ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

M. Tech.
STRUCTURAL ENGINEERING

(Applicable for the batches admitted from 2015-16)

VALLURUPALLI NAGESWARA RAO VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institute, Accredited by NAAC with 'A' Grade
NBA Accreditation for CE, EEE, ME, ECE, CSE, EIE, IT B.Tech. Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
Telephone No: 040-2304 2758/59/60, Fax: 040-23042761
E-mail: postbox@vnrvjiet.ac.in, Website: www.vnrvjiet.ac.in

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
HYDERABAD
An Autonomous Institute

Academic Regulations - M.Tech. Programme
(Applicable for the batches admitted from the academic year 2015-2016)

1. Introduction

Academic programmes of the institute are governed by rules and regulations as approved by the Academic Council of the institute.

These academic rules and regulations are effective from the academic year 2015-16, for the students admitted into two year post graduate programme offered by the college leading to Master of Technology (M. Tech.) degree in different specializations offered by the departments of Civil Engineering, Electrical and Electronics Engineering, Mechanical Engineering, Electronics and Communication Engineering, Computer Science and Engineering, Information Technology and Electronics and Instrumentation Engineering.

The M.Tech. degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on students who are admitted to the programme after fulfilling all the requirements for the award of the degree.

1.1 Eligibility for Admissions

Admission to the above program shall be made subject to the eligibility and qualifications prescribed from time to time. Admissions shall be made on the basis of GATE Rank and merit rank obtained at an Entrance Test conducted by the TSSCHE or as decided by TSSCHE subject to reservations prescribed by the university/ State Government from time to time.

2. Programmes of study

The following two year M.Tech. degree programmes of study are offered by the departments at VNR VJIET.

Department	Specializations
ME	1. Advanced Manufacturing Systems 2. Automation 3. CAD/CAM
CE	1. Highway Engineering 2. Structural Engineering 3 Geotechnical Engineering
EEE	1. Power Electronics 2. Power Systems
CSE	1. Software Engineering 2. Computer Science and Engineering
ECE	1. VLSI System Design 2. Embedded Systems
EIE	Electronics and Instrumentation
IT	Computer Networks and Information Security

- **'ENGLISH'** language is used as the medium of instruction in all the above programmes.

3. Attendance requirements

Each academic year shall be divided into two semesters, each of 90 Instructions days, excluding examination, evaluation, declaration of results etc.

3.1 A student shall be eligible to appear for the semester end examinations in subject if he / she acquire a **minimum of 75% of attendance in that subject.**

3.2 Shortage of attendance up to 10% in any subject (i.e., attendance of 65% and above and below 75%) in a semester may be condoned by the Institute Academic Committee based on the rules prescribed by the Academic Council of the Institute from time to time.

3.3 A student shall get **minimum required attendance in at least three (03) theory subjects** in the present semester to get promoted to the next semester. In order to qualify for the award of the M.Tech. degree, the student shall complete all the academic requirements of the subjects, as per the course structure.

3.4 Shortage of **attendance below 65% shall in NO case be condoned**.

3.5 A stipulated fee shall be payable towards condonation of shortage of attendance.

3.6 In case the student secures less than the required attendance in any subject(s), he shall not be permitted to appear for the semester end examination in that subject(s). He shall re-register for the subject when offered next.

4. Evaluation

i. The performance of a student in each semester shall be evaluated subject–wise with a maximum of **100 marks for theory** and **100 marks for practical subjects**. In addition, **mini-project** and **comprehensive viva-voce** shall be evaluated for **100 marks** respectively.

ii. For theory subjects, the distribution shall be **40 marks for mid-term evaluation** and **60 marks for the semester end examination**.

❖ **Mid-Term Evaluation (40 M):**

Mid-term evaluation consists of **mid-term examination (30 M)** and **assignment/objective test/ case study/course project (10 M).**

➢ **Mid-term examination (30 M):**

- For theory subjects, two mid-term examinations shall be conducted in each semester as per the academic calendar. Each mid-term examination shall be evaluated for 30 marks.
- Pattern of Mid-term examination:
  3 X 10M = 30 M (three internal choice questions one from each UNIT shall be given, the student has to answer ONE question from each UNIT)
- There shall be TWO mid-term examinations for each subject and the average of two mid-term examinations shall be considered for calculating final mid-term examination marks in that subject.

- **Assignment/objective exam/ case study/course project (10 M):**

- Two assignment/objective exam/ case study/course project shall be given to the students covering the syllabus of first mid-term and second mid-term examinations respectively and evaluated for 10 marks each.
- The first assignment/objective exam/ case study/course project shall be submitted before first mid-term examination and the second one shall be submitted before second mid-term examination.
- The average of 2 assignments shall be taken as final assignment marks.

iii. For practical subjects, there shall be a **continuous evaluation during the semester for 40 marks and 60 marks for semester end examination**. Out of the 40 marks, **day-to-day work in the laboratory shall be evaluated for 10 marks**, and **15 marks for practical examination** and **15 marks for laboratory record.**

- **Semester End Examination (60 M):**

(a) Theory Courses

Question paper pattern for semester end examination (60 Marks)

- Paper shall consist of 05 questions of 10 marks each. (05X12M = 60 M)
- There shall be 01 question from each unit with internal choice.

(b) Practical Courses

Each laboratory course shall be evaluated for 60 marks. The semester end examination shall be conducted by two examiners, one Internal and other external concerned with the subject of the same / other department / Industry. The evaluation shall be as per the standard format.

4.1. Evaluation of Mini-Project: There shall be two presentations during the first year, one in each semester. For mini-project 1 and mini-project 2, a student under the supervision of a faculty member, shall collect the literature on a topic, critically review the literature, carry out the mini-project, submit it to the department in a report form and shall make an oral presentation before the departmental Project Review Committee (PRC). The Departmental PRC consists of Head of the Department, supervisor and one senior faculty member of the department. For each mini-project there shall be only internal evaluation of 100 marks. A student has to secure a minimum of 50% to be declared successful.

4.2. There shall be a comprehensive viva-voce in II year I semester. The comprehensive viva- Voce shall be conducted by a committee consisting of Head of the Department and two senior faculty members of the department. The comprehensive viva-voce is aimed to assess the students' understanding in various subjects studied during the M.Tech. programme of study. The comprehensive viva-voce shall be evaluated for 100 marks by the committee. There are no internal marks for the comprehensive viva-voce. A student must secure a minimum of 50% to be declared successful.

4.3. A student shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the semester end examination and a minimum aggregate of 50% of the total marks in the semester end examination and mid-term evaluation taken together.

4.4. A student shall be given one chance to re-register, after completion of the course work, for each subject, provided the internal marks secured by a student are less than 50% and he has failed in the semester end

examination. In such a case student may re-register for the subject(s) and secure required minimum attendance. Attendance in the re-registered subject(s) has to be calculated separately to become eligible to write the end examination in the re-registered subject(s). Re-registration for the subjects is allowed only if that particular re-registration subjects are the hindrance for the award of Degree. Re-registration is allowed in this case provided the student doesn't have any subject(s) yet to pass other than the re-registration subjects where the internal marks are less than 50% with prior permission.

4.5. Laboratory examination for M.Tech. courses must be conducted with two examiners, one of them being laboratory class teacher and second examiner shall be a teacher of same specialization either external or a teacher from the same department other than the teacher who conducted laboratory classes for that batch.

5. Evaluation of Project / Dissertation Work.

5.1 Registration of Project Work: A student shall be permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).

5.2 A Project Review Committee (PRC) shall be constituted with at least four members namely HOD, PG coordinator of the M.Tech. programme, project supervisor and one senior faculty member of same specialization.

5.3 After getting permission as per 5.1, a student has to submit, in consultation with the project supervisor, the title, objective and plan of action of his project work to the Departmental PRC for its approval. Only after obtaining the approval of PRC, the student can initiate the project work.

5.4 If a student wishes to change his supervisor or topic of the project he can do so with the approval of PRC. However, the committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, the date of registration for the project work shall be the date of change of supervisor or topic as the case may be.

5.5 Internal evaluation of the project shall be on the basis of the seminars (Project reviews) conducted during the second year by the PRC. A student shall submit draft report in a spiral bound copy form.

5.6 The work on the project shall be initiated in the beginning of the second year and the duration of project is for two semesters. A student is permitted to submit Project work only after successful completion of theory and practical course with the approval of PRC not earlier than 240 days from the date of registration of the project work. For the approval of PRC the student shall submit the draft copy of thesis to the Head of the Department (Through project supervisor and PG coordinator) and shall make an oral presentation before the PRC.

The student is eligible to submit project work if he has published at least one paper covering 70% of the project work and presented his project work in Show and Tell activity.

5.7 After approval of PRC, every student has to submit three copies of the project dissertation certified by the supervisor to the Department.

5.8 The dissertation shall be adjudicated by one examiner selected by the Chief Superintendent. For this, HOD shall submit a panel of 3/ 5 examiners, who are eminent in that field with the help of the concerned guide.

5.9 If the report of the examiner is not favourable, the student shall revise and resubmit the Dissertation, within the time frame as prescribed by PRC. If the report of the examiner is unfavourable again, the dissertation shall be summarily rejected.

5.10 If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the project supervisor, Head of the Department and the external examiner who adjudicated the Thesis. The Board shall jointly report students work as:

A. Excellent
B. Good
C. Satisfactory
D. Unsatisfactory

Head of the Department shall coordinate and make arrangements for the conduct of viva-voce examination. The student has to secure any one of the grades as Excellent, Good or Satisfactory on his dissertation and viva-voce. If the report of the viva-voce is unsatisfactory, the student shall retake the viva-voce examination after three months, making modifications as suggested. If he fails to get a satisfactory report at the second viva-voce examination, he has to re-register for the project work as mentioned in clause 5.1. However, the student may select a new guide or new topic or both with the approval of the PRC and submit the project dissertation with a minimum of 240 days from the date of re-registration. Of course, this shall not prejudice the clause 6.1 below.

6. Award of Degree and Class

A student shall be declared eligible for the award of the M.Tech. degree, if he pursues a course of study and complete it successfully for **not less than two academic years** and **not more than four academic years**.

6.1 A student, who fails to fulfil all the academic requirements for the award of the degree within four academic years from the year of his admission, for any reason whatsoever, shall forfeit his seat in M.Tech. Course.

6.2 A student shall register and put up **minimum academic requirement in all 84 credits** and earn **84 credits.** Marks obtained in all 86 credits shall be considered for the calculation of Cumulative Grade Point Average (CGPA).

6.3 CGPA System:

Method of awarding absolute grades and grade points in two year M.Tech. degree programme is as follows:

- Absolute Grading Method is followed, based on the total marks obtained in mid-term evaluation and semester end examinations.

