ACADEMIC REGULATIONS
PROGRAM STRUCTURE
and
DETAILED SYLLABUS

Master of Technology
(Structural Engineering)
(Applicable for the Batches admitted from 2014-15)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

Gokaraju Rangaraju
Institute of Engineering and Technology, Hyderabad
M. Tech. GR14 Regulations

Gokaraju Rangaraju Institute of Engineering & Technology 2014 Regulations (GR14 Regulations) are given hereunder. These regulations govern the programmes offered by the Department of Civil Engineering with effect from the students admitted to the programmes in 2014-15 academic year.

1. **Programme Offered:** The programme offered by the Department is M.Tech in Structures, a two-year regular programme.

2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

3. **Admissions:** Admission to the M.Tech in Structures Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the Institute/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in PGECET conducted by the APSCHE for M. Tech Programmes or on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

4. **Programme Pattern**
   a) Each Academic year of study is divided into two semesters.
   b) Minimum number of instruction days in each semester is 90.
   c) The total credits for the Programme is 88.
   d) All the registered credits will be considered for the calculation of the final percentage of marks.

5. **Award of M.Tech Degree:** A student will be declared eligible for the award of the M. Tech Degree if he/she fulfills the following academic requirements:
   a) A student shall be declared eligible for the award of M.Tech degree, if he/she pursues the course of study and completes it successfully in not less than two academic years and not more than four academic years.
   b) A Student, who fails to fulfill all the academic requirements for the award of the degree within four academic years from the date of admission, shall forfeit his/her seat in M.Tech course.
   c) The Degree of M.Tech in Structures shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. Attendance Requirements

a) A student shall be eligible to appear for the end semester examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in a semester may be granted. A committee headed by Dean (Academic Affairs) shall be the deciding authority for granting the condonation.

c) Students who have been granted condonation shall pay a fee as decided by the Academic Council.

d) A candidate shall get minimum required attendance at least in three (3) theory subjects in the semester to get promoted to the next semester. In order to qualify for the award of M.Tech Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re-registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment

a) Paper setting and Evaluation of the Answer Scripts shall be done as per the procedures laid down by the Academic Council of the College from time to time.

b) The following is the division of marks between internal and external evaluations.

Particulars	Internal	External	Total
Theory	40	60	100
Practical	40	60	100
Comprehensive Viva	--	100	100
Seminar	50	----	50
Project Work	Grade	-----	----
Project work & dissertation (Grading System)	------	Grade	----

c) Continuous Internal Evaluation and Semester End Examinations The assessment of the student's performance in each course will be based on continuous internal evaluation and semester-end examinations. The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure

S.No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	40	Internal Exams & Continuous Evaluation	1. Mid-examinations: … 30 Marks (Two mid-semester examinations shall be conducted for 30 marks each for duration of 2 hours. Average of the two mid semester examinations shall be considered) 2. Tutorial: … … 5 Marks 3. Attendance: .. 5 Marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours
2	Practical	40	Internal Exams & Continuous Evaluation	1) Lab Internal :15 marks 2) Record : 5 marks 3) Continuous Assessment : 15 marks 4) Attendance : 5 marks
		60	Semester-end examination	The semester-end examination is for a duration of 3 hours.

d) Comprehensive Viva: There shall be a Comprehensive Viva-Voce in II Year I semester. The Comprehensive Viva-Voce will be conducted by the committee consisting of Head of the Department and two senior faculty members of the Department. The Comprehensive Viva-Voce is aimed to assess the student's understanding in various subjects he/she studies during the M.Tech course of study. The Comprehensive Viva-Voce is valued for 100 marks by the committee. There are no internal marks for the Comprehensive Viva-voce.

e) Seminar: There shall be three Seminar Presentations by the student, one each in the I,II and III semesters. For the seminar, the student shall collect the information on a specialized topic other than his/her project and prepare a technical report, showing his understanding over the topic, and

submit to the department, which shall be evaluated by a Departmental committee consisting of the Head of the department, seminar Supervisor and a senior faculty member. The seminar report shall be evaluated for 50 marks. There shall be no external examination for seminar.

