G. PULLA REDDY ENGINEERING COLLEGE (Autonomous): KURNOOL

Accredited by NBA of AICTE and NAAC of UGC

An ISO 9001:2008 Certified Institution

Affiliated to JNTUA, Anantapur

M.Tech Syllabus- Scheme 2017

(Structural Engineering)

Two Year M.Tech Programme (Scheme – 2017)

Scheme of Instruction and Examination

(Effective from 2017-18)

M.Tech I Semester **STRUCTURAL ENGINEERING**

S. No.	Course Code	Course Title	Credits	Scheme of Instruction periods / week			Scheme of Examination		
				L	T	P	End Exam Marks	Internal Assessment Marks	Total Marks
1	BS 801	Advanced Engineering Mathematics	3	3	-	-	60	40	100
2	CE 801	Theory of Elasticity	3	3	-	-	60	40	100
3	CE 802	Advanced Structural Analysis	3	3	-	-	60	40	100
4	CE 803	Theory and Analysis of Plates	3	3	-	-	60	40	100
5		Elective – I	3	3	-	-	60	40	100
6		Elective – II	3	3	-	-	60	40	100
7	AU 101	Technical English		2			-	-	-
8	CE 808	Structural Engineering Lab	2	-	-	3	50	50	100
		TOTAL	**20**	**20**	**-**	**3**	**410**	**290**	**700**

M.Tech II Semester **STRUCTURAL ENGINEERING**

S. No.	Course Code	Course Title	Credits	Scheme of Instruction periods / week			Scheme of Examination		
				L	T	P	End Exam Marks	Internal Assessment Marks	Total Marks
1	CE 804	Advanced Reinforced Concrete Design	3	3	-	-	60	40	100
2	CE 805	Advanced Structural Steel Design	3	3	-	-	60	40	100
3	CE 806	Stability of structures	3	3	-	-	60	40	100
4	CE 807	Structural Dynamics	3	3	-	-	60	40	100
5		Elective-III	3	3	-	-	60	40	100
6		Elective-IV	3	3	-	-	60	40	100
7	AU 102	Research Methodology		2			-	-	-
8	CE 809	Computer Aided Analysis and Design Lab	2	-	-	3	50	50	100
		TOTAL	**20**	**20**	**-**	**3**	**410**	**290**	**700**

M.Tech III and IV Semester **STRUCTURAL ENGINEERING**

S. No.	Course Code	Course Title	Credits	Scheme of Instruction periods / week			Scheme of Examination		
				L	T	P	End Exam Marks	Internal Assessment Marks	Total Marks
1	CE 901	Dissertation	12	-		-	50	50	100
		TOTAL	**12**	**-**	**-**	**-**	**50**	**50**	**100**

List of Electives

Description	Course Title	Course Code
Elective – I	Structural Optimization	CE 810
	Bridge Engineering	CE 811
	Low Cost Housing Techniques	CE 812
Elective –II	Advanced Concrete Technology	CE 813
	Prestressed Concrete	CE 814
	Prefabricated concrete structures	CE 815
Elective – III	Finite Element Methods	CE 816
	Experimental Stress analysis	CE 817
	Advanced Foundation Engineering	CE 818
Elective –IV	Earthquake Resistant Design of Structures	CE 819
	Analysis and Design of Shells and Folded Plates	CE 820
	Theory and Applications of Cement Composites	CE 821

ADVANCED ENGINEERING MATHEMATICS (AEM)

I Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
BS 801	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Understand and apply partial differential equations in solving hydrodynamics and fluid mechanics problems.

CO2: Apply numerical solutions in engineering, science and also in many branches of applied mathematics, e.g in fluid dynamics, boundary layer theory and heat transfer quantum mechanics.

CO3: Understand and apply Laplace Transforms and Fourier Transforms in many fields of learning such as mathematics, physical sciences and engineering

Matrices and Linear System of Equations:

Basic definitions and notations in matrix theory - Solutions of linear system - Direct methods - Gauss Jordan elimination method - Triangularisation method - Choleskey method - Jacobi iteration method - Gauss Siedel iteration method – Eigen value problem to determine Eigen values of symmetric tri -diagonal matrix

Partial Differential Equations

Formation by elimination of arbitrary constants and arbitrary functions - Solutions of equations by the methods of separation of variables in case of simple boundary conditions pertaining to (i) One dimensional wave equation and (ii) Two dimensional wave equation satisfied by vibrating membrane

Special Functions

Gamma and Beta functions Bessel function - Legendre polynomials - Recurrence relations for $J_n(x)$ and $P_n(X)$ - Orthogonality of legendre polynomials-Green's theorem - Spline function

Complex Variables and Laplace Transforms

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

Laplace Transforms: Laplace transformation of impulse function (Dirac-Delta function) and its applications to differential equation.

Numerical Methods

Numerical solutions of partial differential equations - Laplace and Poisson equations by iteration method, heat equation by Schmidt method.

Fast Fourier Transforms

Theory and Applications.

Text Books :
1. Dr.B.S. Grewal, "*Higher Engineering Mathematics",* Khanna Publishers, New Delhi.
2. N.P. Bali and M. Goyal, *"Engineering Mathematics",* Laxmi Publishers, New Delhi.
Reference Books :
1. Erwin Kreyszig, "*Advanced Engineering Mathematics"*, Wiley Estern.
Web References:
1.
2.
3.
Question Paper Pattern:
Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions. **End Exam:** The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

THEORY OF ELASTICITY (TE)

I Semester : SE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
CE 801	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs		

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

CO1: Analyse Plane stress problem.

CO2: Analyse Plane strain problem.

CO3: Analyse three dimensional stress problem

CO4: Analyse three dimensional strain problem

CO5: Analyse Prismatic bar subjected Torsion

Introduction:

Elasticity – Notation for forces and stresses – Components of stress – Components of strain – Hooke's law.

Plane Stress and Plane Strain Analysis:

Plane stress-plane strain-Differential equations of equilibrium – Boundary conditions – Compatibility equations – Stress function.

Two Dimensional Problems in Rectangular Coordinates

Solution by polynomials-Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems – Gravity loading

Two Dimensional Problems in Polar Coordinates

General Equation in polar co-ordinates – Stress distribution symmetrical about an axis – Pure bending of curved bars – Strain components in polar coordinates – Displacements for symmetrical stress distributions – Simple problems.

Analysis of Stress and Strain in Three Dimensions

Introduction – Principal stresses – Stress ellipsoid and stress-director surface – Determination of the principal stresses – Determination of the maximum shearing stress – Homogeneous deformation – Principal axes of strain – Rotation – Differential equations of equilibrium – Conditions of compatibility – Determination of displacements – Equations of equilibrium in terms of displacements

Torsion of Prismatic Bars

Torsion of prismatic bars – Elliptical cross section – Other elementary solutions – Membrane analogy – Torsion of rectangular bars.

Text Books :

1.Timoshenko, S & Goodier *"Theory of Elasticity"*, Mc Graw Hill Book Company.