- Grades and Grade points are assigned as given below.

Marks Obtained	Grade	Description of Grade	Grade Points(GP) Value Per Credit
>=90	O	Outstanding	10.00
>=80 and <89.99	A	Excellent	9.00
>=70 and <79.99	B	Very Good	8.00
>=60 and <69.99	C	Good	7.00
>=50 and <59.99	D	Pass	6.00
<50	F	Fail	
Not Appeared the Exam(s)	N	Absent	

The student is eligible for the award of the M.Tech degree with the class as mentioned in the following table.

CGPA	Class
>= 8.0	First Class with Distinction
>= 7.0 and <8.0	First Class
>= 6.0 and < 7.0	Second Class

➢ **Calculation of Semester Grade Points Average (SGPA):**

- The performance of each student at the end of the each semester shall be indicated in terms of SGPA. The SGPA shall be calculated as below:

$$\text{SGPA} = \frac{\text{Total earned weighted grade points in a semester}}{\text{Total credits in a semester}}$$

$$\text{SGPA} = \frac{\sum_{i=1}^{p} C_i * G_i}{\sum_{i=1}^{p} C_i}$$

Where Ci = Number of credits allotted to a particular subject 'i'

Gi = Grade point corresponding to the letter grade awarded to the subject 'i'

i = 1,2,…..p represent the number of subjects in a particular semester

Note: SGPA is calculated and awarded for the students who pass all the courses in a semester.

- **Calculation of Cumulative Grade Point Average (CGPA):**

The CGPA of a student for the entire programme shall be calculated as given below:

- Assessment of the overall performance of a student shall be obtained by calculating Cumulative Grade Point Average (CGPA), which is weighted average of the grade points obtained in all subjects during the course of study.

$$\text{CGPA} = \frac{\text{Total earned weighted grade points for the entire programme}}{\text{Total credits for the entire programme}}$$

$$\text{CGPA} = \frac{\sum_{j=1}^{m} C_j * G_j}{\sum_{j=1}^{m} C_j}$$

Where C_j = Number of credits allotted to a particular subject 'j'

G_j = Grade Point corresponding to the letter grade awarded to that subject 'j'

j = 1,2,….m represent the number of subjects of the entire program.

- Grade lower than D in any subject shall not be considered for CGPA calculation. The CGPA shall be awarded only when the student acquires the required number of credits prescribed for the program.

- **Grade Card**

The grade card issued shall contain the following:

a) The credits for each subject offered in that semester

b) The letter grade and grade point awarded in each subject

c) The SGPA/CGPA

d) Total number of credits earned by the student up to the end of that semester.

7. Withholding of Results

If the student has not paid dues to the Institute, or if any case of indiscipline is pending against him, the result of the student may be withheld and he shall not be allowed into the next higher semester. The award or issue of the provisional certificate and the degree may also be withheld in such cases. This delay shall not prejudice clauses Nos.6.0 and 6.1.

8. Transitory Regulations

Students who have discontinued or have been detained for want of attendance or any other academic requirements, may be considered for readmission as and when they become eligible. They have to take up Equivalent subjects, as substitute subjects in place of repeated subjects as decided by the Chairman of the BoS of the respective departments. He/She shall be admitted under the regulation of the batch in which he/she is readmitted.

9. Minimum Instruction Days

The minimum instruction days for each semester shall be **90 instruction days.**

10. General

10.1 The academic regulations should be read as a whole for purpose of any interpretation.

10.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

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

10.4 Wherever the words he, him or his occur, they shall also include she, her and hers.

11. Supplementary Examination

Supplementary examinations shall be conducted along with regular semester end examinations. (During even semester regular examinations, supplementary examinations of odd Semester and during odd semester regular examinations, supplementary examinations of even semester shall be conducted).

VNR Vignana Jyothi Institute of Engineering & Technology

An Autonomous Institute

Nizampet (S.O.), Hyderabad – 90

Program Education Objectives (PEOs)

I. To provide proficiency in the basic principles and advanced courses of technology in Structural Engineering so that students are able to formulate, analyse and solve the societal problems for sustainable development related to structural Engineering.

II. To expose the students to the latest innovations and trends with a view to inculcate strong research orientation in structural engineering as well as in multidisciplinary streams.

III. To produce Structural Engineers who integrate and build on the program's core curricularconcepts in the pursuit of professional leadership, teamwork, life-long learning, and successful career advancement.

Program Outcomes (POs)

The program demonstrates that:

a. **Engineering Knowledge:** The graduate is capable of applying the core and multi-disciplinary knowledge for understanding the problems in structural engineering and allied fields.
b. **Problem Analysis:**The graduates will possess critical thinking skills, problem solving abilities, and familiarity with the computational procedures essential to the field.
c. **Design & Development of Solutions:** The graduate is able to formulate, analyse, design and execute the construction of various types of Engineering structures with appropriate consideration for public health and safety and cultural, societal and environmental conditions.
d. **Conduct investigations of complex problems:** Use research based knowledge and research methods to conduct experiments and to analyze and interpret experimental data.
e. **Modern Tool Usage:** The student gets hands on training on various structural analysis and project management softwares.
f. **The Engineer and Society:** Apply reasoning informed by the appropriate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to structural engineering practice.
g. **Environment and Sustainability:** As the students possess substantial knowledge in multi-disciplinary areas, one is able to plan the various projects well, keeping in view its environmental effects on other related fields.
h. Ethics: Apply ethical principles and commitment to professional responsibilities .
i. **Individual and Team work:** Capable of working productively as individual, as member or leader in driver set teams and in multi- disciplinary settings.
j. **Communication:** The student achieves excellence in expressing his ideas, writing technical reports with great communication skills and managerial skills.
k. **Project Management and Finance:**Graduates will be able to understand the critical issues in professional practice such as analyzing the critical design problems, procurement of works and the execution of a project and the financial managerial capabilities.
l. **Life-Long learning:** Student will maintain an awareness of contemporary issues and recognise the need for and engage in life-long learning to update with or develop technologies to meet the growing and changing needs of society

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

M.TECH. (STRUCTURAL ENGINEERING)

(R15 Regulation)

I YEAR I SEMESTER **COURSE STRUCTURE**

Code	Group	Subject	L	T/P/D	Credits
STR01	**Core**	Theory of Elasticity & Plasticity	3	1	4
STR02		Theory and Analysis of Plates	3	1	4
STR03		Advanced Reinforced Concrete Design	3	1	4
STR11	**Elective – I & Elective -II Basket**	Advanced Concrete Technology	3	0	3 + 3
STR12		Prefabricated Structures	3	0	
STR13		Maintenance & Rehabilitation of structures	3	0	
STR14		Advanced Structural Analysis	3	0	
STR15		Soil Dynamics & Machine Foundations	3	0	
STR16		Bridge Engineering	3	0	
MTH31	**Open Elective -I**	Computer based Numerical methods	3	0	3
ENG32		Professional & Technical Communication	3	0	
STR31		Energy Efficient Buildings	3	0	
STR51	**Lab**	Advanced Concrete Laboratory	0	3	2
STR61		Mini Project - I	0	0	4
Total			**18**	**6**	**27**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

M.TECH. (HIGHWAY ENGINEERING)

(R15 Regulation)

I YEAR II SEMESTER **COURSE STRUCTURE**

Code	Group	Subject	L	T/P/D	Credits
STR04	**Core**	Finite Element Methods	3	1	4
STR05		Structural Dynamics	3	1	4
STR06		Computer Aided Design in Structural Engineering	3	1	4
STR21	**Elective – III & Elective – IV Basket**	Earthquake Resistant Design of Building	3	0	3 + 3
STR22		Advanced Steel Design	3	0	
STR23		Composite Materials	3	0	
STR24		Prestressed Concrete	3	0	
STR25		Stability of Structures	3	0	
STR26		Analysis & Design of Shells and Folded Plates	3	0	
STR41	**Open Elective - II**	Optimization Techniques in Engineering	3	0	3
HIG41		Construction Technology & Project Management	3	0	
GTE41		Ground-Foundation-Structure Interaction	3	0	
STR52	**Lab**	Advanced CAD Laboratory	0	3	2
STR62		Mini Project - II	0	0	4
Total			**18**	**6**	**27**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING & TECHNOLOGY

M.TECH. (HIGHWAY ENGINEERING)

(R15 Regulation)

II YEAR I SEMESTER **COURSE STRUCTURE**

Code	Group	Subject	L	P	Credits
STR63		Comprehensive Viva-Voice	0	0	4
STR71		Internship / Dissertation Phase - I	0	0	8
Total			**0**	**0**	**12**

II YEAR II SEMESTER **COURSE STRUCTURE**

Code	Group	Subject	L	P	Credits
STR72		Dissertation Phase - II	0	0	18
Total			**0**	**0**	**18**

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
	3	**1**	**4**

(STR01) THEORY OF ELASTICITY & PLASTICITY

Course Objectives:

Student shall be able to

- **Define** stresses, strains, equilibrium and compatibility
- **Derive** the governing equilibrium equations in Two-dimensional & in three-dimensional problems
- **Solve** the problems in plane stress, plane strain, torsion, bending.
- **Apply** the concepts of elasticity & Plasticity to solve Structural Engineering problems

Course Outcomes:

After the completion of the course, students should be able to

- **Identify** and **analyse** the stress problems in an elastic body.
- **Identify** and **analyse** the deformation problems in an elastic body.
- **Acquire** the concepts on theory of elasticity and theory of plasticity.
- **Solve** problems of theory of elasticity.

UNIT I:

Introduction: Elasticity - notation for forces and stress - components of stresses - components of strain - Hooks law. Plane stress and plane strain analysis - plane stress - plane strain – differential equations of equilibrium - boundary conditions - compatibility equations - stress function – boundary condition.

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 - 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 general solution in polar coordinates.

UNIT III:

Analysis of Stress and Strain in Three Dimensions: Principal stress - stress ellipsoid - director surface - determination of principal stresses - max shear stresses – homogeneous deformation - principal axes of strain rotation. General Theorems: Differential equations of equilibrium - conditions of compatibility - determination of displacement - equations of equilibrium in terms of displacements - principle of super position - uniqueness of solution - the reciprocal theorem.

UNIT IV:

Torsion of Prismatic Bars: Torsion of prismatic bars - bars with elliptical cross sections – other elementary solution - membrane analogy - torsion of rectangular bars - solution of torsional problems by energy method - use of soap films in solving torsion problems - hydro dynamical analogies - torsion of shafts, tubes, bars etc. Bending of Prismatic Bars: Stress function - bending of cantilever - circular cross section - elliptical cross section - rectangular cross section - bending problems by soap film method - displacements.