f) Project: The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters (III & IV). Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the Project Review Committee (PRC).
   i) PRC shall be constituted with HOD as chair person, two senior faculty members and project supervisor.
   ii) Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).
   iii) A candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the PRC for its approval. Only after obtaining the approval of PRC the student can initiate the Project work.
   iv) If a candidate wishes to change his supervisor or topic of the project he/she can do so with approval of PRC. However, the PRC shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of supervisor or topic as the case may be.
   v) Project Work: The candidate should be continuously observed by the project supervisor. His performance is assessed by the PRC through a seminar and interim report. Full credits are awarded 'SAT' on satisfactory performance of the student. 'US' grade is given on unsatisfactory performance. If the performance is unsatisfactory, the PRC should redefined the project and the candidate is allowed to appear for the evaluation only after six months.
   vi) Project Work & Dissertation: A candidate shall submit status report (in a bound-form) in two stages at least with a gap of 3 months between them to the project supervisor.
   vii) A candidate is permitted to submit Project dissertation only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of dissertation to the Head of the Department and shall make an oral presentation before the PRC along with project supervisor.
   viii) Student has to submit to the department three copies of the Project dissertation along with a soft copy on CD certified by the supervisor.
   ix) The dissertation shall be adjudicated by one examiner selected by the Controller of examination from the panel of 3 examiners as

suggested by Head of the Department, who are eminent in that field with the help of the concerned guide and head of the department.

x) If the report of the Examiner is not favorable, the candidate shall revise and resubmit the dissertation, in the time frame as described by PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

xi) If the report of the examiner is favorable, viva-voce examination shall be conducted by a board consisting of the supervisor, Head of the Department and the examiner who adjudicated the dissertation. The Board shall jointly report candidates 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.

If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he/she fails to get a satisfactory report at the second viva-voce examination, he/she will not be eligible for the award of the degree.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for re-counting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Academic Requirements:**
    a) A student shall be deemed to have secured the minimum academic equirements in a subject if he / she 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 Internal Evaluation taken together.

b) In order to qualify for the award of M.Tech Degree, the student shall complete the academic requirements of passing in all the Courses as per the course structure including Seminars and Project if any.

c) In case a Student does not secure the minimum academic requirements in any course, he/she has to reappear for the Semester-end Examination in the course, or re-register for the same course when next offered or re-register for any other specified course, as may be required. However, one more additional chance may be provided for each student, for improving the internal marks provided the internal marks secured by a student are less than 50% and he/she failed finally in the course concerned. In the event of taking another chance for re-registration, both the internal and external marks obtained in the previous attempt are nullified. In case of re-registration, the student has to pay the re-registration fee for each course, when next offered.

13. **Award of Class:** After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of M. Tech Degree by JNTUH, he/she shall be placed in one of the following three classes:

Class Awarded	% of Marks Secured
First Class with Distinction	Marks ≥ 70%
First Class	60% ≤ Marks < 70%
Second Class	50% ≤ Marks < 60%

14. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he/she will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. **Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered eligible for re-registration to the same or equivalent subjects as and when they are offered.

17. General Rules

a) The academic regulations should be read as a whole for the purpose of any interpretation.
b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.
d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute/ University.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
M.TECH (Structural Engineering)

Structural - M.Tech - I Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5153	Numerical Methods of Structural Engineering	3	40	60	100
PC	GR14D5154	Theory of Elasticity and Plasticity	3	40	60	100
PC	GR14D5155	Theory and Analysis of plates	3	40	60	100
PC	GR14D5156	Advanced Reinforced Concrete Design	3	40	60	100
		Elective I	3	40	60	100
PE	GR14D5157	Advanced Concrete Technology				
	GR14D5158	Experimental Stress Analysis				
	GR14D5159	Optimization Techniques in Structural Engineering				
		Elective II	3	40	60	100
PE	GR14D5160	Advanced Structural Analysis				
	GR14D5161	Soil Dynamics and machine foundation Engineering				
	GR14D5162	Fibre Reinforced Cement Concretes				
LAB	GR14D5163	Advanced Concrete Lab	2	40	60	100
SPW	GR14D5175	Seminar-I	2	—	—	—
		Total	**22**	**280**	**420**	**700**

Structural - M.Tech- I Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
PC	GR14D5164	Finite Element Methods	3	40	60	100
PC	GR14D5165	Structural Dynamics	3	40	60	100
PC	GR14D5166	Analysis and Design of Shells and FoldedPlates	3	40	60	100
PC	GR14D5167	Advanced. Steel Design	3	40	60	100
		Elective III	3	40	60	100
PE	GR14D5168	Pre-stressed concrete				
	GR14D5169	Advanced Foundation Engineering				
	GR14D5170	Computer Aided Design in Structural Engineering (CAD)				
		Elective IV	3	40	60	100
PE	GR14D5171	Principles of Bridge Engineering				
	GR14D5172	Earthquake Resistant Design of Buildings				
	GR14D5173	Plastic Analysis and Design				
LAB	GR14D5174	CAD Lab	2	40	60	100
SPW	GR14D5176	Seminar-II	2	—	—	—
		Total	**22**	**280**	**420**	**700**