2. Sadhu Singh *"Theory of Elasticity and Plasticity"*, Khanna Publishers.

Reference Books :
1.Papov *"Advanced Strength of materials"* , Mc Graw Hill Book Company.
2.Martin H. Sadd *"Elasticity Theory, Applications and Numerics"* Elsevier India Pvt. Ltd. Academic Press, New Delhi.
Web References:
1.
2.
3.
Question Paper Pattern:
Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions. **End Exam:** The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

ADVANCED STRUCTURAL ANALYSIS (ASA)

I Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 802	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Analyse continuous beam by stiffness & flexibility matrix methods

CO2: Analyse Rigid Jointed frames by Stiffness & flexibility matrix methods

CO3: Analyse Pin Jointed Structures by Stiffness & Flexibility matrix method

CO4: Formulate element and gloabal stiffness matrix by using direct stiffness method

CO5: Apply Equation solution Technique for Engineering problem

Indeterminacy

Determination of static and kinematic indeterminacies of two – dimensional and three dimensional portal frames – Pin-jointed trusses and hybrid frames – Coordinate systems – Structural idealization.

Introduction to Matrix Methods of Analysis

Flexibility and stiffness matrices – Force displacement relationships for axial force, couple, 8orsional moments - Stiffness method of analysis and flexibility method of analysis.

Analysis of Continuous Beams

Stiffness method and flexibility method of analysis - Continuous beams of two and three spans with different end conditions

Analysis of Two – Dimensional Pin Jointed Trusses

Stiffness and flexibility methods – Computation of joint displacement and member forces.

Analysis of Two – Dimensional Portal Frames

Stiffness and flexibility method of analysis of 2-D portal frames with different end conditions – Plotting of bending moment diagrams.

Transformation of Co-ordinates

Local and Global co-ordinate systems - Transformation of matrices from local to global coordinates of element stiffness matrix - Direct stiffness method of analysis - Assembly of global stiffness matrix from element stiffness matrices – Static condensation – Sub-structuring**.**

Equation Solution Techniques

Solution of system of linear algebraic equations – Direct inversion method – Gauss elimination method – Cholesky method – Banded equation solvers – Frontal solution technique.

Text Books :

1.C.S.Reddy, " *Structural Analysis*", Tata Mc Graw Hill Book Company

2.Pandit and Gupta, " *Structural Analysis*", Tata Mc Graw Hill Book Company.

Reference Books :

1. Coates, R.C., Couties,M.G., and Kong, F.K., "*Structural Analysis*", ELBS.
2. Mc Guire,W and Gallagher, R.H., "*Matrix Structural Analysis*", John Wiley and sons.
3. John L.Mek., "*Matrix Structural Analysis",* Mc Graw Hill Book Company
4. R.C.Hibbeler, "*Structural Analysis*", Shroff Publishers.
5. C.K. Wang, "*Intermediate Structural Analysis*", Standard Publications.
6. Madhu B. Kanchi, *"Matrix Methods of Structural Analysis",* New Age International Publishers
7. V.K. Manicka Selvam, "*Elements of Matrix and Stability Analysis of Structures*", Khanna Publishers

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

THEORY AND ANALYSIS OF PLATES (TAP)

I Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 803	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Analyse Rectangular plates subjected to concentrated, UDL and Hydro static Pressure

CO2: Analyse Orthotropic plates subjected to simultaneous bending and stretching using differential equations

CO3: Analyse Circular plates subjected to concentrated, UDL and Hydro static Pressure

CO4: Analyse Plate Problem using Numerical and approximate methods

Cylindrical Bending of Plates

Different kinds 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 of plates.

Small Deflection Theory of Thin Rectangular Plates

Assumptions – Derivation of governing differential equation for thin plates – Boundary conditions – solution of simply supported rectangular plates under various loading conditions viz. Sinusoidal load, U.D.L. and hydro static pressure - Navier and Levy's type of solutions for various boundary conditions.

Circular Plates

Symmetrical bending of circular plates – Relation between slope, deflection, moments and curvature – Governing differential equation – plates loaded at the centre, uniformly loaded and concentrically loaded plates, with clamped and simply supported edges – Central hole – bending by moments and shearing forces uniformly distributed.

Plates under Simultaneous Bending and Stretching

Derivation of the governing differential equation- rectangular plates with simply supported edges subjected to U.D.L.

Orthotropic Plates

Introduction – Bending of anisotropic plates - Derivation of the governing differential equation - applications to the of Grid works.

Numerical and Approximate Methods

Energy solutions by Ritz and Galerkin methods. Finite difference and Finite Element methods of analysis for plate problems.

Text Books :

1.S.Timoshenko, and S. Woinowsky-Krieger, "*Theory of Plates and Shells*", Tata Mc Graw Hill Education Pvt.Ltd., New Delhi..

Reference Books :
1. K.Chandrasekhara. "*Theory of Plates*", Universities Press (India) Pvt.Ltd.
2.S.S.Bhavikatti, " *Theory of Plates and Shells*", New Age International(P) Ltd, Publication, New Delhi.
Web References:
1.
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3.
Question Paper Pattern:
Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions. **End Exam:** The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions. **End Exam:**

TECHNICAL ENGLISH (TE)

I Semester: Common for All M.Tech Programmes					Scheme: 2017			
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	Foundation	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
		2	**-**	**-**	**-**	**-**	**-**	**-**
Sessional Exam Duration: -					**End Exam Duration: -**			

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

CO 1: write Technical Reports, Journal Papers and Project Reports.

CO 2: write Job Applications, Resumes and Statements of Purpose.

Course Content

1. Technical Reports –Formats and Styles
   a) Feasibility Report
   b) Factual Report
   c) Project Reports
2. Journal Papers- Formats
3. Paper Presentation Strategies
4. Statement of Purpose for Internships and Apprenticeships
5. Letter Writing- Job Applications, Resume Preparation
6. Common Errors in Research Papers

Reference Books:

1. Sangeeta Sharma & Binod Mishra, Communication Skills for Engineers and Scientists, PHI Learning Private Limited.
2. M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw-Hill Publishing Company Ltd., 2005.
3. Thomas S. Kane , The Oxford Essential Guide to Writing, OUP, 2010
4. Joan van Emden, A Guide to Technical Report Writing http://scisweb.ulster.ac.uk/~projects/guide-to-technical-writing-1.pdf

STRUCTURAL ENGINEERING LABORATORY (SEP)

I Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 808	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		-	3	2	50	50	100
				End Exam Duration: 3 Hrs			

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

ADVANCED REINFORCED CONCRETE DESIGN (ARCD)

II Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 804	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Apply serviceability criteria for R.C. elements

CO2: Design deep beams, ribbed (voided) slabs

CO3: Design Grid floors, flat slabs

CO4: Design plain concrete walls

CO5: Design shear walls

Estimation of Crack Width and Redistribution of Moments in Reinforced Concrete Beams

Limit State of cracking – Cracking in R.C. members – Causes, mechanism and effects of cracking – Classification and effect of cracks - Factors affecting crack width in beams - Calculation of crack width - Empirical method -Estimation of crack width in beams by IS 456 - Shrinkage and thermal cracking - Redistribution of moments in a fixed beam and a two-span continuous beam - Advantages and disadvantages of moment redistribution – Moment-Curvature relation of reinforced concrete sections.