UNIT V:

Theory of Plasticity: Introduction - concepts and assumptions - yield criterions.

Text Books:

1. Theory of Elasticity by S.Timoshenko &J.N.Goodier , McGraw-Hill Publications,3rd Edition, 2010
2. Theory of Elasticity by Sadhu Singh, Khanna Publishers, 1997

References:

1. Theory of Plasticity by J.Chakarbarthy, McGraw-Hill Ryerson, 2006
2. Applied Elasticity by C.T. Wang, McGraw Hill, 1953.
3. Elasticity - Theory, Applications and Numerics,Martin,H.Sadd, Elsevier, Second Edition,2011
4. Theory of Plasticity by Sadhu Singh, Dhanpat Rai sons Private Limited, New Delhi, 2004

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
	3	**1**	**4**

(STR02) THEORY AND ANALYSIS OF PLATES

Course Objectives:

Student shall be able to

- To **understand** the classical theory of elastic plates.
- To Build the **Knowledge** on analytical and numerical solution techniques in thin plate theory.
- To **Introduce** students various theories like Navier, Levy's, and Rayleigh—Ritz solutions to plates with different end conditions.
- To **analyse** plates with different boundary conditions

Course Outcomes:

After the completion of the course, students should be able to

- **Apply** the theory of plates in engineering designs.
- **Describe** and **exploit** various modelling avenues for structural engineering components and obtain the exact and/or approximate solutions.
- **Select** an appropriate plate theory for different Engineering applications.
- **Formulate** differential equations for plate problems

UNIT I:

Cylindrical Bending: Different kind of plates -Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load. Pure Bending of Plates: Slope and curvature of slightly bent plates - Relations between moments and curvature - Particular cases of pure bending - Strain energy in pure bending – Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

UNIT II:

Small Deflection Theory of Thin Rectangular Plates: Assumptions - Derivation of governing differential equation for thin plates - Boundary conditions - simply supported plate under sinusoidal load-Navier solution – Application to different cases - Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

UNIT III:

Circular Plates: Symmetrical loading - Relations between slope, deflection, moments and curvature - Governing differential equation - Uniformly loaded plates with clamped and simply supported edges - Central hole - bending by moments and shearing forces uniformly distributed **Orthotropic Plates:** Introduction - Bending of anisotropic plates - Derivation of governing differential equation - Determination of Rigidities in various cases like R.C. slabs, corrugated sheet –Application to the theory of grid works.

UNIT IV:

Plates on Elastic Foundations: Governing differential equation-deflection of uniformly loaded simply supported rectangular plate - Navier and Levy type solutions - Large plate loaded at equidistant points by concentrated forces.

UNIT V:

Buckling of Plates: Governing equation for Bending of plate under the combined action of in-plane loading and lateral loads - Buckling of rectangular plates by compressive forces acting in one and two directions in the middle plane of plate.

Text Books:

1. Theory of Plates and Shells by Timoshenko and Krieger, Tata McGraw-Hill Edition,2nd Edition,2010.
2. Theory of Plates by K.Chandrasekhara, University Press,2001.

References:

1. Plate Analysis by N. K. Bairagi, Khanna Publishers,New Delhi,2000.
2. Thin plates and shells by Eduard Venstel and Theodor Krauthammer, Marcel dekker Inc publishers , Newyork, 2001.
3. Theory and Analysis of Plates by R. Szilard, Prentice Hall Inc publishers, 2000.
4. Stress in Plates and Shells,A.C. Ugural, McGraw-Hill,2nd Edition, 1999.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
	3	**1**	**4**

(STR03) ADVANCED REINFORCED CONCRETE DESIGN

Course Objectives:

Student shall be able to

- **Analyze and Design** of slabs by using yield line theory.
- **Understand** the various types of loads in current codes of practice for the design of tall buildings.
- **Understand** the Design concepts of flat slabs.
- **Analyze and Design** of Concrete Deep beams and retaining walls.

Course Outcomes:

After the completion of the course, students should be able to

- **Determine** moment of resistance for square and circular slabs.
- **Analyze and design** of flat slabs
- **Design** of Concrete Deep beams and Retaining walls
- **Understand** the various types of loads to consider in the design of tall buildings.

UNIT I:

Review of Limit State Design Concepts:

Limit Sate Analysis of R.C. Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, and applications for fixed and continuous beam. Yield line analysis for slabs: upper bound and lower bound theorems – yield line criterion - Virtual work and equilibrium methods of analysis - For square and circular slabs with simple and continuous end conditions.

UNIT II:

Design of Ribbed slabs, Flat slabs: Analysis of the Slabs for Moment and Shears Ultimate moment of resistance, Design for shear, Deflection, Arrangement of Reinforcements.

Flat slabs: Direct design method - Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns - Shear in Flat slabs-Check for one way shear-Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip.

UNIT III:

Design of Reinforced Concrete Deep Beams: steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams.

UNIT IV:

Introduction to Tall buildings: The Tall Building in the Urban Context - The Tall Building and its Support Structure - Development of High Rise-Building Structures - General Planning Considerations. Dead Loads - Live Loads-Construction Loads -Snow, and Wind Loads-Seismic Loading.

UNIT V:

Retaining Walls: Analysis and design of cantilever retaining walls- ***Counterfort retaining wall

Note :* No numerical problem

Text Books:

1. Reinforced concrete design by s. unnikrishna Pillai & Menon, TMH.
2. Advanced Reinforced Concrete Design - PC Varghese, Practice Hall, 2008

References:

1. Limit state theory and design of reinforced concrete by Dr. S.R.Karve and Dr V L Shah, Standard publishers, Pune, 3rd Edition 1994
2. Reinforced concrete structures, Vol.l, by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2004.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-I / Elective-II	**3**	**0**	**3**

(STR11) ADVANCED CONCRETE TECHNOLOGY

Course Objectives:

Student shall be able to

- **Adopt the correct** type of cement to suit the particular requirements depending on exposure conditions.
- **Design** economic concrete mix proportion for the given exposure conditions and with the available materials, to the extent possible for the desired strength.
- **Address** various problems that arise during concreting operations.
- **Judge and resolve** any controversy that arises regarding material suitability confidently by substantiating through field and laboratory tests.

Course Outcomes:

After the completion of the course, students should be able to

- **Determine** the properties of concrete ingredients i.e. cement, sand, coarse aggregate by conducting different tests and decide the suitability.
- **Recognize** the effects of the rheology and early age properties of concrete on its long-term behavior.
- **Use** appropriate chemical admixtures and mineral additives for achieving the desired properties.
- **Use** advanced laboratory techniques to assess the strength characteristics after disasters.

UNIT I:

Concrete Making Materials: Cement – Bogue's compounds –Hydration process - Types of cement –Aggregates-Gradation curves-Combined aggregates-Alkali silica reaction–Admixtures-mineral and chemical admixtures .

UNIT II:

Fresh and Hardened Concrete: Fresh concrete-workability tests on concrete–setting times of fresh concrete- segregation and bleeding.

Hardened Concrete: Abram's law – Gel- space ratio - maturity concept –stress strain behavior-creep and shrinkage-durability of concrete-Non-destructive testing of concrete. Introduction to XRD & SEM Analysis.

UNIT III:

High Strength Concrete: Microstructure-manufacturing and properties--ultra high strength concrete.

High performance concrete- Requirements and properties of high performance concrete-design considerations.

UNIT IV

Special Concretes: Light weight concrete-Self Compacting concrete-Polymer concrete -Fiber reinforced concrete –Reactive powder concrete-Bacterial concrete-Geo-polymer concrete – Requirements and guidelines- Advantages and Applications – Porous pavement – White Topping – Roller compacted concrete.

UNIT V:

Concrete Mix Design: Quality control –Quality assurance-Quality audit-Mix design by various methods-BIS method-DOE method-ACI method - Erntroy & Shacklock's method .

Text Books:

1. Concrete Technology by M.L.Gambhir, McGraw Hill Education(India) Pvt. Ltd,5th edition
2. Concrete Technology by M.S.Shetty, S.Chand & Co.

References:

1. Concrete technology by A.M.Neville& J J Brooks,Low price edition 2004, Pearson Education
2. Concrete –Microstructure, properties and materials by P.Kumar Mehta & Paulo J.M.Monteiro- 3rd edition published by Tata Mc Graw Hill Education Pvt.Ltd.
3. Properties of concrete by A.M.Neville, Pearson publishers,
4. Design of Concrete Mixes by N.Krishna Raju, CBS Publications.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-I / Elective-II	**3**	**0**	**3**

(STR12) PREFABRICATED STRUCTURES

Course Objectives:

Student shall be able to

- To impart the knowledge in the area of prefabricated structures.

Course Outcomes:

After the completion of the course, students should be able to

- Know the types of prefabrication systems.
- Understand the behavior of prefabricated structures.
- Design pre fabricated units.
- Do the detailing of pre fabricated units.

UNIT I:

Introduction: Types of foundation - Modular co-ordination – Components - Prefabrication systems and structural schemes - Design considerations - Economy of prefabrication - Prefabrication of load-carrying members - Disuniting of structures - Structural behavior of pre cast structures.

UNIT II:

Handling and Erection: Stresses - Application of pre stressing of roof members – Floor systems - Two way load bearing slabs - Wall panels.

UNIT III:

Dimensioning and Detailing of Joints : Joints for different structural connections – Construction and expansion joints.

UNIT IV:

Erection of Prefabricated Structures : Production - Transportation and Erection - Organising of production - Storing and erection equipment - Shuttering and mould design - Dimensional tolerances, Erection of R.C.structures, Total prefabricated buildings.

UNIT V:

Design of Prefabricated Units: Prefabricated units for Industrial structures, Multi-storied buildings and Water tanks etc., Application of pre-stressed concrete in prefabrication.

Text Books:

1. Hass, A.M., (1995) Precast concrete Design and Applications, Applied Science Publishers, England.
2. Promyslov, V. (1998), Design and Erection of Reinforced concrete structures, MIR Publishers, Moscow.

References:

1. Levit, M., (2000), Precast concrete materials, Manufacture properties and usage, Applied Science Publishers, London.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-I / Elective-II	**3**	**0**	**3**

(STR13) MAINTENANCE AND REHABILITATION OF STRUCTURES

Course Prerequisites: Concrete Technology

Course Objectives:

Student shall be able to

- This subject imparts a broad knowledge in the area of repair and rehabilitation of structures.

Course Outcomes:

After the completion of the course, students should be able to

- Understand the properties of fresh and hardened concrete.
- Know the strategies of maintenance and repair.
- Get an idea of repair techniques.
- Understand the properties of repair materials.

