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, Anantapuramu

M.Tech Scheme & Syllabus - Scheme 2022

(Structural Engineering)

CIVIL ENGINEERING DEPARTMENT

Two Year M.Tech Degree Program

Scheme of Instruction and Examination
(Effective from 2022-23)

I Semester - Structural Engineering (SE) **Scheme-2022**

S. No.	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
I		**Theory**							
1	PC	Theory of Elasticity	3	-	-	3	60	40	100
2	PC	Advanced Structural Analysis	3	-	-	3	60	40	100
3	PC	Theory of Plates	3	-	-	3	60	40	100
4	PE	Professional Elective – I	3	-	-	3	60	40	100
5	PE	Professional Elective – II	3	-	-	3	60	40	100
6	MC	Research Methodology & IPR	2	-	-	2	-	100	100
7	AC	Audit Course-I	2	-	-	0	-	-	-
II		**Practical**							
8	PCL	Structural Engineering Lab	-	-	3	2	60	40	100
9	PCL	Computer Aided Analysis and Design Lab-I	-	-	3	2	60	40	100
	Total		**19**	**-**	**6**	**21**	**420**	**380**	**800**

II Semester - Structural Engineering (SE) **Scheme-2022**

S. No.	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
I		**Theory**							
1	PC	Advanced Reinforced Concrete Design	3	-	-	3	60	40	100
2	PC	Finite Element Methods	3	-	-	3	60	40	100
3	PE	Professional Elective-III	3	-	-	3	60	40	100
4	PE	Professional Elective-IV	3	-	-	3	60	40	100
5	PE	Professional Elective-V	3	-	-	3	60	40	100
6	AC	Audit Course-II	2	-	-	0	-	-	-
II		**Practical**							
7	PCL	Advanced Structural Engineering Lab	-	-	3	2	60	40	100
8	PCL	Computer Aided Analysis and Design Lab-II	-	-	3	2	60	40	100
	Total		**17**	**-**	**6**	**19**	**420**	**280**	**700**

CIVIL ENGINEERING DEPARTMENT

Two Year M.Tech Degree Program

Scheme of Instruction and Examination
(Effective from 2022-23

III Semester - Structural Engineering (SE) **Scheme-2022**

S. No.	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
1	OE	Open Elective (OE)*	2	-	-	2	-	-	100
2	PR	Dissertation Phase-I	-	-	20	10	-	100	100
3	CAA	Co-Academic Activities	-	-	-	2	-	100	100
	Total		**2**	**-**	**20**	**14**	**-**	**200**	**300**

***** Open elective will be offered through MOOCs

IV Semester - Structural Engineering (SE) **Scheme-2022**

S. No.	Category	Course Title	L	T	P	Credits	End Exam Marks	CIA Marks	Total
2	PR	Dissertation Phase - II	-	-	32	16	60	40	100

List of Professional Elective Courses

Description	Subject Title
PE-I	Applications of Cement & Composites
	Rehabilitation & Retrofitting of Structures
	Low-Cost Housing Techniques
PE-II	Bridge Engineering
	Advanced Prestressed Concrete
	Advanced Foundation Engineering
PE-III	Stability of Structures
	Structural Optimization
	Design of High Rise Structures
PE-IV	Earthquake Resistant Design of Structures
	Theory of Shells and Folded Plates
	Design of Masonry Structures
PE-V	Structural Dynamics
	Advanced Steel Design
	Building Construction and Management

Open Elective

OE	Open elective will be selected through MOOCs

List of Audit Courses

AC-I	Disaster Management
	English for Research Paper Writing
	Sanskrit for Technical Knowledge
AC-II	Pedagogy Studies
	Personality Development through Life Enlightenment Skills
	Stress Management by Yoga

Two Year M.Tech Degree Program

Scheme of Instruction and Examination
(Effective from 2022-23)

I Semester - Structural Engineering (SE) **Scheme-2022**

S. No.	Category	Course Title	L	T	P	Credits	End Exam marks	CIA Marks	Total
I		**Theory**							
1	PC	Theory of Elasticity	3	-	-	3	60	40	100
2	PC	Advanced Structural Analysis	3	-	-	3	60	40	100
3	PC	Theory of Plates	3	-	-	3	60	40	100
4	PE	Professional Elective – I	3	-	-	3	60	40	100
5	PE	Professional Elective – II	3	-	-	3	60	40	100
6	MC	Research Methodology & IPR	2	-	-	2	-	100	100
7	AC	Audit Course – I	2	-	-	0	-	-	-
II		**Practical**							
8	PCL	Structural Engineering Lab	-	-	3	2	60	40	100
9	PCL	Computer Aided Analysis and Design Lab-I	-	-	3	2	60	40	100
	Total		**19**	**-**	**6**	**21**	**420**	**380**	**800**

