, the directional dependence of different properties, and the mechanical properties of thin laminates.

UNIT III

Properties of matrix and reinforced materials-orthotropic coefficients needed for design activities, the Hill-Tsai failure criterion,

UNIT IV

Bending and torsion of composite beams, and the bending of thick composite plates

UNIT V

Micromechanics and principles of strengthening

UNIT VI

Fabrication methods and structural applications of different types of composite materials - thermo elastic properties. Failure analysis and the bonding of cylinders, sandwich beam buckling and flexure shear, and vibrations in composite plates

READING:

1. Engineering Mechanics of composite materials by Isaac M. Daniel and H. Thomas Hahn
2. An introduction to composite materials by by D. Hull and T.W. Clyne
3. The Theory of Composites - Graeme W. Milton- Cambridge

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T 4 C 4

(D2024152) PRE-FABRICATED CONCRETE STRUCTURES

Elective -IV

Pre-requisites: Design ofConcrete Structuresand Design ofSteel Structures.
CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Do Functional Design Principles of Pre-Fabricated Structures
- Design of Floors, Stairs, Roofs and Walls
- Design of Industrial buildings

DetailedSyllabus:

UNIT I

Types of RC Prefabricated Structures: Long wall and cross wall large panel buildings- One way and two way prefabricated slabs - Framed buildings with partial and curtain walls, single storey industrial buildings with trusses and shells - Crane – Gantry systems.

UNIT II

Functional Design Principles: Modular coordination – Standardization - Disuniting, Diversity of prefabricates – Production – Transportation – Erection - Stages of loading and codal provisions - Safety factors - Material properties - Deflection control - Lateral load resistance - Location and types of shear walls.

UNIT III

Floors, Stairs and Roofs: Types of floor slabs - Analysis and design example of cored and panel types and two-way systems - Staircase slab design. Roofs: Types of roof slabs and insulation requirements - Description of joints, their behavior and requirements - Deflection control for short term and long term loads - Ultimate strength calculations in shear and flexure.

UNIT IV

Walls: Types of wall panels - Blocks of large panels – Curtain partition and load bearing walls - Load transfer from floor to wall panels - Vertical loads - Eccentricity and stability of wall panels - Design curves - Types of wall joints, their behavior and design - Leak prevention, Joint sealents, sandwich wall panels.

UNIT V

Industrial Buildings: Components of single storey industrial sheds with crane gantry systems - Design of R.C. Roof Trusses - Roof panels. Design of R.C. Crane - Gantry Girders - Corbels and columns -Wind bracing design.

UNIT VI

Cylindrical, Folded Plate and Hyper Prefabricated Shells: Erection and joining - Joint design - Hand book based design.

READING :

1. Marashev, V.I.Sigalov, E.Y.Baikov, U.N., "*Design of RC Structures*", Mir Publishers, Moscow.
2. "*SERC,Design & Construction of Prefabricated Residential & Industrial Buildings*", Organized by SERC, Chennai

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T C
4 4

(D2025152) STRATEGIC MANAGEMENT

ELECTIVE -IV

Pre-requisites: None.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Learn about Management, Entrepreneurship, Communication Skills, Quality and Customer Care.
- Do manage an organization, ability to take decisions in crisis and ability to bring change when it is necessary in an organization.
- Do maintain Quality control of materials

DetailedSyllabus:

UNIT I

Basics of Management: Scientific management: Fredrick Winslow Taylor; Henry foyal's Administrative Management; Managerial Roles; Managerial skills. Managing Change: Need for change; Paradigm shifts; Organization inertia; Leadership committed to change; Strategy of managing change; case studies highlighting steps needed for managing change successfully.

UNIT II

Crisis Management: Contingencies; contingency planning; Visualizing possible majors Problems for the organization in the foreseeable future; preparing an organization and its staff to Deal with such problems; case studies.

UNIT III

Innovation and Creativity: Encouraging creativity at all levels; Innovation; key for future Leadership; Innovation for product; process or the organization itself; Increment improvement v/s Quantum jump.

UNIT IV

Entrepreneurship: Need of the hour: Entrepreneurship; developing qualities for Entrepreneurship; Calculated Risk; Entrepreneurship within an organization.

Work study and Re-engineering: Productivity; Methods of improving productivity by changes in The manufacturing process as well as by better utilization of assts; Re-engineering the product process as well as the organizational set up.

UNIT V

Managing Intangibles: Management at different levels in an organization; Organizational culture; Leadership effective leadership for overall success; Motivation; Developing a diverse Workforce; Negotiations within the organization; Attitudes and Behavior.