Design of Deep Beams and Corbels

Steps of designing deep beams by IS 456 – Detailing of deep beams – Design of corbels.

Design of Ribbed (voided) Slabs

Analysis of the ribbed slabs for moment and shears - Design for shear – Deflections - Arrangement of reinforcements.

Design of Grid Floors

Introduction – Design of grid floors by IS Code method.

Design of Flat Slabs

Introduction - Advantages and disadvantages of flat slabs - Design of flat slabs using direct design method and equivalent frame method – Design for interior panel.

Design of Plain Concrete Walls

Braced and unbraced walls - Eccentricities of vertical loads - Empirical design method (walls carrying axial load) - Design of wall for In-plane horizontal forces.

Design of Shear Walls

Classification of shear walls - Loads in shear walls - Design of rectangular and flanged shear walls - Moment of resistance of rectangular shear walls

Text Books :

1. P.C. Varghese, "*Advanced Reinforced Concrete Design*", Prentice-Hall of India, Private Ltd., New Delhi.

2. N. Krishna Raju, "*Advanced Reinforced Concrete Design-SI Units*" CBS, New Delhi.

3.S.S.Bhavikatti, "A*dvanced R.C.C.Design (R.C.C.,Vol. II)"*, New Age Intl.Publishers Pvt. Ltd., New Delhi.

Reference Books :

1. V.L.Shah and S.R.Kharve, "*Limit State Theory and Design of Reinforced concrete*", Standard Publishers, New Delhi.
2. S. Unnikrishn Pillai and Devdas Menon *" Reinforced Concrete Design"*, Tata Mc.GrawHill
3. H.J. Shah, "*Reinforced Concrete.Vol. II (Advanced Reinforced Concrete)*" Charotar Publishing House Pvt. Ltd., Anand
4. Blume, J.A., New mark, N.M and Corning, L.M, "*Design of Multi Storey Reinforced Concrete Buildings for Earthquake Motion*", Portland cement Association, Chicago.
5. I.S. Codes: *IS 456 & IS 13920*.

Web References:

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

ADVANCED STRUCTURAL STEEL DESIGN (ASSD)

II Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 805	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Design compression and Flexural members using light gauge steel sections

CO2: Analyse and design Transmission towers

CO3: Analyse and design continuous beams and portal frames using plastic theory

CO4: Design Tension members and laterally restrained beams using limit state method.

Light Gauge Steel Structures

Light gauge steel – Types of sections – Specifications- Permissible stresses.
Compression members – Local buckling of elements - Stiffened compression elements –Computation of permissible stresses – Design of columns.
Flexural members – Bending- Deflection - Local buckling of compression elements – Laterally supported and unsupported beams – Computation of permissible stresses – Design of beams- Connections – Various methods – Welding.

Transmission Line Towers

Introduction - Types of towers - Tower configuration – Loads – Analysis and design of self supporting simple towers.

Plastic Design

Analysis and design of continuous beams, Portal frames (up to two bay two storey) and single span gable frames.

Limit State Design

Introduction - Characteristic strength – Characteristic load – Partial safety factor – Limit state of collapse in flexure and shear – Limit state of serviceability.

Design of Tension Members

Introduction-Types of tension members-Types of sections-Slenderness ratio-Net area of cross section-Design of tension members-Lug angles.

Design of Beams

Introduction-Effective length of compression flange-Design of laterally restrained beams and unrestrained beams.

Design of Compression Members

Design of Plain and built up compression members.

Text Books :

1.N. Subramanian, "*Design of Steel Structures*", Oxford University press, New Delhi

2. Ramachandra, "*Design of Steel Structures - Vol.II*", Scientific Publishers.

Reference Books :

1. S.K.Duggal and L.S.Beedle, "*Limit State Design of Steel Structures",* Tata Mc.Graw Hill.
2. (ISI)-No.6, "*Structural Engineers Handbook*", Bureau of Indian Standard
3. Arya and Ajmani, "*Design of Steel Structures*", Nem Chand Publishers.
4. S.R. Satish and A.R. Santha Kumar, "*Design of Steel Structures I & II"*.
5. Wei-wen YU , "*Cold – Formed Steel Structures*", Mc. Graw hill book co.
6. *Structural Steel Design INSDAG Vol.I,* Institute for Steel Development & Growth, Calcutta
7. IS Codes: *IS 800, IS 802, IS 875 (Part1), IS 801& IS 811*
8. Handbook of Transmission Tower Design, Central Power Research Institute.

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

STABILITY OF STRUCTURES (SS)

II Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 806	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Analyse Beam-Column subjected to Axial and Later loads

CO2: Analyse elastic and inelastic buckling of bars

CO3: Understand the various numerical methods for treatment of stability problems in buckling

CO4: Analyse Thin walled Bars of open cross section subjected to Torsional Buckling

CO5: Analyse Simply supported beams of rectangular cross section subjected to Later buckling

Beam Columns

Differential equation for beam columns - Beam column with concentrated loads - Continuous lateral load - Couples - Beam column with built in ends - Continuous beams with axial load.

Elastic Buckling of Bars

Elastic buckling of straight columns - Effect of shear stress on buckling - Eccentrically and laterally loaded columns - Energy methods -Buckling of a bar on elastic foundation-Buckling of bar with intermediate compressive forces and distributed axial loads-Buckling of bars with change in cross section-Effect of shear force on critical load-Built up columns.

Inelastic Buckling

Buckling of straight bars-Double modulus theory-Tangent modulus theory.

Mathematical Treatment of Stability Problems

Buckling problem - Orthogonality relation-Ritz method-Timoshenko method and Galerkin method.

Torsional Buckling

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

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 two directions and one direction

Text Books :

1. Stephen P. Timoshenko and James M. Gere., " *Theory of Elastic Stability*",McGraw Hill Book company.

Reference Books :

1. Blunch- "*Stability of Metallic Structure*", Mc Graw Hill.
2. Chem. & Atsute "*Theory of Beam Columns, Vol I*" Mc Graw Hill.
3. Smitses, " *Elastic Stability of Structures*" ,Prentice Hall.
4. Brush and Almorth, "*Buckling of Bars, Plates and Shells*" , Mc Graw Hill book company.
5. Chajes,A., " *Principles of Structural Stability Theory*", Prentice Hall.
6. Ashwini Kumar, " *Stability theory of Structures"* , Tata Mc Graw Hill Publishing company Ltd, New Delhi.
7. Bleaigh " *Elastic Stability*", Tata Mc Graw Hill Publishing Company Ltd, New Delhi

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

STRUCTURAL DYNAMICS (SD)

II Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 807	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Analyse the effects of free vibrations on SDOF systems

CO2: Analyse the effects of forced vibrations on SDOF systems

CO3: Analyse the effects of free vibrations on MDOF systems

CO4: Analyse the effects of forced vibrations on MDOF systems

CO5: Understand the concepts of practical vibration analysis

Theory of Vibrations

Introduction - Elements of a vibratory system - Degrees of freedom - Continuous systems – Lumped mass idealization - Oscillatory motion - Simple harmonic motion - Free vibrations of single degree of freedom (SDOF) systems – Undamped and damped - Critical damping - Logarithmic decrement - Forced vibrations of SDOF systems - Harmonic excitation - Dynamic magnification factor - Bandwidth.