UNIT I:

Serviceability and Durability of Structures: Quality Assurance for concrete construction - Fresh concrete properties – Strength – Permeability - Cracking - 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 - Cathodic protection

UNIT II:

Diagnosis and Assessment of Distress: Visual inspection – Non destructive tests – Ultrasonic pulse velocity method – Rebound hammer technique – ASTM classifications – Pullout tests – Core test

UNIT III:

Materials for Repair: Special concretes and mortar - Concrete chemicals – Special elements for accelerated strength gain - Expansive cement - Polymer concrete – Ferro cement, Fibre reinforced concrete - Fibre reinforced plastics.

UNIT IV:

Techniques for Repair: Rust eliminators and polymers coatings for rebars during repair Foamed concrete - Mortar and dry pack - Vacuum concrete - Gunite and shotcrete -Epoxy injection - Mortar repair for cracks - Shoring and underpinning.

UNIT V:

Repairs to Structures: Repairs to overcome low member strength –Deflection – Cracking - Chemical disruption - Weathering wear - Fire leakage – Marine exposure.

Text Books:

1. Concrete Technology by Santha Kumar, A.R., , Oxford University Press, 2007
2. Concrete Technology Theory and Practice by Shetty, M.S. , S.Chand and company, New Delhi, 2005

References:

1. Concrete Chemical Theory and Applications , Santha Kumar, A.R., Indian Society for Construction Engineering and Technology, 1996
2. Structural assessment by Garas, F.K,.Clarke, J.L, Armer, GST, Butterworths, UK, 1997
3. Repair of Concrete Structures by R.T. Allen and S.C.Edwards, Blakie and Sons, UK, 1998

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-I / Elective-II	**3**	**0**	**3**

(STR14) ADVANCED STRUCTURAL ANALYSIS

Course Objectives:

Student shall be able to

- **Learn** how to calculate static and kinematic indeterminacies of various types of structures.
- **Formulate** the stiffness matrix for continuous beams, portal frames and trusses.
- **Formulate** the flexibility matrix for continuous beams, portal frames and trusses.
- **Understand** the structural behavior of frames with and without shear walls.

Course Outcomes:

After the completion of the course, students should be able to

- **Generate** the global stiffness matrix by assembling the element stiffness matrices.
- **Analyze** the continuous beams, portal frames and trusses by stiffness method.
- **Solve** the continuous beams, portal frames and trusses by flexibility method.
- **Analyze** the shear walls by approximate methods.

UNIT I:

Introduction to matrix methods of analysis – static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization - stiffness and flexibility matrices - suitability element stiffness equations - element flexibility equations - mixed force – displacement equations for truss element, beam element and torsional element. Transformation of coordinates - element stiffness matrix - load vector - local and global coordinates.

UNIT II:

Assembly of global stiffness matrix from element stiffness matrices - direct stiffness method - general procedure - band matrix - semi bandwidth - computer algorithm for assembly by direct stiffness matrix method.

UNIT III:

Analysis of plane truss - continuous beam - plane frame and grids by flexibility method.

UNIT IV:

Analysis of plane truss - continuous beam - plane frame and grids by stiffness method.

UNIT V:

A special analysis procedure - static condensation and sub structuring - initial and thermal stresses.

Shear walls- Necessity - structural behaviour of large frames with and without shear walls – Approximate methods of analysis of shear walls.

Text Books:

1. Structural Analysis : A Matrix Approach by G.S.Pandit, S.P.Gupta, Tata McGraw-Hill Publishers, 2nd Edition.
2. Matrix Analysis of Framed structures by William weaver, James M. Gere, CBS publications, 2nd Edition.

References:

1. Theory of Structures – Vol. II by S.P.Gupta, G.S. Pandit, R.Gupta, Tata McGraw-Hill Publishers, Ist Edition.
2. Structural Analysis by Devdas Menon, Narosa Publishers, 2008.
3. Structural Analysis by A.Ghali, A.M. Neville and T.G. Brown, Spon Press, 6th Edition, 2009.
4. Matrix methods of Structural Analysis by M.B. Kanchi, New age International Publishers.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech.	**L**	**T/P/D**	**C**
Elective-I / Elective-II	**3**	**0**	**3**

(STR15) SOIL DYNAMICS & MACHINE FOUNDATIONS

Course Objectives:

Student shall be able to

- **Use** the techniques, skills, and modern engineering tools necessary for engineering practice.
- **Understand** the impact of engineering solutions in economic and environmental context.
- Design, analyze and interpret data related to the geotechnical engineering.

Course Outcomes:

After the completion of the course, students should be able to

- Accentuate the understanding of the basic principles and exposes the student to the latest developments, with a strong research orientation.
- Identify, formulate and solve foundation related problems.
- Understand the latest trends, modern standards and state-of-the-art techniques for geotechnical engineering.

UNIT I:

Types of machine foundations - general requirements design - criteria for machine foundations, permissible amplitudes and bearing pressure. Resonance and its effect - free and forced Vibrations with and without damping - constant force and rotating mass type excitation - magnification steady state vibrations - logarithmic decrement.

UNIT II:

Natural frequency of foundation - soil system - Barkan's and I.S. methods of determining natural frequency.

UNIT III:

Elastic properties of soil for dynamical purpose and their experimental determination - Elastic waves and their characteristics -'Experimental determination of shear modulus from wave theory.

UNIT IV:

Apparent soil mass - bulb of pressure concept - Pauw's analogy of foundation - soil systems (concept only) - Theory of elastic half space - lamb and the dynamic Boussinesq's problem - Relsner's solution and its limitations - Quinlan and Sung's modifications - Hsiegh's equations for vertical vibration.

UNIT V:

Principles of design of foundations for reciprocating and impact type of machine - as per I.S. Codes. Vibration isolation - types and methods of isolation - isolating materials and their properties.

Text Books:

1. Hand Book of Machine Foundations by S. Srinivasulu and Vaidganathan.
2. Soil Mechanics & Foundation Engineering by B.C.Punmia.

References:

1. Analysis and Design of Foundation and retaining structures-Sham Sher Prakets, Etal.
2. Vibration of Soils & Foundations - Richant Hall & Woods.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-I / Elective-II	**3**	**0**	**3**

(STR16) BRIDGE ENGINEERING

Course Objectives:

Student shall be able to

- **Develop** an understanding of and appreciation for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality
- **Develop** a clear understanding of conceptual design of bridge elements
- **Understand** the load flow mechanism and identify loads on bridges
- Carry out the **design** of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements

Course Outcomes:

After the completion of the course, students should be able to

- **Understand** the various of loads in design of bridges
- **Analyze and design** of solid slab bridges
- **Analyze and Design** of Prestressed Concrete bridges
- **Understand** the Design methods of girder bridges.

UNIT I:

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load live load- Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads-Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of road way and footway-General Design Requirements.

UNIT II:

Solid slab Bridges: Introduction-Method of Analysis and Design.

UNIT III:

Girder Bridges:-Introduction-Method of Analysis and Design- Courbon's Theory Grillage analogy

UNIT IV:

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in pre stessed concrete member-Concrete cover and spacing of pre-stressing steel slender beams-composite section-propped-Design of propped composite section- Unproped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT V:

Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments.

Text Books:

1. Design of Bridges by N.Krishna Raju, Oxford and IBH Publishing company,2010
2. Essentials of Bridge Engineering by D. John Victor, Oxford & IBH Publishing Co. Pvt. Ltd.

References:

1. Design of concrete Bridges by M.G.Aswani, V.N.Vazirani and M.M.Ratwani, Khanna Publishers, 1972
2. Design of Bridge Structures by TR Jagdeesh and MA Jayaram, 2nd Edition, Prentice Hall of ndia Pvt. Ltd.,2003.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Open Elective-I	**3**	**0**	**3**

(MTH31) COMPUTER BASED NUMERICAL METHODS

Course Objectives:

Student shall be able to

- Apply the basic knowledge of mathematics in engineering.
- Provide a formidable base for analysis and programming using computer applications.
- Develop the ability in programming and solutions based on the various analysis tools.

sCourse Outcomes:

After the completion of the course, students should be able to

- Apply it to basic (linear) ordinary and partial differential equations.
- Identify mathematical model for solution of common engineering problems.
- Formulate simple problems into programming models.

UNIT I:

Solution of Algebraic and Transcendental Equations: Introduction, errors and approximations, binary and decimal systems, computing roots using direct methods (bisection, regulafalsi) and Iterative Methods (fixed point iterative and Newton-Raphson Methods) and applications

Lab: Implementation of algorithms on computers using any computer language and comparison (Bisection and N-R Method)

UNIT II:

Solution of Simultaneous Linear Equations: Introduction, Methods of solution direct (Matrix inversion and Gauss elimination methods) and iterative methods (Gauss Jacobi and Gauss seidel methods) disadvantages of ill-conditioned systems and pivoting, Eigen value, computing largest Eigen value by power method and applications

Lab: Implementation of algorithms on computers and comparison

UNIT III:

Interpolation, Numerical Differentiation and Integration: Introduction, Interpolation for equally spaced data and unequally spaced data by Newton's methods, Lagrange's method and cubic splices.Numerical differentiation formulae using finite differences and interpolation.Newton-Cotes integration formulae (Trapezoidal and Simpsons rules) and Gauss quadrature formulae and applications.

Lab: Implementation of algorithms on computer (Newton's formula, Trapezoidal and Simpsons rule)

UNIT IV:

Numerical Solutions of Differential Equations (ODE & PDE): Introduction, solution of ODE of IVP type by Euler's methods, Runge-Kutta methods (single step) and multistep methods**.** Numerical solution of PDE using finite difference schemes approach, (Parabolic, Elliptic type) and applications

Lab: Implementation of R-K method (for ODE) Bender Schmidt and Crank- Nicolson methods (for PDE)

UNIT V:

Linear Programming Problems (LPP): Introduction, formation of LPP, methods of solution. Graphical method, simplex methods, dual simplex method, artificial variables, Big-on method, Transportation problems (by VAM) and applications.

Lab: Implementation of Simplex algorithm

Text Books:

1. Numerical Methods by Dr.B.S.Grewal
2. Numerical Analysis by R.L.Burden & J.D.Faires

References:

1. Numerical Methods for Engineers byChopras S.C and Canale R.P
2. Numerical Methods for scientists and Engineers byIyenger& Jain

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Open Elective-I	**3**	**0**	**3**

(ENG32) PROFESSIONAL AND TECHNICAL COMMUNICATION

Introduction:
This course aims to offer students a practical approach to professional and technical communication; and to focus specifically on verbal and written communication. Additionally, the course is designed to build confidence and; group communication and public speaking competence. Each unit in the syllabus is devised so as to include a writing component as well as an oral component.