THEORY OF ELASTICITY (TOE)

I Semester : SE					Scheme : 2022		
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:	Analyze Plane stress problem.
CO2:	Analyze Plane strain problem.
CO3:	Analyze three dimensional stress problem.
CO4:	Analyze three dimensional strain problem.
CO5:	Analyze 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*, McGraw Hill Book Company.
2. Sadhu Singh, *Theory of Elasticity and Plasticity*, Khanna Publishers.

Reference Books :

1. Papov, *Advanced Strength of materials*, McGraw Hill Book Company.
2. Martin H. Sadd, *Elasticity Theory, Applications and Numerics*, Elsevier India Pvt. Ltd. Academic Press, 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.

ADVANCED STRUCTURAL ANALYSIS (ASA)

I Semester : SE					Scheme : 2022		
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 global 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, torsional 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.

Text Books :

1. C.S.Reddy, *Structural Analysis*, Tata McGraw Hill Book Company.
2. Pandit and Gupta, *Structural Analysis*, Tata McGraw 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*, McGraw Hill Book Company.
4. R.C.Hibbeler, *Structural Analysis*, Shroff Publishers.
5. C.K. Wang, *Intermediate Structural Analysis*, Standard Publications.
6. 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 OF PLATES (TOP)

I Semester :SE					Scheme : 2022		
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 McGraw 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.
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 METHODOLOGYAND INTELLECTUAL PROPERTY RIGHTS (RM& IPR)

I Semester: Common for All M.Tech Programmes						**Scheme : 2022**		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**		
	MC	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		2	**-**	**-**	**-**	**100**	**-**	**100**
Sessional Exam Duration : -						**End Exam Duration: -**		

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

CO1: Analyze research related information.

CO2: Follow research ethics.

CO3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

CO4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

CO5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT – I

Meaning of research problem – Sources of research problem – Criteria Characteristics of a good research problem – Errors in selecting a research problem – Scope and objectives of research problem – Approaches of investigation of solutions for research problem – Data collection, analysis, interpretation, necessary instrumentations.

UNIT – II

Effective literature studies approaches – Analysis Plagiarism – Research ethics – Effective technical writing – How to write report – Paper Developing a Research Proposal – Format of research proposal – A presentation and assessment by a review committee.

UNIT – III

Nature of Intellectual Property: Patents – Designs, Trade and Copyright – Process of Patenting and Development: technological research, innovation, patenting, development – International Scenario – International cooperation on Intellectual Property – Procedure for grants of patents – Patenting under PCT.

UNIT – IV

Patent Rights: Scope of Patent Rights – Licensing and transfer of technology – Patent information and databases – Geographical Indications.

UNIT – V

New Developments in IPR: Administration of Patent System – New developments in IPR – IPR of Biological Systems – Computer Software etc. – Traditional knowledge Case Studies – IPR and IITs.
Text Books :
1. Stuart Melville and Wayne Goddard, *Research methodology: an introduction for science &engineering students.*
2. Wayne Goddard and Stuart Melville, *Research Methodology: An Introduction*
Reference Books :
1. Ranjit Kumar, 2nd Edition, *Research Methodology: A Step by Step Guide forbeginners*.
2. Halbert, *Resisting Intellectual Property*, Taylor & Francis Ltd, 2007.
3. Mayall, *Industrial Design*, McGraw Hill, 1992.
4. Niebel, *Product Design*, McGraw Hill, 1974.
5. Asimov, *Introduction to Design*, Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, *Intellectual Property in New Technological Age*, 2016.

STRUCTURAL ENGINEERING LABORATORY [SE(P)]

I Semester : SE						Scheme : 2022		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
CE 804	PCL	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		-	-	3	2	40	60	100
						End Exam Duration : 3 Hrs		

Course Outcomes: The student shall be able to

CO1: Determine the properties of supplementary cementitious materials as per standard specifications.