Introduction to Structural Dynamics

Fundamental objective of dynamic analysis - Types of prescribed loading - Methods of descretization - Formulation of the equations of motion.

Single Degree of Freedom System

Formulation and solutions of the equation of motion –Free vibration response - Response to harmonic, periodic, impulsive and general dynamic loading - Duhamel integral.

Multi Degree of Freedom System

Selection of the degree of freedom - Evaluation of structural property matrices - Formulation of MDOF equations of motion - Undamped free vibrations - Solution of Eigen value problem for natural frequencies and mode shapes - Analysis of dynamic response – Normal coordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

Practical Vibration Analysis

Stodola method - Fundamental mode analysis – Analysis of second and higher modes - Holzer method - Basic procedure - Transfer matrix procedure.

Text Books :

1. Clough & Penzien, "*Dynamics of Structures*", Mc-Graw Hill Publications.

2.Mario Paz, "*Structural Dynamics*", CBS Publications.

Reference Books :

1.A.K. Chopra, *"Dynamics of structures Theory and Applications to Earthquake Engineering"*, Pearson Education, New Delhi.

Web References:

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

RESEARCH METHODOLOGY (RM)

I Semester : Common for All M.Tech Programmes					Scheme : 2017			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
	Foundation	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		2	-	-	-	-	-	-
Sessional Exam Duration : -					End Exam Duration: -			

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

CO1: Understand overview of research process, state the research problem and conduct a literature review of the concepts comprising the research questions.

CO2: Study the data collection methods and process the data statistically.

CO3: Understand the basic properties of estimators, analyse the estimated data and interpret the data in a research paper.

Meaning, Objective and Motivation in Research

Types of Research, Research Approaches, Research Process, Validity and Reliability in Research. Features of Good Design, Types of Research Design, Basic Principles of Experimental Design, Steps in Sampling Design, Characteristics of a Good Sample Design, Random Samples and Random Sampling Design.

Measurement and Scaling Techniques

Errors in Measurement, Tests of Sound Measurement, Scaling and Scale Construction Techniques, Forecasting Techniques, Time Series Analysis, Interpolation and Extrapolation.

Methods of Data Collection

Primary Data, Questionnaire and Interviews, Collection of Secondary Data, Cases and Schedules.

Statistical Processing

Correlation and Regression Analysis, Method of Least Squares, Regression Vs. Correlation, Correlation Vs. Determination, Types of Correlation and Their Specific Applications.

Hypothesis Testing

Tests of Hypothesis, Parametric Vs. Non-Parametric Tests, Procedure for Testing Hypothesis, Use of Statistical Techniques for Testing Hypothesis, Sampling Distribution, Sampling Theory Chi-Square Test, Analysis of Variance and Covariance, Multivariable Analysis

Interpretation of Data

Data interpretation, Layout of a Research Paper, Techniques o f Interpretation.

Reference Books :

1. C.R. Kothari, *Research Methodology (Methods & Techniques)*, New Age International Publishers.
2. R.Cauvery, V.K.Sudha Nayak, M.Girija, Research Methodology, S.Chand Publishers.

COMPUTER AIDED ANALYSIS AND DESIGN LAB (CAADP)

II Semester : SE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
CE 809	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
		-	3	2	50	50	100
					End Exam Duration: 3 Hrs		

1. Introduction to STAAD - Pro package.
2. Analysis and Design of R.C.C. Beams, Slabs and Columns subjected to axial forces Uni-axial bending and Biaxial bending.
3. Analysis and Design of Steel Plane Truss subjected to gravity forces and joint forces.
4. Analysis and Design of Steel and Concrete space building frame subjected to gravity and wind forces.
5. Analysis and Design of Steel and Concrete building frame subjected to gravity forces and earthquake forces.
6. Analysis and Design of R.C.C. retaining Walls.
7. Analysis and Design of Industrial space truss for gravity and wind forces.
8. Analysis and Design of Gantry Girder for moving loads.

STRUCTURAL OPTIMIZATION (SO)

(Elective I for M. Tech-I Semester)

I Semester : SE					**Scheme : 2017**		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 810	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1: Apply Optimization techniques, linear optimization and simple algorithm

CO2: Apply one dimensional minimization methods

CO3: Apply Non-linear optimization methods, Fletchers Reeaves' method Davidon- Fletchers-Powell method

CO4: Apply Non-linear constrained optimization methods, Dynamic programming, Integer programming methods

CO5: Apply Optimization Techniques for simple structures- minimum weight design using plastic theory

Introduction

Introduction to optimization techniques - Problem formation and objective function - Linear optimization - Geometry of linear programming - Simple algorithm - Duality in Linear Programming.

Non- Linear Optimization-I

One dimensional minimization methods - Exhaustic search, Dichotomous search and direct root methods.

Non- Linear Optimization-II

Direct search method - Random search methods - Descent method – Steepest descent methods - Fletcher- Reeaves' method, Davidon – Fletcher - Powell method.

Non- Linear Constrained Optimization

Cutting plane method and penalty function methods -Geometric plane programming - Dynamic Programming and integer programming.

Application of Optimization techniques for simple structures of homogeneous materials -Problem formulation for structures of non-homogeneous materials - Minimum weight design of structures using plastic theory.

Text Books :

1. S.S.Rao, "*Optimization Theory & Applications"*, Wiley Eastern Ltd.

Reference Books :

1. Urikirsch, "*Optimum Structural Design*", McGraw Hill.
2. Spunt, "*Optimum Structural Design, Civil Engineering and Engineering Mechanics*", Prentice Hall.
3. Richard Brownson, "*Operations Research*", Schaum's outlines, Mc Graw Hill Ltd.

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

BRIDGE ENGINEERING (BE)

(Elective I for M. Tech- I Semester)

I Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 811	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Design Box Culvert and Deck slab Bridge by using working stress method

CO2: Design T-Beam Bridges for IRC loading using working stress method

CO3: Design Prestressed concrete bridges for IRC loading

CO4: Understand the concepts of Ball bearings and Pad bearings

CO5: Design Pier and Abutments

Introduction

Classification – Investigations and planning - choice of type – Economic span length - IRC specifications for road bridges – Standard live loads – Other forces acting on bridges – General design considerations.

Design of Box Culverts

General aspects - Design loads - Design moments, shears and thrusts - Design of critical section.