Course Objectives:
- To enable the students to write without errors in spelling, mechanics, grammar and punctuation; resume, business letters, proposals and reports to accomplish academic as well as professional goals.
- To train students to write clearly, cohesively, emphatically and concisely.
- To groom students to speak accurately and fluently and prepare them for real world activities
- To train students in soft skills through group discussion to improve their EQ.

Course Outcomes:
Students will be able to:
- analyze communication situations and audiences to make choices about the most effective and efficient way to communicate and deliver messages
- write resume, business letters, project proposals and reports
- speak fluently and address a large group of audience and participate in discussions.
- navigate through complex environments through interpersonal and collaborative skills.

UNIT I:
- Oral Communication :Self-introduction
- Applications and Covering letters
- Resume Writing
- Job Interviews

UNIT II:
- Oral Communication: Impromptu Speech
- Reading Business and Technical Texts
- Writing E-mails
- Writing Business Letters and Business Memos

UNIT III:
- Oral Communication: Group Discussions
- Summarizing and Synthesising

- Writing Abstracts

UNIT IV:

- Oral Communication : Debate
- Writing Business Proposals
- Writing Technical Proposals

UNIT V

- Oral Communication: Making Presentations
- Interpreting Graphic Information
- Writing Business Reports
- Writing Technical Reports

Text Books and Materials:

1. Ashraf Rizvi, M (2005). Effective Technical Communication, Tata Mc Graw Hill Publishing Company Limited, New Delhi.
2. M. Raman and S. Sharma, Technical Communication: Principles and Practices, OUP, 2004. (Indian Edition)

References:

1. William S. Pfeiffer, (2012) Technical Communication: A Practical Approach (7th ed.) Longman
2. Burnett, Rebecca. Technical Communication. 5th Ed., Heinle, 2001.
3. Gerson Sharon J. and Steven Gerson : Technical Writing Process and Product. 3rd edition, New Jersey: Prentice Hall 1999
4. Markel, Mike**.** Technical Communication: Situations and Strategies (8th EDITION (2006-2007)
5. R. C. Sharma and K. Mohan, Business Correspondence and Report Writing, Third Edition, TMH, 2002. (Indian Edition)
6. Anderson, Paul V. (2003). Reports. In Paul V. Anderson's Technical Communication: A Reader-Centered Approach (5th ed..) (pp. 457-473). Boston: Heinle.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Open Elective - I	**3**	**0**	**3**

(STR31) ENERGY EFFICIENT BUILDINGS

Course Objectives:

Student shall be able to

- **Study** the design of energy efficient buildings which balances all aspects of energy, lighting, space conditioning and ventilation.
- **Learn** passive solar design strategies.
- **understand** the use of materials with low embodied energy.
- **Design** the standards for ventilation and different climatic zones

Course Outcomes:

After the completion of the course, students should be able to

- **Design** energy efficient buildings which balance all aspects of energy, lighting, space conditioning and ventilation.
- **Design** energy efficient buildings with passive solar design strategies.
- **Use** materials with low embodied energy.
- **Apply** concepts in Energy auditing

UNIT I:

Introduction: Energy required for building construction - Heat Transfer – Measuring Conduction –Thermal Storage – Measurement of Radiation – The Green house Effect – Psychrometry Chart – Measuring latent and sensible heat. Thermal Comfort – Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Protection – Types of Shading Devices – Conservation – Heating and Cooling loads.

UNIT II:

Passive Solar Heating and Cooling: General Principles of passive Solar Heating – Key Design Elements - Direct gain Trombe Walls, Water Walls, Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Predicting ventilation in buildings – window ventilation calculations - Radiation – Evaporation and dehumidification – Mass Effect – Load Control – Air Filtration and odor removal – Heat Recovery in large buildings

UNIT III:

Daylighting and Electrical Lighting: Materials, components and details - Insulation – Optical materials – Radiant Barriers Glazing materials - Day lighting – Sources and concepts – Building Design Strategies –Case Studies – Electric Lighting –Light Distribution – Electric Lighting control for day lighted buildings – Illumination requirement – Components of Daylight factor – Recommended Daylight factors – Day lighting analysis – Supplementary Artificial Lighting Design

UNIT IV:

Heat Control and Ventilation: Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings Influence of Design Parameters – Mechanical controls –Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation.

UNIT V:

Design for Climatic Zones: Energy efficiency – an overview of design concepts and architectural interventions –Energy efficient buildings for various zones – cold and cloudy – cold and sunny –composite – hot and dry – moderate – warm and humid – case studies of residences, office buildings and other buildings in each zones – Energy Audit – Certification

Text Books:

1. Energy – efficient Buildings in India by Majumdar, M. (Ed), Tata Energy Research Institute, Ministry of Non Conventional Energy Sources, 2002.
2. Handbook on energy audits and management Tata Energy Research by Tyagi, A. K.(Ed),

References:

1. Environmental Control System by Moore, F., McGraw Hill Inc., 2002
2. Sun, Wind and Light – Architectural Design Strategies by Brown, G.Z. and DeKay, M., John Wiley and Sons Inc, 2001
3. Energy Conservation in Commercial and Residential Buildings by Chilogioji, M.H., and Oura, E.N., Marcel Dekker Inc., New York and Basel, 1995.
4. Energy Conservation Standards – For Building Design, Construction and Operation by Dubin, F.S. and Long, C.G., McGraw Hill Book Company ,1990.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – I Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
	0	**3**	**2**

(STR51) ADVANCED CONCRETE LABORATORY

Course Objectives:

Student shall be able to

- **Characterize** the engineering properties of the raw materials for suitability for use and the required design parameters.
- **Recognize** the effects of the rheology and early age properties of concrete and their influence on the properties of hardened concrete.
- **Adopt** various chemical admixtures and mineral additives to concrete to achieve the desired quality of the concrete and necessary modifications in the design of Concrete Mix.
- **Understand** the fresh and hardened properties of SCC and other special concretes.

Course Outcomes:

After the completion of the course, students should be able to

- **Specify** concrete and the materials from which it is made
- **Identify**, describe and carry out the main laboratory tests relevant to the use of concrete on site
- **Describe** the materials used to make concrete; including their sources, production and properties.
- **Design** SCC concrete mixes

1. Tests on Cement –
    a. Specific Gravity of Cement.
    b. Standard Consistency of Cement.
    c. Setting time of Cement.
    d. Soundness of Cement.
    e. Compressive Strength of Cement.

2. Tests on Aggregate –
    a. Bulking of Fine Aggregate.
    b. Specific Gravity of Fine & Coarse Aggregates.
3. IS Method of Mix Design for Normal Concrete.
4. Workability Tests on Normal concrete -
    a. Slump Cone Test.
    b. Compaction Factor Test.
    c. Vee-Bee Consistometer Test.
5. Mix Design of Self Compacting Concrete (SCC).
6. Tests on Fresh Properties of SCC -
    a. Flow Table Test.
    b. V-Funnel Test.

c. T_5 Test.
d. J-Ring Test.
e. L-Box Test.

7. Compressive strength of Concrete.
8. Flexure Testing of Beams.
9. Non Destructive Testing of Concrete –
a. Rebound Hammer Test
b. Ultrasonic Pulse Velocity Test
10. Determination of Poisson's ratio of concrete using UPV apparatus
11. Study of stress-strain behavior & determination of Modulus of Elasticity (Static & Dynamic) of concrete.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year- I Sem. M.Tech (Structural Engineering)	L	T/P/D	C
	0	0	4

(STR61) MINI PROJECT – I

A mini project work shall be carried out on any topic of Structural Engineering and a seminar should be given on the same along with a brief report.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
	3	**1**	**4**

(STR04) FINITE ELEMENT METHODS

Course Objectives:

Student shall be able to

- **Develop** the skills in applying the basic matrix operation to form a globalmatrix equation and enforce the concept of steps in obtaining solutions for structural mechanics problems.
- **Apply**theskills in solving the bar, beam, Plane stress and Plane strain problems.
- **Gain** some knowledge and analysis skills in forming basicdata required in a FEM computer program.

Course Outcomes:

After the completion of the course, students should be able to

- **Analyze** finite element method efficiently in order to solve field problems.
- **Identify**the most appropriate mathematical model for solution of common Engineering problems.
- **Select** the suitable finite element and solve the problem having complicated geometry and loadings using the software.

UNIT I:

Introduction: concepts of FEM - steps involved - merits and demerits - Energy principles-discretization - Raleigh - Ritz method of functional approximation Principles of Elasticity:Stressequations-strain-displacement relationship in matrix form, plane stress & plane strain and axisymmetric bodies of revolution with axi-symmetric loading.

UNIT II:

One Dimensional FEM: Stiffness matrix for beam and bar elements - shape functions for 1D element.

Two Dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models –generalized coordinates - shape functions - convergence and compatibility requirements – geometric Invariance - natural coordinate system - area and volume coordinates – Generation of element stiffness and nodal load matrices.

UNIT III:

Isoparametric Formulation: concept – different isoperimetric elements for2D analysis-formulation of 4-noded and 8-noded isoparametric quadrilateral elements - Lagrange elements - serendipity elements Axi symmetric Analysis: bodies of revolution axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements.

Three Dimensional FEM: Different 3-D elements-strain-displacement relationship - formulation of hexahedral and isoparametric solid element.

UNIT IV:

Introduction to Finite Element Analysis of Plates: basic theory of plate bending - thin plate theory - stress resultants - Mindlins approximations - formulation of 4-noded isoperimetric quadrilateral plate element - Shell Element.

UNIT V:

Introduction to Non - Linear Analysis - basic methods - application to special structures.

Text Books:

1. A First course in Finite element method by Daryl Logan, Third edition, Thomson Asia publishers, 2002.
2. Finite element analysis by S.S.Bhavikatti, Third edition, New Age International Publishers, 2015.

References:

1. Introduction to Finite elements in Engineering by Tirupathi R.Chandra Patla and Ashok D. Belegundu, Prentice hall of India, 1996.
2. Fundamentals of Finite Element Analysis by David V. Hutton, TATA McGraw-Hill Edition 2005.
3. Concepts and Applications of Finite Element Analysis by Robert D. Cook, David S.Malkus and Michael E. Plesha, John Wiley & Sons,1999.
4. Finite Element Analysis by C.S.Krishnamoorthy, Tata McGraw Hill Publishing Co. Ltd, 2002.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Structural Engineering)	**L**	**T/P/D**	**C**
	3	**1**	**4**

(STR05) STRUCTURAL DYNAMICS

Course Objectives:

Student shall be able to

- **Know t**he fundamental concepts and theory of dynamic analysis.
- **Understand** the free vibrations concepts and the problem of determining the natural frequency of a system.
- **Understand** the free vibrations concepts of harmonically excited vibrations.
- **Understand** the free Vibrations of Multi -degree of freedom.