UNIT VI

CommunicationSkills: Communication Basic: Written and Verbal communication, Presentation skill, Meetings and their effective; organization; Dealing / Interacting with Customers. Quality and Customer Care: Quality Management; Reliability of product; Defect and Defect Analysis;

Total Quality; Economics of Quality; Quality Standards and ISO-9000; Customer care and important outcome of quality and quality relationship.

READING:

1. Principles of Management by Charles WL Hill and steven LMcshane; Tata McGrawh-Hill' New Delhi; 2008
2. Principles of Management by PC Tripathi and PN Reddy; Tata McGrawh-Hill' New Delhi; 1991.
3. Organizational Behavior by John W. Newstrom and Keith Danis; Tata McGrawhHill' New Delhi; 2002

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T 4 C 4

(D2026152) SOIL-STRUCTURE INTERACTION

ELECTIVE-IV

Pre-requisites: Soil MechanicsandFoundationEngineering.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- To know the behavior of the soil and its interaction problems with foundation
- To know the design of the under reamed piles
- To know the engineering properties of different types of the soils

DetailedSyllabus:

UNIT I

Soil-Foundation Interaction: Introduction to soil-foundation interaction problems, Soil behavior, Foundation behavior, Interface behavior, Scope of soil foundation interaction Analysis, soil response models, Winkler, Elastic continuum, two parameter elastic models, Elastic plastic behavior, Time dependent behavior.

UNIT II

Beam on Elastic Foundation- Soil Models: Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness**.**

UNIT III

Plates on Elastic Medium: Thin and thick plates, Analysis of finite plates, Numerical analysis of finite plates, simple solutions.

UNIT IV

Elastic Analysis of Pile: Elastic analysis of single pile, Theoretical solutions for settlement and load distributions, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap.

UNIT V

Laterally Loaded Pile: Load deflection prediction for laterally loaded piles, Subgrade reaction and elastic analysis, Interaction analysis, Pile-raft system, Solutions through influence charts.

UNIT IV

Foundations in Problematic Soils: Foundations in black cotton soils - Basic foundation problems associated with black cotton soils - Lime column techniques – Principles and execution. Under reamed piles – Principle of functioning of under reamed pile - Analysis and structural design of under reamed pile – Use of Cohesive Non Swelling (CNS) layer below shallow foundations.

Reading:

1. Selvadurai, A. P. S, Elastic Analysis of Soil-Foundation Interaction, Elsevier, 1979.
2. Poulos, H. G., and Davis, E. H., Pile Foundation Analysis and Design, John Wiley, 1980.
3. J.E. Bowles, “Foundation analysis and design”, McGraw Hill 1996

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) T C
4 4

(D2027152) SMART STRUCTURES AND APPLICATIONS

ELECTIVE-IV

Pre-requisites: None

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Understand the passive and active systems
- Understand the different types of smart materials
- Learn about Characteristics and behavior of smart materials, sensor & control systems.

DetailedSyllabus:

UNIT I:

Introduction to passive and active systems – need for active systems – smart systems – definitions and implications - active control and adaptive control systems – examples.

UNIT II:

Components of smart systems– system features and interpretation of sensor data – pro active and reactive systems – demo example in component level – system level complexity. Materials used in smart systems – characteristics of sensors – different type's smart materials

UNIT III:

Characteristics and behavior of smart materials – modeling smart materials – examples. Control Systems – features – active systems – adaptive systems.

UNIT VI:

Electronic, thermal and hydraulic type actuators – characteristics of control systems – application examples

UNIT V:

Of sensors and control systems – modeling features – sensor-response integration

UNIT VI:

Processing for proactive and reactive components – FE models – examples

READING:

1. Srinivasan, A.V. and Michael McFarland, D., Smart Structures: Analysis and Design,
2. Cambridge University Press, 2000.
3. Yoseph Bar Cohen, Smart Structures and Materials 2003, the International Society for
4. OpticalEngineering2003.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) P C
3 2

(D2028152) STRUCTURAL ENGINEERING LAB-II

Pre-requisites: ConcreteTechnology.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Conduct and monitor various types of non-destructive test, strain measurement test etc.
- Select type method to adopt based on application.

DetailedSyllabus:

- Importance of experimental methods, similitude laws and design of experiments, some simple measuring instruments,
- Strain gauges - principles and applications, mechanical, optical and electrical strain gauges, semiconductor strain gages, strain recording instruments.
- Transducers - LVDT, piezoelectric sensors, accelerometers, load cells etc
- Self Compacting Concrete..
- Non Destructive Testing on Concrete
- Rebound Hammer
- Ultra Sonic Pulse Velocity.
- Accelerating Curing Methods
- Tensile Test on Mild Steel
- Deflection Test on I joist
- Study of behavior of steel beam under flexure

Reading:

1. A.M.Neville,“Properties ofConcrete”, 5thEdition, PHI,2012.
2. KumarMehta.PandPauloJMMonteiro,“ConcreteMicrostructure,Propertiesand Materials”,McGrawHill,2006.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) P C
3 2

(D2029152) CAD LAB-II

Pre-requisites: Building Planningand Construction.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Use of important software's used in the field of structural engineering for analysis, design and drafting
- Design of RC Structures and Steel Structures using software tools like STAAD, E-TAB.