Structural - M.Tech - II Year, I Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5178	Comprehensive Viva	2	—	100	100
SPW	GR14D5177	Seminar-III	2	50	—	50
SPW	GR14D5179	Project work	18	Grade		
		Total	**22**	**50**	**100**	**150**

Structural - M.Tech - II Year, II Semester

Group	Sub-Code	Subject	Credits	Int	Ext	Marks
SPW	GR14D5180	Project work and Dissertation	22	Grade		

I-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

NUMERICAL METHODS OF STRUCTURAL ENGINEERING

Course Code: GR14D5153 L:3 T:0 P:0 C:3
I Year I Semester

Unit- I

Solutions of linear equations: Direct method – Cramer's rule, Guass – Elimination method- Gauss Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods Jacobi – Iteration method – Gauss – Siedel iteration, Successive over –relaxation method.

Eigen values and eigen vectors: Jacobi method for symmetric matrices-Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices –Power method.

Unit-II

Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

Unit-III

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas – Backward and forward and central differences-Derivation of Differentiation formulae using Taylor series- Boundary conditions-Beam deflection – Solution of characteristic value problems- Richardson's extrapolation- Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas- Numerical solution to spatial differential equations

Unit-IV

Numerical Differentiation: Difference methods based on undetermined coefficients- optimum choice of step length– Partial differentiation. Numerical Integration: Method based on interpolation-method based on undetermined coefficient – Gauss – Lagrange interpolation method- Radaua integration method- composite integration method – Double integration using Trapezoidal and Simpson's method.

Unit-V

Ordinary Differential Equation: Euler's method – Backward Euler method – Mid point method – single step method, Taylor's series method- Boundary value problems-case studies.

Text Books

1. M.K.Jain-S.R.K.Iyengar, R.K.Jain Numerical methods for scientific and engineering computations, Willey Eastern Limited, 1987
2. S.S.Shastry, Numerical methods.
3. Curtis I.Gerala, Applied numerical analysis, Addission Wasley published campus.

Reference Books

1. C.Chopra, Raymond P.Canal, Numerical methods for Engineers Stevan, Mc. Graw Hill book Company, 4th edition, 2002.
2. C.Xavier, C Language and Numerical methods, New age international publisher, 2003.
3. Dr. M.Shanta Kumar, Computer based numerical analysis, Khanna Book publishers, New Delhi.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

THEORY OF ELASTICITY AND PLASTICITY

Course Code: GR14D5154 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Introduction: Elasticity - notation for forces and stresses - 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 corier 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 stresses - 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 displacemets - 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 torsion 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. Timeshanko, Theory of Elasticity, McGrawhill Publications, 2010.
2. J.Chakarbarthy, Theory of Plasticity, McGrawhill Publications, 1987.

Reference Books

1. Y.C.Fung Theory of Elasticity.
2. Gurucharan Singh Theory of Elasticity.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

THEORY AND ANALYSIS OF PLATES

Course Code: GR14D5155 L:3 T:0 P:0 C:3
I Year I Semester

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-supported plate under simply sinusoidal load-Navier's solution- Application to 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 P.

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.

Finite Difference Methods: Introduction - Application to rectangular plates subjected to simple loading.

Text Books

1. Timoshenko, Theory of Plates and Shells, McGraw Hill Book Co., New York, 2nd edition, 2003.
2. P. Szilard, Theory and Analysis of Plates, Preintice Hall, 1973.

Reference Books

1. Chandrasekhar, Theory of Plates, University Press, 2001.
2. N. K. Bairagi, Plate Analysis, Khanna Publishers, New Delhi, 1986.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED REINFORCED CONCRETE DESIGN

Course Code: GR14D5156 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Over View of Reinforced concrete design: Behaviour in flexure, Design of singly reinforced rectangular sections, Design of doubly reinforced rectangular sections, Design of flanged beams, Design of shear, Design for Torsion, Limit state of Serviceability: Deflections of Reinforced concrete beams and slabs, short term deflection and long term deflection, estimation of crack width in RCC members, calculation of crack widths.

Unit-II

Limit 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-III

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 and two way shears - Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip.

Unit-IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels , Design of Procedure of Corbels, Design of Nibs.

Unit-V

Design of Compression members: Estimation of effective length of a column-Code requirements on Slenderness Limits, Design of Short Columns under Axial Compression, Design of Short Columns with Uniaxial Bending, Design of Short

Columns under Biaxial Bending, Design of Slender Columns.
Design of Combined Footings- Distribution of soil Pressure – Geometry of Two Column Combined Footing – Design Considerations in Combined Footing for Two – Columns.