Course Outcomes:

After the completion of the course, students should be able to

- **Apply** the fundamental concepts and definitions used in structural dynamics.
- **Calculate** the natural frequency of a system using equilibrium or energy methods.
- **Determine** the effect of viscous damping on the response of a freely vibrating system.
- **Determine** the response of a system to a harmonic excitation.

UNIT I:

Theory of Vibrations: Introduction - Elements of vibratory system - Degrees of Freedom – continuous it;6 - Lumped mass idealization - oscillatory motion - Simple Harmonic motion – Vectorial representation of S.H.M. – Formulation of single degree of freedom system - undamped and damped motions - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation -Dynamic magnification factor- Phase angle – Bandwidth

UNIT II:

Introduction to Structural Dynamics: Fundamental objectives of dynamic analysis -Types of prescribed loading – Method of discretization - Formulation of equations of motion by different methods - Direct equilibration using Newton's law of motion / D' Alembert's principle of virtual work and Hamilton Principle Single Degree of Freedom systems : Formulation and solution of the equation of motion – Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III:

Multi Degree of Freedom Systems: Selection of the degrees of Freedom - Evaluation of structural property matrices- formulation of the MDOF equations of motion -Undamped free vibrations – Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response - Normal co-ordinates - uncoupled equations of motion Orthogonal properties of normal modes - Mode super position procedure.

UNIT IV:

Practical Vibration Analysis: Introduction - stadola method - Fundamental mode analysis– Analysis of second and higher modes - Holzer method.

UNIT V:

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

Text Books:

1. Dynamics of Structures by Clough &Penzien, Mc Graw Hill New York
2. Structural Dynamics by Mario Paz, CBS Publishers New Delhi,

References:

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

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech (Structural Engineering)	**L**	**T/P/D**	**C**
	3	**1**	**4**

(STR06) COMPUTER AIDED DESIGN IN STRUCTURAL ENGINEERING

Course Objectives:

Student shall be able to

- **Understand** computer hardware, software requirements, design process and graphics
- **Formulate** stiffness matrix for beams and frames
- **Explain** fundamentals of FEA.
- **Understand** design optimization and expert systems.

Course Outcomes:

After the completion of the course, students should be able to

- **Explain** design process
- **Formulate** stiffness matrix for beams and frames
- **Apply** fundamentals of FEA for solving structural analysis problems
- **Perform** design optimization and **understand** Knowledge based expert systems.

UNIT I:

Introduction: Fundamentals of CAD - Hardware and software requirements - Design process - Applications and benefits - Graphic primitives - Transformations -Wire frame modeling and solid modeling -Graphic standards –Drafting packages.

UNIT II:

Structural Analysis: Structural analysis –stiffness matrix method; Application to beams and frames

UNIT III:

Finite Element Analysis: Fundamentals of finite element analysis – Discretization -Types of elements – shape function –plane stress and plane strain problems Analysis packages and applications.

UNIT IV:

Design and Optimisation: Principles of design of steel and RC Structures -Applications to simple design problems – Optimisation techniques - Algorithms - Linear Programming – Simplex method

UNIT V:

Expert Systems: Introduction to artificial intelligence - Knowledge based expert systems -Rules and decision tables –Inference mechanisms - Simple applications.

Text Books:

1. CAD/CAM, Computer Aided Design and Manufacturing by Groover M.P. and Zimmers E.W. Jr., Prentice Hall of India Ltd, New Delhi, 1993.
2. Computer Aided Design by Krishna moorthy C.S.Rajeev S., Narosa Publishing House, New Delhi, 1993

References:

1. Structural Analysis and Design by Harrison H.B., Part I and II Pergamon Press, Oxford, 1990.
2. Optimisation Theory and Applications by Rao S.S., Wiley Eastern Limited, New Delhi, 1977.
3. Expert System Principles and Case Studies by Richard Forsyth (Ed), Chapman and Hall, London, 1989.
4. Computational structural mechanics by S. Rajasekaran, G. Sankara subramanian, PHI Learning,2001

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-III / Elective-IV	**3**	**0**	**3**

(STR21) EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

Course Objectives:

Student shall be able to

- **Explain** the possible causes for earthquakes understanding seismology.
- **Understand the** principles of earthquake resistant deign of RC and masonry buildings
- Learn to **evaluate** base shears using IS methods
- **Detail** the structural members for Ductile requirements

Course Outcomes:

After the completion of the course, students should be able to

- **Predict** the sources of earthquakes understanding seismology and conceptually design the buildings
- **Apply** the Response Spectrum Analysis Method and static equivalent method for the **determination** of lateral loads on the buildings
- **Apply** ductility requirements for the design of structural components.
- **Assess** seismic performance of non-structural components and structural components and identify effective measures to mitigate potential damage.

UNIT I:

Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- plate seismic tectonics- waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales- Energy released-Earthquake measuring instruments-seismoscope, accelerograph, accelerograph- Characteristics of strong ground motions - Seismic zones of India.

UNIT II:

Conceptual Design: Introduction-Functional planning-continuous load path-overall form-simplicity and symmetry-elongated shapes-stiffness and strength-Horizontal and Vertical members-Twisting of buildings-Ductility-definition-ductility relationships, flexible buildings-framing systems-choice of construction materials-unconfined concrete-confined concrete, masonry-reinforcing steel. Introduction to earthquake resistant design: seismic design requirements-regular and irregular configurations - basic assumptions - design earthquake loads - basic load combinations- permissible stresses-seismic methods of analysis-factors in seismic analysis-equivalent lateral force method – response spectrum method -Time history method.

UNIT III:

Reinforced Concrete Buildings: Principles of earthquake resistant deign of RC members-structural models for frame buildings- seismic methods of analysis- seismic design methods- Is code based methods for seismic design- seismic evaluation and retrofitting- Vertical line-irregularities- plan configuration problems- Lateral load resisting systems- Determination of design lateral forces- Equivalent lateral force procedure- Lateral distribution of base shear. **Masonry Buildings:** Introduction-Elastic properties of masonry assemblage- Categories of

masonry buildings- Behaviour of unreinforced and reinforced masonry walls- Behaviour of walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour of masonry buildings- Load combinations and permissible stresses- seismic design requirements- Lateral load analysis of masonry buildings.

UNIT IV:

Structural Walls and Non-structural Elements: strategies in the location of structural walls- sectional shape+ variations in elevation- cantilever walls without openings- Failure mechanism of non-structures- Effects of non-structural elements on structural system- Analysis of non-structural elements- prevention of non-structural damage- Isolation of non-structures.

UNIT V:

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility' Requirements for Ductility- Assessment of ductility- Factors-affecting Ductility- Ductile detailing considerations as per IS 13920. Behaviour of beam, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquakes. Capacity Based Design: Introduction to capacity Design, Capacity Design for Beams and columns- Case studies.

Text Books:

1. Earthquake Resistant Design of Structures-S.K.Duggal, Oxford University Press, 2011
2. Earthquake Resistant Design of Structures-Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt.Ltd.,2006

References:

1. Seismic Design of Reinforced Concrete and Masonry Building -T Paulay and M.J.N. Priestly, John Wiley & Sons, 2009
2. D.J. Dowrick, Earthquake Resistant Design and Risk Reduction, 2nd Edition, Wiley India, 011.
3. Earthquake Resistant Design of Masonry Building ,MihaTomazevic, Imperial College Press, 2006
4. Earthquake Tips-Learning Earthquake Design and Construction- C.V.R.Murthy

Standards:

1. IS: 1893(Part-1)-2002, “Criteria for Earthquake Resistant Design of structures”, B.I.S., New Delhi
2. IS: 13920-1993, “Ductile detailing of Concrete structures subjected to seismic force”-guidelines, B.I.S. New Delhi

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-III / Elective-IV	**3**	**0**	**3**

(STR22) ADVANCED STEEL DESIGN

Course Objectives:

Student shall be able to

- **Compute** the Dead, Live and Wind loads acting on roofs.
- **Analyze** the multistory building frames for horizontal loads by approximate methods.
- **Calculate** the forces in the members of the steel truss girder bridges for various loads.
- **Understand** the Static and Kinematic methods of Plastic analysis.

Course Outcomes:

After the completion of the course, students should be able to

- Analyze the industrial buildings for various loads and design the various components.
- **Compute** the axial forces, shear forces and bending moments in beams and columns of a multistory building frame and can sketch SFD, BMD.
- **Design** the compression and tension members of a steel truss girder bridges.
- **Compute** the collapse loads, plastic moment capacities of continuous beams, portal frames and gable frames.

ELASTIC DESIGN:

UNIT I:

Analysis and Design of Industrial Buildings: Dead loads, live loads on roofs, Design wind speed, wind pressure and wind load on roofs, wind effect on cladding and louvers, Design of angular roof truss, Design of tubular roof truss, Truss for a railway platform, Design of purlins for roofs, Design of built-up purlins, Design of knee braced trusses and stanchions, Design of bracings.

UNIT II:

Analysis of Multistorey Frames : Approximate methods for lateral loads such as Portal method, Cantilever method and Factor method.

Space Frames: Types of space structures, Materials used in space frames, Advantages, Disadvantages & Practical difficulties, Analysis and design of towers.

UNIT III:

Design of Steel Truss Girder Bridges: Types of truss bridges, Component parts of a truss bridge, Economic proportions of trusses, Self weight of truss girders, Design of bridge compression members, tension members, Wind load on truss girder bridges, Wind effect on top lateral bracing, bottom lateral bracing, portal bracing and sway bracing.

PLASTIC DESIGN:

UNIT IV:

Analysts of Structures for Ultimate Load: Introduction, Shape factor, Static method of analysis, Mechanism method of analysis, Applications to continuous beams, rectangular portal frames, gable frames, inclined frames using instantaneous centre method, Methods for performing moment check, Trial and error method, Moment balancing method.

UNIT V:

Ultimate Deflections: Deflections at ultimate load, Applications to beams and frames, Principles of optimization in structural design, Application to some simple cases- Minimum weight design.

Text Books:

1. Design of Steel Structures by S. K. Duggal, Tata McGraw-Hill Publishers, 3rd Edition, 2008.
2. Design of Steel Structures -Vol. II by Dr. Ramachandra, Scientific Publishers.