Design of Deck Slab Bridges

Effective width analysis - Working stress design and detailing of deck slab bridges for IRC loading.

Design of T-Beam Bridges

Introduction - Wheel load analysis – Bending moments in slab - Pigaud's theory – Analysis of longitudinal girders by courbon's theory - Working stress design and detailing of reinforced concrete T- beam bridges for IRC loading.

Prestressed Concrete Bridges

General features - Advantages of prestressd concrete bridges - Pretensioned prestressed concrete bridges - Post tensioned prestressed concrete bridge decks - Design of post tensioned prestressed concrete slab bridge deck.

Bridge Bearings

General features - Types of bearings - Forces on bearings - Basis for selection of bearings-Design principles of steel rocker and roller bearings and its design – Design and detailing of elastomeric pad bearing.

Piers and Abutments

General features - Bed block - Materials for piers and abutments - Types of piers - Forces acting on

piers - Design of pier - Stability analysis of piers - General features of abutments -Forces acting on abutments - Stability analysis of abutments.

Text Books :

1. D.Johnson Victor, "*Essentials of Bridge Engineering*", Oxford & IBH Publishers Co. Pvt. Ltd.
2. N.Krishna Raju, "*Design of Bridges*", Oxford & IBH

Reference Books :

1. Mc Aswanin, VN Vazarani and MM Ratwani, "*Design of Concrete Bridges*", Khanna Publishers.
2. S. Ponnuswamy, "*Bridge Engineering*", Tata Mc Graw Hill Publishing Co.
3. Rowe R.E., "*Concrete Bridge Design*", C.R. Books Ltd. London.
4. Taylor F.W., Thomson,S.E., and Smulski E, "*Reinforced Concrete Bridges*", John Wiley and Sons, New York.
5. Derrick Beckett, "*An Introduction to Structural Design of Concrete Bridges*", Surrey University press, Henley-thomes, Oxford shire.
6. Bakht. B and Jaegar, L.G. "*Bridge Analysis Simplified*", Mc Graw Hill.
7. FR Jagadeesh, M.A. Jay Ram, "*Design of Bridge Structures*", Eastern economy edition.
8. MORTH - Specifications for Road & Bridge Works, 5th Revision 1

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

LOW COST HOUSING TECHNIQUES (LCHT)
(Elective I for M. Tech- I Semester)

I Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 812	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Understand Housing Scenario and Housing Finance

CO2: Apply Building by-laws for urban planning and Housing for Poor

CO3: Apply Low Cost Housing Techniques

CO4: Use Building Materials for low cost Housing

CO5: Apply concepts of Traditional practices of Rural Housing Technology

Housing Scenario

Introduction – Status of urban housing – Status of rural housing.

Housing Finance

Introduction - Existing finance system in India – Government role as facilitator – Status at rural housing finance – Impediments in housing finance and related issues.

Land Use and Physical Planning for Housing

Introduction – Planning of urban land – Urban land ceiling and regulation act – Effectiveness of building bye laws – Residential densities.

Housing the Urban Poor

Introduction – Living condition in slums – Approaches and strategies for housing urban poor.

Development and Adoption of Low Cost Housing Technology

Introduction – Adoption of innovative cost effective construction techniques - Adoption of precast elements in partial prefabrication - Adoption of total prefabrication of mass housing in India – General remarks on pre cast roofing/ flooring systems – Economical wall system – Single brick thick load bearing wall – 19 cm thick load bearing masonry walls – Half brick thick load bearing wall – Fly ash - gypsum brick for masonry – Stone block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building.

Alternative Building Materials for Low Cost Housing

Introduction – Substitute for scarce materials – Ferrocement – Gypsum boards – Timber substitutions - Industrial wastes - Agricultural wastes.

Low Cost Infrastructure Services:

Introducing - Present status - Technological options - Low cost sanitations - Domestic wall - Water

supply, energy.

Rural Housing

Introduction - Traditional practice of rural housing - Mud housing technology -Mud roofs - Characteristics of mud - Fire resistant treatment for thatched roof - Soil stabilization - Rural housing programmes.

Housing in Disaster Prone Areas

Introduction – Earthquake - Damages to houses - Traditional houses in disaster prone areas -Type of damages in non-engineered buildings - Repair and restore action of earthquake damaged non-engineered buildings-Recommendations for future constructions-Requirements of structural safety of thin pre- cast roofing units against earthquake forces -Status of R&D in earthquake strengthening measures - Floods, cyclones and future safety.

Text Books :

1. A.K.Lal , "*Hand Book of Low Cost Housing*", Newage International publishers.
2. G.C.Mathur, "*Low Cost Housing*", South Asia Books.

Reference Books :

1. *"Building Materials for Low-income Houses"*- International council for building research studies and documentations.
2. . Neville A.M., "*Properties of Concrete*" Pitman publishing Limited, London.
3. Kiado, Rudhai.G, "*Light weight Concrete Academic*", Publishing home of Hungarian Academy of sciences.
4. A.G.Madhava Rao, D.S.Ramachandra Murthy and G.Annamalai "*Modern Trends in Housing in Developing Countries*".

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

ADVANCED CONCRETE TECHNOLOGY (ACT)
(Elective II for M. Tech-I Semester)

I Semester : SE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
CE 813	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs		

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

CO1: Determine the properties of concrete ingredients

CO2: Understand the properties of concrete both in Fresh and hardened state

CO3: Understand the long term durability characteristics of concrete

CO4: Compute the Mix design of concrete using IS method and ACI method.

CO5: Understand the usage of special concretes-Fiber reinforced concrete Polymer concrete and Self compacting concrete

Cement

Portland Cement – Chemical Composition – Hydration, Setting and Fineness of cement – Structure of Hydrated Cement – Mechanism of cement gel - Water held in hydrated cement paste – Heat of Hydration of cement – Influence of the compound composition on properties of cement –Tests on physical properties of cement - I.S. Specifications-Different Types of cements.

Aggregates

Classification of aggregates - Particle shape and texture - Bond , strength and other mechanical properties of aggregates– Soundness of aggregate - Alkali aggregate reaction-Thermal properties - Grading of fine and coarse aggregates - Gap graded aggregates.

Admixtures

Benefits-Types of admixtures-Accelerating, retarding and water reducing admixtures –Super plasticizers-Special admixtures.

Fresh Concrete

Workability - Factors affecting workability - Measurement of workability by different tests - Effect of time and temperature on workability - Segregation and Bleeding – Mixing and vibration of concrete - Quality of mixing water.

Hardened Concrete

Water/Cement ratio - Effective water in the mix – Gel space ratio – Porosity-Influence of properties of coarse aggregate on strength-Influence of aggregate/cement ratio on strength-Nature of Strength of concrete-Micro cracking-Aggregate-cement paste interface- Effect of age on strength of concrete-Maturity of concrete-Relation between compressive and tensile strengths- Curing of concrete– Factors affecting strength– Non destructive tests.