Text Books

1. S. Unnikrishna Pillai & Menon, Reinforced concrete design, Tata Mc. Graw Hill, 2nd Edition, 2004.
2. P.C.Varghese, Advanced Reinforced Concrete Design, Preintice Hall, 2008.
3. Dr. S.R. Karve and Dr. V.L. Shah, Limit state theory and design of reinforced concrete, Standard publishers, Pune, 3rd Edition, 1994.
4. N.Krishna Raju, Advanced Concrete Design.

Reference Books

1. Kennath Leet, Reinforced concrete design, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
2. P.Purushotham, Reinforced concrete structural elements – behaviour, Analysis and design, Tata Mc.Graw-Hill, 1994.
3. Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Design of concrete structures, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Reinforced concrete structures, Vol.1, by, Laxmi Publications, 2004.
5. I.C. Syal & A.K. Goel, Reinforced concrete structures, S. Chand, 2004.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
ADVANCED CONCRETE TECHNOLOGY

Course Code: GR14D5157 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Concrete Making Materials: Cement- Bogues compounds-Hydration Process-Alkali silica reaction -Admixtures-Chemical and Mineral admixtures. Studies on Micro structure of concrete and applications of SEM (Scanned Electronic Microscope)

Unit-II

Fresh and Hardened Concrete: Fresh Concrete - work ability tests on Concrete Setting times of Fresh Concrete - Segregation and bleeding.
Hardened Concrete: Abram's law- Gel space ratios, Maturity Concept – Stress Behaviour – Creep and Shrinkage – Durability tests on concrete - Non destructive testing of concrete.

Unit-III

High Strength Concrete –Use of Nano materials – Manufacturing and Properties-Design of HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete.
High Performance Concrete- Requirements and properties of High Performance Concrete- Design Considerations.

Unit-IV

Special Concretes: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete –Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete, Bacterial concrete
Concrete mix design: Quality Control - Quality assurance - Quality audit- Mix Design method - BIS method, ACI method, DOE method, Mix Design for Blended concretes

Unit-V

Form work for concrete – materials – structural requirements – form work systems – connections – specifications – slip forms, permanent form work, latest form work– design of form work – shores – removal of forms – reshoring – failure of form work-case studies

Text Books

1. A.M.Neville, Properties of Concrete, ELBS publications, 4th pointing DECLO, 1996.
2. A.K. Santhakumar, Concrete Technology, Oxford Press, 2002.
3. M.S.Shetty, Concrete Technology, S.Chand & Co, 2005.

Reference Books

1. Rajat Siddique, Special Structural concretes, Galgotia Publications, 3rd edition, 1994.
2. N.Krishna Raju, Design of Concrete Mixes, CBS Publications, 2014.
3. P.K.Mehta, Concrete: Micro Structure, ICI, Chennai.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
EXPERIMENTAL STRESS ANALYSIS

Course Code: GR14D5158 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Basic equations and Plane Elasticity Theory: Introduction, Strain equations of Transformation, Compatibility, Stress-Strain Relations-Two dimensional State of Stress. The Plane-Elastic problem, The Plane-Strain Approach, Plane Stress, Airy's Stress function-Cartesian Co-ordinates-Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms.

Principles of Experimental Approach: Merit of Experimental Analysis introduction, uses of experimental stress analysis-Advantages of experimental stress analysis, Different methods, Simplification of problems.

Unit-II

Strain Measurement using Strain Gauges: Definition of strain and its relation to Experimental Determinations, properties of strain-gauge systems, Types of strain gauges, Mechanical and Optical strain gauges. Electrical Strain Gauges - Introduction, LVDT - resistance strain gauge - various types - gauge factor, Materials for adhesion base, etc.

Strain Rosettes: Introduction, The three element rectangular Rosette - The delta rosette - Corrections for Transverse strain effects.

Unit-III

Brittle Coating Method: Introduction, Coating stresses - Failure theories - Brittle coating Crack pattern - Crack detection - Types of Brittle coating - Test procedures for brittle coating analysis - Calibration procedures - Analysis of brittle coating data.

Unit-IV

Theory of Photo Elasticity: Introduction, Temporary double refraction - The stress optic law - Effects of stressed model in a Polaris cope for various arrangements - Fringe sharpening, Brewster stress optic law.