References:

1. Comprehensive Design of Steel Structures by B.C. Punmia, Laxmi Publications, 1998.
2. Design Steel Structures by Edwin H. Gaylord, Charles N.Gaylord, James E. Stallmeyer, Tata McGraw-Hill Publishers, 3rd Edition, 1992.
3. The Plastic Methods of Structural Analysis by B.G.Neal, Spon Press, 3rd Edition, 1977.
4. Plastic Design of Steel Frames by Lynn S. Beedle, John Wiley & Sons, 1958.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-III / Elective-IV	**3**	**0**	**3**

(STR23) COMPOSITE MATERIALS

Course Objectives:

Student shall be able to

- **Develop** an understanding of the linear elastic analysis of composite materials.
- **Understand** the concepts such as anisotropic material behavior and the analysis of laminated plates.
- **learn** the underlying principles and techniques associated with the stress analysis and strength predictions of composite material structures.
- **Design** GRP Structures

Course Outcomes:

After the completion of the course, students should be able to

- **Analyze** problems on macromechanical behavior of composite lamina.
- **Understand** the Behaviour of Glass Fibre-Reinforced laminates
- **Design** GRP sections
- **Solve** the problems on bending, buckling, and vibration of laminated plates and beams.

UNIT I:

Introduction: Requirements of structural materials influence of nature of materials in structural form. Nature of structural materials- Homogeneous materials, composite materials.

UNIT II:

Macro Mechanical Properties of Composite Laminae: Introduction, Assumptions and Idealizations, stress strain relationship for composite Laminae- Isotropic, orthotropic laminae, strength characteristics – Basic concepts- hypothesis for isotropic and orthotropic laminae Macro mechanical Analysis of composite laminae, Introduction, Assumptions and Limitations, stiffness characteristics of glass reinforced laminae- Stress- Strain relationships in continuous discontinuous fibre laminae, strength characteristics of glass reinforced laminae- strengths in continuous, discontinuous fibre laminae.

UNIT III:

Behaviour of Glass Fibre-Reinforced laminates: Introduction, stiffness characteristics of Laminated composites-Behaviour of laminated beams and plates, strength characteristics of Laminated composites- Strength, analysis and failure criteria, Effect of inter laminar structures Glass Reinforced composites: Introduction - continuously reinforced laminates, uni-directional and multi directional continuously reinforced laminates, Discontinuously reinforced laminates - Stiffness and Strength properties.

UNIT IV:

GRP Properties Relevant to Structural Design: Introduction, short-term strength and stiffness-Tensile compressive, Flexural and Shearing' Long term strength and Stiffness properties, Temperature effects, Effect of Fire, structural joint Adhesive, mechanical, Combinational, Transformed sections.

UNIT V:

Design of GRP Box Beams: Introduction, loading, span and cross-sectional shape selection of material, Beam manufacture beam stresses, Experimental Behaviour, Effect on Beam performance- Modulus of long term loading. Design of Stressed skinned roof structural Introduction, loading and material properties, preliminary design, and computer analysis.

Text Books:

1. Mechanics of composite materials and Structures by Madhujith Mukhopadhyay, Universities Press.
2. Mechanics of Composite Materials by Robert M Jones, 2nd Edition, Taylor and Francis/BSP Books, 1998.

References:

1. New Concrete Materials by R.N. Swamy, 1st Edition, Blackie Academic and Professional, Chapman & Hall,1983
2. GRP in Structural Engineering by M. Holmes and D.J Just.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	L	T/P/D	C
Elective-III / Elective-IV	**3**	**0**	**3**

(STR24) PRESTRESSED CONCRETE

Course Objectives:

Student shall be able to

- **Realize** the necessity of pre-stressing the concrete structures.
- **Critically review** the techniques of prestressing ,both Pre-tensioning and Post-tensioning.
- **Design** the prestressed concrete members for ultimate limit state and limit state of serviceability.
- Realize the importance of the Statically Indeterminate structures and Load Balancing.
- **Analyze** and **design** continuous prestressed concrete beams with bent cables having straight and parabolic profiles.

Course Outcomes:

After the completion of the course, students should be able to

- **Realize** the importance of prestessing the long span structures and heavily loaded members.
- **Acquire** the knowledge of various prestressing techniques ;their merits and demerits.
- **Develop** skills in planning, analysis and design of prestressed concrete beams, and slabs.
- **Develop** skills to satisfy the serviceability and strength provisions of the Indian Standards (IS: 1343-2012).

UNIT I:

General Principles of Prestressed Concrete: Pre-tensioning and Post –tensioning, Prestressing by straight, concentric, eccentric, bent and parabolic tendons, Different methods and systems of prestressing like Hoyer system, Freyssinet system, Magnel-Blaton system and Lee-Mc call system.

Losses of Prestress : Loss of prestress 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 member and frictional loss. Analysis of sections for flexure.

UNIT II:

Design of Section for Flexure: Allowable stresses, Elastic design of simple beams having rectangular and I-section for flexure, kern lines, cable profile and cable layout.

Design of Sections for Shear: Shear and Principal Stresses, Improving shear resistance by different prestressing techniques - horizontal, inclined and vertical prestressing, Analysis of rectangular and l-beam, Design of shear reinforcement, Indian code provisions.

UNIT III:

Deflections of Prestressed Concrete Beams: Short term deflections of uncracked members, Prediction of long-time deflections, Load - Deflection curve for a PSC beam, IS code requirements for maximum deflections.

UNIT IV:

Transfer of Prestress in Pre-tensioned Members: Transmission of prestressing force by bond,Transmission length, Flexural bond stresses, IS code provisions.

Anchorage zone stresses in post-tensioned members: stress distribution in End block - Analysis by approximate, Guyon and Magnel methods, Anchorage zone reinforcement.

UNIT V:

Statically Indeterminate Structures: Advantages & disadvantages of continuous beams - Primary and secondary moments - P and C lines - Linear transformation, concordant and non-concordant cable profiles -Analysis of continuous beams.

Text Books:

1. Pre-stressed Concrete by Krishna Raju, Tata Mc.Graw Hill Publications,4th Edition,2006
2. Pre-stressed Concrete by N.Rajagopalan, Narosa publications, 2nd Edition,2014

References:

1. Pre-stressed Concrete by Ramamrutham, Dhanpat Rai & Sons Publications, 2nd Edition,2005
2. Pre-stressed Concrete Structures by P.Dayaratnam,Oxford & IBH Publishers, Fourth Edition
3. Design of Pre-stressed Concrete Structures by T.Y. Lin & N.H.Burns, John Wiley & Sons, 3rd Edition, 2005
4. Pre-stressed Concrete Structures by M.K.Hurst, Tata Mc-Graw Hill Publications, 2nd Edition, 2009

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-III / Elective-IV	**3**	**0**	**3**

(STR25) STABILITY OF STRUCTURES

Course Objectives:

Student shall be able to

- **Derive** the differential equations for beam columns
- **Understand** the Elastic Buckling of bars and frames
- **Understand**the Torsional Buckling
- **Analyse** lateral buckling of beams and plates

Course Outcomes:

After the completion of the course, students should be able to

- **Apply** the approximate methods based on energy to determine the stability of simple systems.
- **Differentiate** how the tangent modulus and double modulus theories of inelastic buckling led to the column paradox, thereby preventing further difficulties for a general theory of structures.
- **Analyse** elastic and in-elastic buckling of bars and frames
- **Analyse** the beams for lateral-torsional buckling

UNIT I:

Beam Columns: Differential equations for beam columns- beam columns with concentrated loads - continuous lateral loads-couples- beam columns with built in ends - continuous beams with axial load - application of trigonometrically series - Effects of initial curvature on deflections – Determination of allowable stresses.

UNIT II:

Elastic Buckling of Bars and Frames: Elastic Buckling of straight columns - Effect of shear stress on buckling - Eccentrically and laterally loaded columns- Buckling of frames large deflections of buckled bars-Energy methods- Buckling of bars on elastic foundations- Buckle line of bar with intermediate compressive forces - Buckling of bars with change in cross-section - Effect of shear force on critical load- built up columns.

UNIT III:

In-Elastic Buckling: Buckle line of straight bar- Double modulus theory - Tangent modulus theory, Inelastic lateral Buckling. Experiments and design formulae: Experiments on columns – Critical stress diagram - Empirical formulae for design - various end conditions

UNIT IV:

Torsion Buckling: Pure torsion of thin walled bars of open cross section - Non-uniform torsion of thin wall debars of open cross section-Torsional buckling-Buckling by torsion and flexure.

UNIT V:

Lateral Buckling of Simply Supported Beams: Beams of Rectangular cross-section subjected to pure bending. Buckling of simply supported Rectangular plates: Derivation of equation of plate subjected to constant compression in one and two directions.

Text Books:

1. Theory of elastic Stability by Timoshenko & Gere, Mc Graw Hill,2010
2. Stability of metallic structures by Blunch, Mc Graw Hill

References:

1. Theory of Beam- Columns ,Vol- I by Chem. &Atste, Mc. craw Hill
2. Structural Stability of Columns and Plates by N.G.R. Iyengar, Ellis Horwood Ltd, 1988.
3. Principles of Structural Stability Theory by Alexander Chajes, , Prentice Hall, 1974.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Elective-III / Elective-IV	**3**	**0**	**3**

(STR26) ANALYSIS & DESIGN OF SHELLS AND FOLDED PLATES

Course Objectives:

Student shall be able to

- **Understand** different types of shells and folded plates.
- **Know** different theories for the analysis.
- **Know** procedure to analyse the structures.
- **Differentiate** between different theories of analysis.

Course Outcomes:

After the completion of the course, students should be able to

- **Use** appropriate theory to analyse the shell structures.
- **Differentiate** a shell structure based on its properties.
- **Analyse** and **Design** shell structures
- **Understand** the structural importance of shells and folded plates.

UNIT I:

Shells: Functional behaviour - examples - structural behaviour of shells - classification of shells - Definitions - various methods of analysis of shells - merits and demerits of each method - 2D. Membrane equation. Equations of equilibrium: Derivation of stress resultants - cylindrical shells - Flugge's simultaneous equations.

UNIT II:

Derivation of the governing DKJ equation for bending theory - Schorer's theory - Application to the analysis and design of short and long shells - Beam theory of cylindrical shells: Beam and arch action, Analysis using beam theory.

UNIT III:

Introduction to the Shells of Double Curvature: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic paraboloid shells, inverted umbrella type.

UNIT IV:

Axi-Symmetrical Shells: General equation - Analysis of axi-symmetrical shells by membrane theory. Application to spherical shell and hyperboloid of revolution, cooling towers.

UNIT V:

Folded Plates: Introduction - Types of folded plates - structural behaviour of folded plates - advantages – Assumptions – Whitney's method of analysis - Edge shear equation - Analysis of folded plates by Whitney's method. Simpson's method of Analysis of folded plates - moment and stress distribution - no notation and rotation solutions - continuous folded plates - pre stressed continuous folded plates.