Elasticity, Shrinkage and Creep

Modulus of Elasticity - Dynamic modulus of elasticity - Poisson's ratio-Early volume changes – Swelling - Drying Shrinkage - Mechanism of Shrinkage - Factors affecting Shrinkage - Differential Shrinkage - Moisture movement - Carbonation shrinkage - Creep of concrete - Factors influencing creep - Relation between creep and time - Nature of creep - Effect of creep.

Durability of Concrete

Causes of inadequate durability-Diffusion – Absorption -Water permeability - Air and vapour permeability – Carbonation - Acid attack on concrete - Sulphate attack on concrete – Efflorescence - Effect of sea water on concrete – Disruption by alkali-silica reaction – Abrasion of concrete – Types of cracking.

Mix Design

Proportioning of concrete mixes by various methods – ACI and IS code methods – Factors in the choice of mix proportions – Durability of concrete – Quality control of concrete – High strength concrete mix design by IS method.

Special Concretes

Light weight concretes – Light weight aggregate concrete – No-Fines concrete – High density concrete - Fibre reinforced concrete – Different types of fibres – Factors affecting properties of FRC-Applications-Polymer concrete – Types of polymer concrete-Properties of polymer concrete – Applications – Self compacting concrete - SIFCON.

Text Books :

1. A.M.Neville, "*Properties of Concrete*" Pearson Education.
2. ML Gambhir, "*Concrete Technology*", Tata Mc Graw Hill Publishing Company.
3. M.S.Shetty , "*Concrete Technology*", S. Chand and Company Limited.

Reference Books :

1. P.D. Kulkarni, R.K.Ghosh and Y.R.Phaul, "*Text Book of Concrete Technology*".
2. P.K.Mehata, "*Concrete Technology*", Mc Graw Hill Publications
3. N. Krishna Raju, "*Concrete Technology*", Sehgal Publishers.

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

PRESTRESSED CONCRETE (PSC)

(Elective II for M. Tech-I Semester)

I Semester : SE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
CE 814	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs		

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

CO1: Understand the principles of Prestressing

CO2: Analyze the Prestress concrete beams with straight concentric and eccentric tendons

CO3: Design the prestessed concrete members for Flexure, shear, Bond and Anchorage-

CO4: Determine the Short term and Long term deflections of prestressed concrete elements

CO5: Understand the concepts of Circular prestressing and Dome prestressing

Introduction

Development of prestressed concrete - Advantages and disadvantages of PSC over RCC – General principles of prestressing - Pretensioning and post tensioning - Materials used in PSC - High strength concrete - High tension steel - Different types/methods/systems of prestressing.

Losses of Prestress

Estimation of the loss of prestress due to various causes like elastic shortening of concrete - Creep of concrete - Shrinkage of concrete - Relaxation of stress in steel - Slip in anchorage, friction etc.

Flexure

Elastic analysis of concrete beams prestressed with straight, eccentric, bent and parabolic tedons – Kern lines - Cable profile - Design criteria as per I.S. code of practice - Elastic design of Beams (rectangular, I, and T-sections) for flexure – Introduction to partial prestressing.

Shear, Bond, Bearing and Anchorage

Shear in PSC beams - Principal stresses - Conventional elastic design for shear - Transfer of prestress in pretensioned members - Transmission length - Bond stresses - Bearing at anchorage - Anchorage zone stresses in post tensioned members - Analysis and design of end blocks by Guyon, Magnel and approximate methods - Anchorage zone reinforcements.

Deflections

Introduction – Factors influencing deflections – Short term and long term/ time deflections of un-cracked and cracked members.

Circular Prestressing
Introduction – Circumferential prestressing - Design of prestressed concrete tanks - Dome prestressing.
Statically Indeterminate Structures
Introduction - Advantages and disadvantages of continuity - Layouts for continuous beams -Primary and secondary moments - Elastic analysis of continuous beams - Concordant cable profile - Design of continuous beams.
Text Books :
1. N.Krishna Raju, "*Prestressed Concrete*", Tata Mc Graw Hill Publications.
Reference Books :
1. T.Y.Lin, "*Design of Prestressed Concrete Structures*", Asian publishing house,Bombay.
2. Y.Guyon, "*Prestressed Concrete, Vol.I&II*", Wiley and Sons.
3. F.Leohhardt, "*Prestressed Concrete Design and Construction*", Wilhelm Ernst and Shon, Berlin.
4. C.E.Reynold and J.C. Steedman, "*Reinforced Concrete Designers Hand Book*", A view point publication.
Question Paper Pattern:
Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions. **End Exam:** The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

PRE-FABRICATED CONCRETE STRUCTURES (PFCS)

(Elective II for M. Tech-I Semester)

I Semester : SE				Scheme : 2017			
Course Code	Hours/Week			Credits	Maximum Marks		
CE 815	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs				End Exam Duration: 3 Hrs			

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

CO1: Apply Functional Design Principles for Pre-Fabricated Structures

CO2: Design of Floors, Stairs and Roofs

CO3: Understand the concepts of behavior of wall joints and Sandwich wall panels

CO4: Design Industrial Buildings

CO5: Apply the concepts of Cylindrical Folded plate and Hyper Prefabricated Shells

Types of RC Prefabricated Structures

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

Functional Design Principles

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

Floors, Stairs and Roofs

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

Walls

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

Industrial Buildings

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

Cylindrical, Folded Plate and Hyper Prefabricated Shells
Erection and joining - Joint design - Hand book based design.
Text Books :
1. Marashev, V.I.Sigalov, E.Y.Baikov, U.N., "*Design of RC Structures*", Mir Publishers, Moscow.
Reference Books :
1. B.Leweicki, "*Building with Large Prefabrication*", Elsevier Publishing Co.
2. "*SERC, Design & Construction of Prefabricated Residential & Industrial Buildings*", Organized by SERC, Chennai.
Question Paper Pattern:
Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions. **End Exam:** The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

FINITE ELEMENT METHODS (FEM)

(Elective III for M. Tech-II Semester)

II Semester : SE				**Scheme : 2017**			
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 816	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs				**End Exam Duration: 3 Hrs**			

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

CO1: Understand the concepts of FEM and Energy principles

CO2: Analyse stiffness matrix and Shape Functions for Beam & Bar elements

CO3: Analyse Two Dimensional Isoparametric elements with Four and Eight nodes

CO4: Analyse Axi-Symmetric bodies of revolution

CO5: Apply Finite Element Analysis to Plates

Introduction

Concepts of FEM-Steps involved - Merits and demerits - Energy principles – Descretization - Rayleigh – 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.

One Dimensional FEM

Stiffness matrix for beam and bar elements-Shape functions for 1-D elements - Static condensation of global stiffness matrix – Solution - Initial strain and temperature effects.

Two Dimensional FEM

Different types of elements for plane stress and plane strain analysis - Displacement models – Generalized coordinates – Shape functions - Convergent and compatibility requirements -Geometric invariance - Natural coordinate system - Area and volume coordinates-Generation of element stiffness and nodal load matrices-Static condensation.