Unit-V

Two Dimensional Photo Elasticity: Introduction, Isochromatic Fringe patterns - Isoclinic fringe patterns, passage of light through plane Polaris cope and circular Polaris cope, Isoclinic fringe pattern - Compensation techniques - calibration methods, separation methods, scaling Model to Proto type stress- Materials for photo - elasticity, properties of photo elastic materials.

Text Books

1. Dr. Sadhu Singh, Experimental Stress Analysis, 3rd edition, Mc Graw Hill, 1991.
2. J.W.Dally and W.F.Riley, Experimental Stress Analysis, Mc Graw Hill, 1991.

Reference Books

1. Dove and Adams, Experimental Stress Analysis, 1st edition, 1964.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I
OPTIMIZATION TECHNIQUES IN STRUCTURAL ENGINEERING

Course Code: GR14D5159 L:3 T:0 P:0 C:3
I Year I Semester

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 to 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. non-Linear Programming: Introduction - Unimodal 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 a function - Steepest descent method - Conjugate gradient - Newton's method.

Unit-III

Dynamic Programming: Introduction - Multistage decision processes - concept of sub-optimization 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-IV

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.

Unit- V

Application of Optimization techniques to trusses, Beams and Frames.

Text Books

1. S.S.Rao, Optimization: Theory and Applications.
2. G. N.Vanderplaats, Numerical Optimization Techniques for Engineering Design with applications.

Reference Books

1. R.T.Haftka and Z.Gurdal, Elements of Structural Optimization.
2. U.Kirsch, Optimum Structural Design.
3. K.I.Majid, Optimum Design of Structures.
4. J.S.Arora, Introduction to Optimum Design.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE -II
ADVANCED STRUCTURAL ANALYSIS

Course Code: GR14D5160 L:3 T:0 P:0 C:3
I Year I Semester

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 - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element.
Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

Unit-II
Assembly of stiffness matrix from element stiffness matrix - direct stiffness method - general procedure - Rank 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 methods.

Unit-IV
Analysis of plane truss - continuous beam - plane frame and grids by stiffness methods.

Unit-V
Special analysis procedures - 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. William Weaver J.R and James M.Geve, Matrix Analysis of Frames structures, CBS publications, Delhi 2004.
2. Ashok.K.Jain, Advanced Structural Analysis, New Channel Brothers, 1996.
3. C.S.Reddy, Structural Analysis, 3rd edition, 2010.

Reference Books
1. Kanchi, Matrix Structural Analysis, 1995.
2. J.Meek, Matrix Methods of Structural Analysis, 3rd edition, 1980.
3. Ghali and Neyveli, Structural Analysis, 3rd edition , December, 1990.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
SOIL DYNAMICS AND MACHINE FOUNDATIONS

Course Code: GR14D5161 L:3 T:0 P:0 C:3
I Year I Semester

Unit-I

Introduction to soil dynamics: Fundamentals of vibration, natural frequency, resonance, simple harmonic motion, free and forced vibrations, single and multi degree freedom systems, Rayleighs method of fundamental frequency, logarithmic decrement, damping, transmissibility, vibrating measuring instruments.

Unit-II

Dynamic soil properties: Elastic properties, experimental determination, elastic waves and their characteristics, shear modulus.

Unit-III

Vibration analysis: Apparent soil mass, pressure bulb 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-IV

Types of machine foundations: General requirements, design criteria, permissible amplitudes, bearing pressure, constant force and rotating mass type excitation, magnification steady state vibrations.

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Unit- V

Design of machine foundations: 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. Braja M. Das and G.V.Ramana, Principles of soil dynamics, Cengage Learning, 2nd Edition, 2011.
2. Dr.Swami Saran, Soil dynamics and machine foundations, Galgotia Publications, 2nd edition, 2nd Reprint, 2010.

Reference Books

1. Prakash S and Puri V. K., Analysis and design of machine foundations, McGraw Hill, New York, 1993.
2. Srinivasulu P and Vidyanathan C.V., Hand Book of Machine Foundations, Tata McGraw Hill, New Delhi, 1981.
3. Richart, F.E.Mall J.R and Woods R. D., Vibration of soils and foundations, Prentice Hall Inc., 1970.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE II
FIBRE REINFORCED CEMENT CONCRETES

Course Code: GR14D5162 L:3 T:0 P:0 C:3
I Year I Semester

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 relationships for composite Laminae- Isotropic, Orthotropic laminae, Strength Characteristics- Basic concepts, Strength 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

Behavior 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-directionally and multi directionally 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 joints- 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 Elasticity, Compressive Strength, I value, prevention of compression buckling failure, Behaviour under long term loading.