Text Books:

1. Design and Construction of Concrete Shell Roofs by G.S. Ramaswamy, CBS Publisher, 1st Edition, 2005.
2. Thin Shell Structures- Classical and Modern Analysis by J.N.Bandyopadhyay, New Age International Publishers, 1st Edition, 2014.

References:

1. Design of Reinforced Concrete Shells and Folded Plates by P.C.Varghese, PHI Learning Pvt. Ltd., 1st Edition, 2011.
2. Theory and Design of concrete shell roofs by Binoy Kumar Chatterjee, Chapman and Hall, 1st edition, 1988.
3. Thin shell concrete structures by David P. Billington, McGraw-Hill, 1st Edition, 1982.
4. Advanced Reinforced Concrete Design by Dr.N.Krishna Raju, CBS Publishers & Distributors, 2nd Edition, 2013.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Open Elective-II	**3**	**0**	**3**

(STR41) OPTIMIZATION TECHNIQUES IN ENGINEERING

Course Objectives:

Student shall be able to

- **Define** statement of optimization problem
- **Solve** optimization problems using linear programming
- **Solve** optimization problems using Dynamic programming
- **Optimize** structural elements like beams, trusses and framesand achieve efficient designs based on various applications and objective functions for professional practice.

Course Outcomes:

After the completion of the course, students should be able to

- **Understand** Engineering optimization.
- **Classify** and **formulate** the optimization problems.
- **Acquire** the concepts of linear programming & Dynamic programming.
- **Perform** network analysis

UNIT I:

Introduction to Optimization: Introduction - Historical developments – Engineering applications of optimization - statement of an optimization problem - classification of optimization problems - Optimization Techniques. Optimization by calculus: introduction - Unconstrained functions of a single variable - problems involving simple constraints _ Unconstrained functions of several variables - treatment of equality constraints _ Extension lo multiple equality constraints - Optimization with inequality constraints - The generalized Newton-Raphson method.

UNIT II:

Linear Programming: Introduction - Applications of linear programming - standard form of a linear programming problem - Geometry of linear programming problems - Definitions and theorems - Solution of a system of Linear simultaneous equations - pivotal reduction of a general system of equations - Motivation of the simplex Method - simplex Algorithm _ Two phases of the simplex method.

UNIT III:

Non-Linear Programming: Introduction - Unimoial Function - unrestricted search - Exhaustive search - Dichotomous search - Interval Halving method _ Fibonacci method - Golden section method- comparison of elimination methods _ Unconstrained optimization techniques- Direct search methods - Random search methods _ grid search method - Univariate method - Powell's method - simplex method – Indirect search methods - Gradient of afunction - steepest descent method - conjugate gradient - Newton's method.

UNIT IV:

Dynamic Programming: Introduction - Multistage decision processes - concept of suboptimization and the principle of optimality - computational procedure in dynamic programming - example illustrating the Calculus method of solution - example illustrating the tabular of solution - conversion of a final value problem into an initial value problem - continuous dynamic programming - Additional applications.

UNIT V:

Network Analysis: introduction - Elementary graph theory - Network variables and problem types - Minimum-cost route - Network capacity problems - Modification of the directional sense of the network.

Text Books:

1. Optimization: Theory and Applications by S.S. Rao, Halsted Press,2009
2. Numerical optimization Techniques for Engineering Design with applications by G.N.Vanderplaats, Tata Mc-Graw hill,1984

References:

1. Introduction to Optimum Design by J.S.Arora, Academic press,2004

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Open Elective-II	**3**	**0**	**3**

(HIG41) CONSTRUCTION TECHNOLOGY & PROJECT MANAGEMENT

Course Objectives:

Student shall be able to

- To **understand** role of project management
- To **learn** preparation of project Schedules, Life cycle cost.
- To **learn** about critical construction management
- To **understand** about on BOT, BOOT & PP projects

Course Outcomes:

After the completion of the course, students should be able to

- **Develop** Organization Structure of Construction Company
- **Estimate** Project Cost and Develop Cost Models
- **Prepare** Contract documents
- Arbitration and settlement of disputes, arbitration and conciliation Act

UNIT I:

Introduction to Project Management: Construction as industry and its challenges, Role of Project management, systems approach, systems theory and Concepts, Organisation, Management Functions, Overview of Management Objectives, Tools and Techniques, Life cycle of construction projects, time estimates and construction schedules, CPM and PERT, Linear programming, queuing concept, simulation, bidding models, game theory

UNIT II:

Project Cost Estimation: Approximate cost, detailed cost estimates, administrative approval and expenditure sanctions, rate analysis by client and contractor, bidding processes and strategies, Pre-qualification of bidders, construction equipment, equipment economics, various items of construction : Earthwork, Excavation. Earth- moving, Drilling, Blasting, dewatering, foundation, Finishing items, construction safety including of fire and electrical works

UNIT III:

Contract Management: Why law is critical to construction management, contract, its definition, Indian contract Act, documents forming a contract, Tendering and contractual procedures, stages of awarding contract, general conditions of Indian (domestic) contracts, General conditions of International contracts (FIDIC), contract administration; Duties and responsibilities of parties; important site documents, importance of standards and codes in contract documents.

UNIT IV:

Quality Management and Safety in Construction Industry: Quality control by statistical methods, sampling plan, control charts, ISO 14000, Safety Measures, Safety Programmes, Safety Awareness and Implementation of Safety Plan - Compensation

UNIT V:

Interpretation of Contract: Interpretation of contract in case of inconsistency, post contract problems, contract interpretation, concealed conditions, termination of contract, claims and disputes, dispute resolution techniques, negotiations, arbitration and settlement of disputes, arbitration and conciliation Act, alternate dispute resolutions, delay, liquidated damages, actual damages.

Text Books:

1. "A Guide to Quantity Surveyors, Engineers Architects and Builders(Vol I: Taking off quantities, Abstracting & Billing; Vol II: Analysis of Prices)" by Kharb, K.S.
2. "Building and Engineering Contracts" by Patil, B.S., Pune

References:

1. "Law relating to Building and Engineering Contracts in India" by Gajerai, G.T., Butterworths.
2. Construction Cost Engineering Handbook by Anghel Patterson - Marcel DekkenInc
3. Fundamentals of Construction Management and Organisations by K.Waker A Teraih and Jose M.Grevarn;
4. A Guide to the Project Management Body of Knowledge (PMBOK), Draft Copy, 1994. A Publication of the Project management Institute, USA.

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
Open Elective-II	**3**	**0**	**3**

(GTE41) GROUND-FOUNDATION-STRUCTURE INTERACTION

Course Objectives:

Student shall be able to

- To **develop** an understanding to function on multidisciplinary areas.
- To **introduce** the concepts and terminology of structure soil interaction.
- To **create** ability to identify, formulates, and solve foundation engineering problems.
- **Understanding** the impact of engineering solutions in economic and environmental context.

Course Outcomes:

After the completion of the course, students should be able to

- **identify**, **formulate** and **solve** geotechnical engineering problems.
- **design** a foundation system for economic and safe aspects for the society.
- **improvise** techniques, skills, and modern engineering tools necessary for necessary understanding in geotechnical engineering practice.
- **apply** the theoretical knowledge to solve real life problems in the field.

UNIT I:

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

UNIT II:

Beam on Elastic Foundation: Soil Models: Infinite beam, Two-parameters models, Isotropic elastic halfspace model, Analysis of beams of finite length, combined footings.

UNIT III:

Analysis of Finite Plates: Axis symmetric loading of circular plate, two-parameter elastic medium, elastic solid medium, Application of strain enerygy method. Rectangular plates-elastic medium, elastic solid medium. Numerical analysis of finite plates – Finite difference method, Finite element techniques, Discrete element method.

UNIT IV:

Analysis of Axially and Laterally Loaded Piles and Pile Groups: 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, Load deflection prediction for laterally loaded piles, Sub grade reaction and elastic analysis, Interaction analysis, Pile-raft system.

UNIT V:

Ground-Foundation-Structure Interaction: Effect of structure on ground foundation interaction, Static and dynamic loads.

Text Books:

1. Elastic Analysis of Soil-Foundation Interaction by Selvadurai, A. P. S., Elsevier, 1979
2. Pile Foundation Analysis and Design by Poulos, H. G., and Davis, E. H.,Wiley, 1980

References:

1. Foundation Analysis by Scott, R. F., Prentice-Hall, 1981
2. Foundation Design & Analyses by Bowles, J. E., Mc Graw Hill Education, Fifth Edition
3. Advanced Foundation Engineering by Das, B. M., Cengage learning, Seventh Edition, 2011

VNR Vignana Jyothi Institute of Engineering & Technology

I Year – II Sem. M.Tech. (Structural Engineering)	**L**	**T/P/D**	**C**
	0	**3**	**2**

(STR52) ADVANCED CAD LABORATORY

Course Objectives:

Student shall be able to

- **Understand** the importance of writing macros in Excel
- **Model** the physical problem in STAAD
- **Analyse** and interpret the post process results
- **Design** the structures for gravity & lateral loads as per Indian codes

Course Outcomes:

After the completion of the course, students should be able to

- **Write** program blocks in Excel
- **Preprocess** the structural elements/structures using STAAD.Pro
- **Analyse** the structural elements/structures
- **Design** the RC and Steel structural elements as per IS Codes.

1. Program for design of slabs using Excel
2. Program for design of beams using Excel
3. Program for design of column using Excel
4. Program for design of footings using Excel
5. Analysis of 2-D frame using STAAD Pro.
6. Analysis and design of truss using STAAD Pro.
7. Analysis of multi-storeyed space frame, using STAAD Pro.
8. Analysis of multi-storeyed buildings for lateral loads (Wind or Earthquake)

VNR Vignana Jyothi Institute of Engineering & Technology

I Year- II Sem. M.Tech (Structural Engineering)	L	T/P/D	C
	0	0	4

(STR62) MINI PROJECT – II

A mini project work shall be carried out on any topic of Structural Engineering and a seminar should be given on the same along with a brief report.

VNR Vignana Jyothi Institute of Engineering & Technology

II Year – I Sem. M.Tech (Structural Engineering)

L	T/P/D	C
0	0	4

(STR63) COMPREHENSIVE VIVA-VOCE

II Year – I Sem. M.Tech (Structural Engineering)

L	T/P/D	C
0	0	8

(STR71) INTERNSHIP / DISSERTATION PHASE- I

II Year – II Sem. M.Tech (Structural Engineering)

L	T/P/D	C
0	0	18

(STR72) DISSERTATION PHASE - II