Isoparametric Formulation

Concept - Different isoparametric elements for 2-D analysis - Formulation of 4-noded and 8-noded isoparametric quadrilateral elements - Lagrangian 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, 3-D strain, displacement relationship-Formation of hexahedral and

isoparametric solid element.

Finite Element Analysis of Plates

Basic theory of plate bending - Thin plate theory - Stress resultants - Mindlin's approximations - Formulation of 4-noded isoparametric quadrilateral plate element.

Text Books :

1. C.S.Krishna Murthy, "*Finite Element Analysis –Theory & Programming*", Tata Mc Graw Hill
2. Tirupathi Chandru Patla A & Belugunudu, " *Introduction to Finite Element Method*", Khanna Publishers

Reference Books :

1. Cook, R.D., "*Concepts and Applications of Finite Element Analysis*", John Wiley and sons Inc., New York.
2. J.N.Reddy, " *Introduction to Finite Element Method*", Mc.Graw Hill Book Co.
3. Bathe K.J., "*Finite Element Procedures in Engineering Analysis*", Prentice Hall.
4. Gallagher R.H., & Wilson, "*Finite Element Analysis Fundamentals*", Prentice Hall Inc..
5. Hinton and Owen, "*Finite Element Programming*" Academic press, London.
6. O.C.Zienkiewicz, "*Finite Element Method*", Butterworth-Heinemann
7. V.K.Manicka Selvam, *"Concepts of Finite Element Methods"*, Scitech Publications
8. Abel & Desai, *"Introduction to Finite Element Method"*, CBS Publications
9. S. Rajasekharan, *"Finite Element Analysis in Engineering"*, S.Chand Publications

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

EXPERIMENTAL STRESS ANALYSIS (ESA)
(Elective III for M. Tech-II Semester)

II Semester : SE					**Scheme : 2017**		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 817	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1: Understand the principles of Experimental stress analysis

CO2: Apply the concepts of mechanical and electrical strain gauges

CO3: Apply Techniques for Non-Destructive Testing

CO4: Understand the brittle coating methods and Techniques

CO5: Understand the concepts of Photo elasticity and photo elastic materials

Principles of Experimental Approach

Merits of experimental analysis – Introduction - Uses of experimental stress analysis - Advantages of experimental stress analysis - Different methods - Simplification of problems.

Strain Measurement using Strain Gauges

Definition of strain and its relation of experimental determinations-Properties of strain gauge systems – Types of strain gauges – Mechanical Acoustic and Optical strain gauges.

Electrical Strain Gauges

Inductance strain gauges – LVDT – Resistance strain gauges – Various types – Gauge factor – Material of adhesion base etc – Reduction of strain gauge data for computation of stresses.

Strain Rosettes

Introduction - The three elemental rectangular Rosette – The delta Rosette – Corrections for transverse strain gauge.

Non Destructive Testing

Ultrasonic techniques for non destructive testing – Rebound hammer test.

Brittle Coating Methods

Introduction – Coating Stress – Failure theories – Brittle coating crack patterns – Crack Detection – Types of Brittle Coating – Test procedures for Brittle Coating Analysis – Calibration procedures - Analysis of Brittle coating data.

Theory of Photo elasticity

Introduction – Temporary Double Refraction - The stress optic law – effects of stressed model in a poloriscope for various arrangements – Fringe Sharpening - Brewster's stress optic law.

Two Dimensional Photo elasticity

Introduction – Isochromic Fringe patterns – Isoclinic Fringe patterns- Passage of light through plane polariscope and circular polariscope- Isoclinic fringe patterns –Compensation techniques – Calibration methods – Separation methods – Scaling model to prototype stresses – Materials for photo – elasticity properties of photoelastic materials.

Text Books :

1. J. W. Dally and W.F. Riley, "*Experimental Stress Analysis*", Mc Graw Hill Publications
2. Dr. Sadhu Singh, "*Experimental Stress Analysis*", Khanna Publishers.

Reference Books :

1. L. S. Srinath, "*Experimental Stress Analysis"* Mc. Graw Hill company publishers.

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

ADVANCED FOUNDATION ENGINEERING (AFE)

(Elective III for M. Tech-II Semester)

II Semester : SE					**Scheme : 2017**		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 818	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1: Estimate soil bearing capacity required for preliminary design of foundation

CO2: Understand the Selection of foundation type and estimation of settlement of foundation

CO3: Apply Techniques to modify the adverse properties of soil

CO4: Analyse and design of Caisson and Well foundations and Sheet pile walls

Shallow Foundations-I

General requirements of foundations - Types of shallow foundations and the factors governing the selection of a type of shallow foundation - Bearing capacity of shallow foundations by Terzaghi's theory and Meyerhof's theory(derivation of expressions and solution to problems based on these theories) - Local shear and general shear failure and their identification.

Shallow Foundations-II

Bearing capacity of isolated footing subjected to eccentric and inclined loads - Bearing capacity of isolated footing resting on stratified soils – Button's theory and Siva Reddy analysis - Analysis and structural design of R.C.C. isolated, combined and strap footings.

Deep Foundations-I

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

Deep Foundations-II

Well foundations – Elements of well foundation - Forces acting on a well foundation - Depth and bearing capacity of well foundation - Design of individual components of well foundation (only forces acting and principles of design) - Problems associated with well sinking.

Sheet Pile Walls

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.

Foundations in Problematic Soils
Foundations in black cotton soils - Basic foundation problems associated with black cotton soils - Lime column techniques – Principles and execution - Under reamed piles – Principle of functioning of under reamed pile - Analysis and structural design of under reamed pile - Use of Cohesive Non Swelling (CNS) layer below shallow foundations.
Text Books :
1. Shamsher Prakash, Gopal Rajan and Swami Saran, "*Analysis and Design of Foundations and Retaining Structures",* Satya Prakashan.
2. Venkatramaiah , *"Geotechnical Engineering".* New Age International publishers
3. K.R.Arora, *"Soil Mechancis and Foundation Engineering"*, Standard Publishers
Reference Books :
1. E.W.Bowles, *"Analysis and Design of Foundations",* Tata Mc. Graw Hill.
2. Tomlinson, "*Foundation Design and Construction",* Prentice hall publishers.
3. Teng , *"Foundation Design",* Prentice hall publishers.
4. A.R Gaba, B. Simpson, W. Powrle, D.R. Beadmin, "*Embedded Retaining Walls – Guidance for Economic Design*"(C-580), CIRIA Publications
Question Paper Pattern:
Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions. **End Exam:** The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES (ERDS)
(Elective IV for M.Tech. – II Semester)

I Semester : SE					Scheme : 2017		
Course Code	Hours/Week			Credits	Maximum Marks		
CE 819	L	T	P	C	Continuous Internal Assessment	End Exam	TOTAL
	3	-	-	3	40	60	100
Sessional Exam Duration : 2 Hrs					End Exam Duration: 3 Hrs		

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

CO1: Understand the causes of earthquake and methods of measurement of earthquake forces.