Design of Stressed skinned roof structure: Introduction, loading and material properties, preliminary design, and computer analysis.

Text Books

1. M.Holmes and D.J.Just, GRP in Structural Engineering, Dec 1983.
2. Dr.V.S Gangadhrar & Dr.Vijay, Fibre Reinforced Concrete.

Reference Book

1. Manjunath Mukhopadhyay, Mechanics of Composite materials and Structures, Universities Press.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED CONCRETE LABORATORY

Course Code: GR14D5163 L:3 T:0 P:0 C:3
I Year I Semester

1. Tests on cement - Consistency, Setting times, Soundness, Compressive Strength.
2. Gradation Charts of Aggregates.
3. Bulking of fine Aggregate.
4. Aggregate Crushing and Impact value
5. Workability Tests on Fresh self compacting concrete
6. Air Entrainment Test on fresh concrete.
7. Marsh cone test.
8. Permeability of Concrete.
9. Non Destructive Testing of Concrete.
10. Accelerated Curing of Concrete.
11. Influence of W/C ratio on strength and Aggregate / Cement ratio on workability and Strength
12. Influence of Different Chemical Admixtures on concrete.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FINITE ELEMENT METHODS

Course Code: GR14D5164 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I
Introduction: Concepts of FEM - steps involved - merits and demerits - energy principles – discrimination - Raleigh - Ritz method of functional approximation.
Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

Unit-II
One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions for 1-D elements.
Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

Unit-III
Isoparametric formulation: Concept - different isoparametric elements for 2D 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 - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

Unit-V
Introduction to non – linear analysis – basic methods – application to Special structures. Application of FEM using softwares.

Text Books

1. GS Krishna Murthy, Finite element analysis, theory and progarmming, 3rd Edition, 1994.
2. Tirupathi Chandra Patila and Belugunudu, Introduction to Finite element Method.

Reference Books

1. Robert D.Cook, David S. Malkus and Michael E. Plesha, John Wiley & Sons, Concepts and Applications of Finite Element Analysis, International Edition, Oct 17, 2001.
2. OC Zienkiewicz, Finite element Methods, 1987.
3. JN Reddy, Introduction to Finite element Methods, 1993.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL DYNAMICS

Course Code: GR14D5165 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

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

Unit-II

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

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 superposition procedure.

Unit-IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure.

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

Unit-V

Introduction to Earthquake Analysis: Introduction - Excitation by rigid base translation - Lumped mass approach - SDOF and MDOF systems - I. S. Code methods of analysis for obtaining response of multi storeyed buildings.

Text Books

1. Clough & Penzien, Dynamics of Structures, McGraw Hill, New York, 1st January, 1975.
2. Mario Paz, Structural Dynamics, C.B.S Publishers, New Delhi, 2nd Edition, 2004.

Reference Books

1. Anil K. Chopra, Dynamics of Structures, Pearson Education (Singapore), Delhi, 4th Edition, 2011.
2. I.S: 1893 - 1984, “Code of practice for Earthquake resistant design of Structures” and latest I.S: 1893 - 2002 (version) Part-1

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALYSIS AND DESIGN OF SHELLS AND FOLDED PLATES

Course Code: GR14D5166 L:3 T:0 P:0 C:3
I Year II Semester

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 – Flugges simulations 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 curvatures: Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic parabolic shapes, inverted umbrella type.

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

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

Text Books
1. G.S.Ramaswami, Analysis and design of concrete shell roofs, 3rd Edition, 1994.
2. Chaterjee, Design of concrete shell roofs, 3rd Edition, 1990.

Reference Books

1. Billington, Design of concrete shell roofs, 3rd Edition, 1990.
2. N.K.Bairagi, Shell Analysis.
3. Dr.N.Krishna Raju, Advanced R.C Design.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED STEEL DESIGN

Course Code: GR14D5167 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Simple Connections –riveted, Bolted Pinned and Welded Connections: Riveted connections-Bolted Connections- Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip – Critical Connections – Praying Action – Combined Shear and Tension for Slip- Critical Connections. Design of Groove welds- Design of Fillet Welds- Design of Intermittent fillet welds- Failure of Welds.

Unit-II

Eccentric and Moment Connections: Introduction – Beams – Column Connections- Connections Subjected to Eccentric Shear – Bolted Framed Connections- Bolted Seat Connections – Bolted Brackete Connections. Bolted Moment Connections – Welded Framed Connections – Welded Brackete Connections - Moment Resistant Connections.

Unit-III

Analysis and Design of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular 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-IV

Esign 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; sway bracing.