DetailedSyllabus:

Exercises on Concrete Structures: -

1. Analysis, design and detailing of solid slabs in a typical floor for a residential building
2. Analysis, design and detailing of beams in a typical intermediate floor of a multi-storey building
3. Analysis, design and detailing of circular ring beam supporting an overhead water tank
4. Analysis, design and detailing of a ribbed slab floor system- Generation of interaction curves for RC rectangular columns
5. Design of slender columns subject to biaxial bending
6. Analysis, design and detailing of shear walls- considering shear wall-frame interaction in a tall RC structure subject to wind loading-
7. Application of strut-and-tie method to design and detail various RC elements and junctions.

Exercises on Metal Structures: -

1. Design of Steel Industrial Building
2. Design of roof trusses
3. Design of Steel Multi-storey Building
4. Design of Material Handling system
5. Design of steel Bridge
6. Design of pre-engineered buildings.
7. Design of storage structures
8. Design of towers

Readings:

1. Macleod, I.A, Shear Wall Frame Interaction. A design aid with commentary Portland Cement Association.
2. IS 456 :2000, Indian Standard for Plain and Reinforced Concrete- Code of Practice, BIS, New Delhi
3. IS 13920 : 1993, Indian Standard for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces - Code of Practice, BIS, New Delhi
4. Dayaratnam, P., Design of steel structures, Wheeler Pub.

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) P C
0 2

(D2030152) COMPREHENSIVE VIVA-II

Pre-requisites: Both I &II Semester course work ofIyear.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Assimilate knowledge of different courses studied.
- Develop overall comprehension about Structural Engineering.
- Analyse real life Structural Engineering problems with theoretical knowledge learned.
- Interpret and Articulate solutions to real life civil engineering problems in general and structural engineering problems in particular.

DetailedSyllabus:

Entire courseof study(All the required coursesstudied)upto II Semester ofIYear **Reading:**

1. ReadingMaterial of all the courses.
2. CaseStudies/Industrial training reports. 3.Mini projectstakenup

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) P C
0 2

(D2031153) SEMINAR

Pre-requisites: None.

CourseOutcomes: At the end of thecourse, thestudentwill be able to:

- Identify and chose appropriate topic of relevance.
- Assimilate literature on technical articles of specified topic and develop comprehension.
- Write technical report.
- Design and develop presentation on a given technical topic.
- Deliver technical presentation on a specified topic.

DetailedSyllabus:

Thereis no specific syllabusfor this course. However,studentcan choose any topic,ofhis choi ce,
pertainingtoEngineeringStructures.Topicshouldbearelevantandcurrentlyresearchedone. Studentsareadvisedtoreferarticlespublishedincurrentjournalsintheareaof Structural Engineeringforchoosingtheirseminartopics. Studentshouldreviewminimum of5to6researchpapersrelevanttothetopicchosen,inadditiontostandardtextbooks,codebooks, etc.Students
arerequiredtoprepareaseminarreport,inthestandardformatandgivepresentationtothe SeminarAssessmentCommittee(SAC)inthepresenceoftheirclassmates.Itismandatoryfor all thestudents toattendthepresentations oftheirclassmates.

Reading:

1.Structural EngineeringJournals.
2.ResearchArticles /Reports available on Internet

RAJEEV GANDHI MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

Autonomous

STRUCTURAL ENGINEERING

M.Tech, II-Sem (SE) P C
0 12

(D2032153) PROJECT WORKP

Pre-requisites: Both I &II Semester course work ofIYear should be completed. **CourseOutcomes:**At the end of thecourse, thestudentwill be able to:

- Define Research Problem Statement.
- Critically evaluate literature in chosen area of research & establish scope of work.
- Develop study methodology.
- Carryout experimental/ analytical/numerical pilot study.

DetailedSyllabus:

Thereisnoprescribedsyllabus.Studentsarerequiredtosearch,collectandreviewvarious researcharticlespublishedinchosenareaofresearch.Astudenthastoselectatopicforhis dissertation,basedonhis/herinterestandtheavailablefacilitiesatthecommencementof dissertationwork.Studentsarerequiredtosubmitadissertationreportontheresearchwork carried out byhim/her.

Reading:

1.Journal Publications.
2.Conference/ Seminar Proceedings.
3.Handbooks/ ResearchDigests/Codebooks.