CO2: Analyze the Structures to resist earthquake forces by static and dynamic methods.

CO3: Design R.C.C. structural elements beams, columns & shear walls, resisting earthquake forces, as per IS Codes.

CO4: Analyze the failure mechanism and effects of non-structural elements on structural system, subjected to earthquake forces.

CO5: Prepare Ductile Detailing of Reinforced Concrete and Masonry wall building as per IS codal provisions.

Earthquake and Ground Motion:

Earthquake-causes of earthquake - Earthquakes and seismic waves - Scale and intensity of earthquake - Seismic activity - Measurement of earthquakes – Seismometer - Strong motion accelerograph - Field observation of ground motion - Analysis of earthquake waves - Earthquake motion - Amplification characteristics of surface layers - Earthquake motion on the ground surface - Relation between the nature of the ground and structural damage

Design Approaches:

Methods of analysis - Selection of analysis - Equivalent lateral force procedure - Seismic base shear - Seismic design coefficient - Vertical distribution of seismic forces and horizontal shear - P-Δ characteristics effect - Earthquake records for design – Factors affecting accelerogram characteristics.

Dynamic Analysis Procedure:

Model analysis - Inelastic time history analysis, evaluation of results

Earthquake Resistant Design of Structural Components and Systems:

Introduction - Monolithic reinforced concrete structures - Masonry wall structures.

Shear Walls And Non-Structural Elements:

Strategies in the location of Shear walls - sectional shape - behaviour of shear walls – design of shear walls - 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

Ductile Detailing:

Review of latest Indian seismic codes-IS: 4326 and IS:13920 - Provision for ductile detailing of R C buildings-beams, columns and joints-Masonry wall buildings.

Earthquake Protective Systems:

Base Isolation – types and materials used for base isolators.

Text Books :

1. S.K.Duggal, *" Earthquake Resistant Design of Structures"*,Oxford Publishers
2. Pankaj Agarwal and Manish Shrikhanda,*" Earthquake Resistant Design of Structures,"* PHI

Reference Books :

1. A.K Chopra, "*Dynamics of Structures: Theory and Applications to Earthquake Engineering"*, Prentice Hall.
2. Mario Paz, "*Structural Dynamics- Theory & Computations*", CBS Publishers & Distributors
3. R. W. Clough and J. Penzien, *"Dynamics of Structures",* Mc Graw-Hill.
4. Neelam Sharma, " Earthquake Resistant Building Construction", S.K. Kataria & Sons.
5. IS Codes: IS 456, IS :1893, IS: 4326, IS: 13920 and SP-16.

Web References:

1.
2.
3.

Question Paper Pattern:

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End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

ANALYSIS AND DESIGN OF SHELLS AND FOLDED PLATES (ADSFP)
(Elective IV for M. Tech-II Semester)

II Semester : SE				**Scheme : 2017**			
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 820	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs				**End Exam Duration: 3 Hrs**			

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

CO1: Analyse cylindrical shell and design short and long shells

CO2: Analyse and design different shells of double curvature

CO3: Analyse axi-symmetrical shells

CO4: Analyse structural behavior of Folded plates

CO5: Analyse the prestressed continuous Folded plates

Shells

Shells – Functional behavior – Examples – Structural behavior 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 simulations equations.
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.

Introduction to the shells of double curvatures

Geometry, analysis and design of elliptic paraboloid, conoid and hyperbolic paraboloid shapes, inverted umbrella type.

Axi-symmetrical shells

General equation – Analysis and axi-symmetrical by membrane theory – Application to spherical shell and hyperboloid of revolution cooling towers.

Folded Plates

Introduction – Types of folded plates – Structural behavior of folded plates – Advantages – Assumptions in Whitney 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 – Prestressed continuous folded plates.

Text Books :

1. S. Timoshenko & W. Krieger, "*Theory of Plates and Shells*", Mc Graw Hill Co.
2. G.S. Ramaswami, "*Analysis and Design of Concrete Shell Roofs*", CBS Publications.

Reference Books :

1. Chatterjee , "*Theory and Design of Concrete Shells*", Oxford&IBH Publishing Co.
2. Billington D.P., "*Design of Concrete Shell Roofs",* Mc Graw Hill Co
3. N.K. Bairagi, "*Shell Analysis*", Khanna Publishers.
4. Dr. N.Krishna Raju, "*Advanced R.C. Design*", Oxford&IBH Publishing Co.
5. J. Ramachandran, "*Thin Shells Theory and Problems*", Universities Press.
6. Wilheln Flugge, *" Stresses in Shells, Springs*" Verlog, Berlin

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End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.

THEORY AND APPLICATIONS OF CEMENT COMPOSITES (TACC)
(Elective IV for M. Tech-II Semester)

II Semester : SE					**Scheme : 2017**		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 821	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**TOTAL**
	3	**-**	**-**	**3**	**40**	**60**	**100**
Sessional Exam Duration : 2 Hrs					**End Exam Duration: 3 Hrs**		

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

CO1: Understand the characteristics of composite materials and advantages

CO2: Understand the stress strain relations for Orthotropic and Anisotropic materials

CO3: Apply the concepts for determining the relations between Elastic constants

CO4: Determine the properties of cement composites

CO5: Understand the applications of cement composites for Housing-Water storage, Boats and miscellaneous structures

Introduction

Classification and characteristics of composite materials - Basic terminology - Advantages.

Stress-Strain Relations

Orthotropic and anisotropic materials – Engineering constants for Orthotropic materials - Restrictions on elastic constants – Plane stress problem - Biaxial strength - Theories for an orthotropic lamina.

Mechanical Behaviour

Mechanics of materials approach to stiffness - Determination of relations between elastic constants - Elasticity approach to stiffness – Bounding techniques of elasticity - Exact solutions – Elasticity solutions with continuity – Halpin - Tsai equations – comparison of approaches to stiffness.

Cement Composites

Types of cement composites – Terminology - Constituent materials and their properties – Construction techniques for fibre reinforced concrete – Ferrocement, SIFCON, Polymer concretes – Preparation of reinforcement – Casting and curing.

Mechanical Properties of Cement Composites

Behaviour of ferrocement – Fibre reinforced concrete in tension, compression, flexure, shear, fatigue and impact-Durability and corrosion.

Application of Cement Composites

FRC and Ferrocement – Housing – Water storage, Boats and miscellaneous structures

Text Books :

1. Robert M Jones, "*Mechanics of Composite Materials*", Mc Graw Hill Co.

Reference Books :

1. R.P.Pama "*Ferrocement – Theory and Applications*", IFIC.

2. Balaguruswamy, "*Fibre Reinforced Concrete".*
3. R.N.Swamy, "*New Engineering Materials*".

Question Paper Pattern:

Internal Exam: The question paper shall consist of **Six** questions out of which the student shall answer any **Four** questions.

End Exam: The question paper shall consist of **Eight** questions out of which the student shall answer any **Five** questions.