Unit-V

Design of Steel Bunkers and Silos Introduction – Janseen's Theory – Airy's Theory – Design of Parameters – Design Criteria – Analysis of Bins – Hopper Bottom –Design of Bins.

Text Books

1. S.K. Duggal, Limit State Design of Steel Structures, Mc Graw Hill Education Private Ltd. New Delhi, 2nd Edition, 2010.
2. N. Subramanian, Design of steel structures.

Reference Books

1. P. Dayaratnam, Design of Steel Structures, Publisher: S. Chand, Edition 2011 – 12.
2. Dr. Ramachandra & Vivendra, Design Steel Structures Volume – II, Gehlot Scientitic Publishes Journals Department, 1st Dec, 2008, 9th Edition.
3. Galyord & Gaylord, Design of Steel Structures, Publisher; Tata Mc Graw Hill, Education. Edition , 2012.
4. Indian Standard Code – IS – 800-2007.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
PRE-STRESSED CONCRETE

Course Code: GR14D5168 L:3 T:0 P:0 C:3
I Year II Semester

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-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 and vertical prestressing – Analysis of rectangular and I-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 max deflections.

Unit-IV

Transfer of Prestress in Pretensioned 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 PSC beams-Primary and secondary moments-P and C lines-Linear transformation concordant and non- concordant cable profiles – Analysis of continuous beams and simple portal frames (single bay and single story)

Text Books

1. N. Krishna Raju, Prestressed concrete, Tata Mc Graw Hill Book – Co., New Delhi, 4th Edition, 2008.
2. S. Ramamrutham, Prestressed concrete, Dhanpat Rai & Sons, Delhi, 2nd Edition, 1983.

Reference Books

1. T.Y. Lin and Burn, John Wiley, Design of prestress concrete structures, New York, 3rd Edition, 1981.
2. Dayaratnam, Prestressed concrete.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE III
ADVANCED FOUNDATION ENGINEERING

Course Code: GR14D5169 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Bearing capacity of footings: Eccentric and Inclined Loading, Meyerhoff's and Hanse's theories, elastic settlement of footings embedded in sands and clays of infinite thickness, footings on soils of finite thickness, Schmertamaunn's method, Janbu and Morgenstern method.

Unit-II

Pile foundations: Settlement of pile groups resting in sands and clays, negative skin friction in single piles and groups of piles, under-reamed piles, specifications, load carrying capacity in sands and clays.

Unit-III

Well foundations: Types of well foundation, different shapes of wells, components of wells, functions and design, design criteria, sinking of wells, lateral stability by Terzaghi's analysis.

Unit-IV

Cantilever sheet piles and anchored bulkheads: Earth pressure diagram, determination of depth of embedment in sands and clays, timbering of trenches, earth pressure diagrams, forces in struts.

Unit-V

Foundations in Expansive soils: Problems in expansive soils, mechanism of swelling , swell pressure and swelling potential, foundation practices, sand cushion, CNS cushion, granular pile anchor technique, stabilization of expansive soils.

Text Books

1. Bowles, J.E., Foundation Analysis and Design, McGraw-Hill Publishing Company, New York, 5th edition (1997).
2. Braja M. Das, Principles of Foundation Engineering, Cengage Learning, New Delhi, 6th edition (2007), Reprint (2012).

Reference Books

1. Gopal Ranjan and ASR Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd, New Delhi, 2nd edition (2000), Reprint (2014).
2. V.N.S. Murthy, Soil Mechanics & Foundation Engineering, CBS Publications, Delhi, 2007.
3. Teng,W.C, Foundation Design, Prentice Hall, New Jersy, 13th edition, Reprint (1992).
4. Shamsher Prakash and Hari. D. Sharma, Pile foundations in engineering practice, John Wiley & sons, 1st edition, 1990.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE -III
COMPUTER AIDED DESIGN IN STRUCTURAL ENGINEERING

Course Code: GR14D5170 L:3 T:0 P:0 C:3
I Year II Semester

UNIT-I
Introduction to computer aided design-An over view-computer as a design medium hardware components of a computer -programming languages. C - Programming language-Introduction-An over view of programming in C-variables and data types- Declaration of variables-Initialization of variables-operators-arithmetic operators- precedence and associability-Input and output-Character I/O-Formatted output. Print f ()-Formatted input scan f ()- Examples.

Unit-II
C Programming Language-Control structures-If statement-Switch statement-loops-nested loops-while and for , Do-While-continue statement-Go to statement-Examples.
C Programming Language-Arrays-One dimensional Arrays-Two Dimensional Arrays-pointer operators- pointer arithmetic-pointers and arrays-Matrix manipulations using arrays and pointers-pointers to functions-data files-basic operations-reading and writing and file accessing files-examples.

Unit-III
Computer Graphics-introduction-applications graphic devices-display devices-output and input devices- two dimensional geometric transformations-homogeneous co-ordinates-world co-ordinates-device co- ordinates-window to view port-transformations-clipping operations.

Unit-IV
Data base management system-introduction-data base systems-hardware-software-users-operational data independence-architecture of data base system-distributed databases.

Unit-V
Knowledge based expert system-introduction-artificial intelligence-components of an expert system- stages in expert system development-knowledge representation-inference mechanisms-applications.

Text Book
1. C.S.Krishnamoorthy and S.Rajeev, Computer Aided Design.

Reference Book
1. S.Rajasekharan, Computational Structures.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE-IV
PRINCIPLES OF BRIDGE ENGINEERING

Course Code: GR14D5171 L:3 T:0 P:0 C:3
I Year II Semester

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-Sesmic loads- Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

Unit-II
Solid slab Bridges: Introduction-Method of Analysis and Design, via duct theory.

Unit-III
Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy, Gifford Mason method.

Unit-IV
Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in prestressed 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. N. Krishna Raju, Bridge Design.
2. M.G.Aswani, V.N.Vazirani and M.M.Ratwani, Design of Concrete Bridges.

Reference Books
1. E.C.Hambly, Bridge Deck Behaviour.
2. V.K.Raina, Concrete Bridge Design and Practice.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE -IV
EARTHQUAKE RESISTANT DESIGN OF BUILDINGS

Course Code: GR14D5172 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales- Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, 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-dynamic analysis-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 deign methods- IS code based methods for seismic design- Seismic evaluation and retrofitting- Vertical 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 shapes- 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 beams, 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. S. K. Duggal, Earthquake Resistant Design of structures, Oxford University Press.
2. Pankaj Agarwal and Manish Shrikhande, Earthquake Resistant Design of structures, Prentice of India Pvt. Ltd.,
3. T. Paulay and M.J.N. Priestly, John Wiley & Sons, Seismic Design of Reinforced Concrete and Masonry Building.

Reference Books

1. Anand S.Arya, Nemchand & Bros, Masory and Timber structures including earthquake Resistant Design.
2. Miha Tomazevic, Earthquake –Resistant Design of Masonry Building, Imperial college Press.
3. C.V.R. Murty, Earthquake Tips – Learning Earthquake Design and Construction.

Reference Books

1. IS: 1893 (Part-1) -2002. “Criteria for Earthquake Resistant – Design of structures.” B.I.S., New Delhi.
2. IS:4326-1993, “ Earthquake Resistant Design and Construction of Building”, Code of Practice B.I.S., New Delhi.
3. IS:13920-1993, “ Ductile detailing of concrete structures subjected to seismic force” – Guidelines, B.I.S., New Delhi.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE -IV
PLASTIC ANALYSIS AND DESIGN

Course Code: GR14D5173 L:3 T:0 P:0 C:3
I Year II Semester

Unit-I

Analysis of Structures for Ultimate Load: Fundamental Principles-statical method of Analysis-Mechanism method of analysis-Method of analysis, Moment check-Carry over factor-Moment Balancing Method.

Unit-II

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

Unit-III

Secondary Design Problems: Introduction-Influence of Axial force on the plastic moment-influence of shear force-local buckling of flanges and webs-lateral buckling-column stability.

Unit-IV

Design of Connections: Introduction-requirement for connections-straight corner connections-Haunched connection- Interior Beam-Column connections.

Unit-V

Design of Steel Frames: Introduction – Sinole span frames – simplified procedures for Sinole span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections: Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Sinole span frames.

Text Books

1. B.G.Neal, Plastic Analysis.

Reference Books

1. L.S.Beedle, Plastic Design of Steel Frames.
2. Horve, Plastic Analysis.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CAD LAB

Course Code: GR14D5174 L:0 T:0 P:3 C:2
I Year II Semester

1. Program using arrays and functions for matrix manipulation.
2. Programs to draw bending moment and shear force diagrams. Using graphic in C
3. Program for design of slabs using Excel
4. Program for design of beams using Excel
5. Program for design of column using excel
6. Program for design of footing using excel
7. Analysis of truss using STAAD Pro.
8. Analysis of multistoried space frame, using STAAD Pro & e-tab.
9. Analysis of Bridge deck slab.
10. Analysis & Design of Elevated tanks & Silos by using straps.