CO2: Design the proportions of concrete mix by IS method and ACI method.

CO3: Determine the stress-strain behavior of concrete mixes and high strength steel.

CO4: Correlate the relation between w/c ratio, workability and strength of concrete.

CO5: Determine the strength of concrete using accelerated curing methodology.

CO6: Determine the durability property of concrete by conducting sorptivity test.

List of Experiments

1. Specific Gravity of Supplementary Cementitious Materials.
2. Fineness of Cement and Supplementary Cementitious Materials by Blaine's Air Permeability Test.
3. Mix Design Methods of Concrete and Casting of Specimens by IS Code.
4. Mix Design Methods of Concrete and Casting of Specimens by ACI Code.
5. Study of effect of water/cement ratio on workability and strength of concrete.
6. Study of stress-strain curve of concrete for different mixes and different rates of loadings.
7. Study of Correlation between Cube Strength, Cylinder Strength, Split Tensile Strength and Modulus of Rupture.
8. Water absorption and Sorptivity Test for Concrete.
9. Accelerated Curing Tests on Concrete Cubes.
10. Study of Stress-Strain curve for High Strength Steel Bars.

COMPUTER AIDED ANALYSIS AND DESIGN LAB - I [CAAD(P)]

I Semester : SE						Scheme : 2022		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
CE 805	PCL	-	-	3	2	40	60	100
						End Exam Duration : 3 Hrs		

Course Outcomes: The student shall be able to

CO1: Understand the basic commands of structural analysis, design and detailing software.

CO2: Analyse and design RCC beams and columns for various loading, support conditions.

CO3: Analyse and design RCC framed structures for gravity, wind and seismic loads.

CO4: Analyse and design steel framed structures for gravity, wind and seismic loads.

CO5: Analyse and design retaining walls, steel plane and industrial trusses for various forces.

List of Experiments

1. Analysis and Design of R.C.C. Beams for Different Support Conditions.
2. Analysis and Design of R.C.C. Columns subjected to Axial Forces, Uniaxial Bending and Biaxial Bending.
3. Analysis and Design of Concrete Space Building frame subjected to Gravity and Wind Forces.
4. Analysis and Design of Concrete Space Building Frame subjected to Gravity and Earthquake Forces.
5. Analysis and Design of Steel Building Frame subjected to Gravity and Wind Forces.
6. Analysis and Design of Steel Building Frame subjected to Gravity and Earthquake Forces.
7. Analysis and Design of R.C.C. retaining Walls.
8. Analysis and Design of Steel Plane Truss subjected to gravity forces and joint forces.
9. Analysis and Design of Industrial space truss for gravity and wind forces.

Two Year M.Tech Degree Program

Scheme of Instruction and Examination
(Effective from 2022-23)

II Semester - Structural Engineering (SE) **Scheme-2022**

S. No.	Category	Course Title	L	T	P	Credits	End Exam marks	CIA Marks	Total
I		**Theory**							
1	PC	Advanced Reinforced Concrete Design	3	-	-	3	60	40	100
2	PC	Finite Element Methods	3	-	-	3	60	40	100
3	PE	Professional Elective-III	3	-	-	3	60	40	100
4	PE	Professional Elective-IV	3	-	-	3	60	40	100
5	PE	Professional Elective-V	3	-	-	3	60	40	100
6	AC	Audit Course-II	2	-	-	0	-	-	-
II		**Practical**							
7	PCL	Advanced Structural Engineering Lab	-	-	3	2	60	40	100
8	PCL	Computer Aided Analysis and Design Lab-II	-	-	3	2	60	40	100
	Total		**17**	**-**	**6**	**19**	**420**	**280**	**700**

ADVANCED REINFORCED CONCRETE DESIGN (ARCD)

II Semester : SE					**Scheme : 2022**		
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:	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 (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 McGraw Hill
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*.

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)

II Semester :SE					Scheme : 2022		
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: 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 – Discretization – Rayleigh – Ritz method of functional approximation.

Principles of Elasticity

Stress equations – Strain displacement relationships in matrix form – Plane stress, plane strain.

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.

Axisymmetric Analysis

Bodies of revolution – Axisymmetric modeling – Strain displacement relationship – Formulation of axisymmetric 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 McGraw 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*, McGraw 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. ManickaSelvam, *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.

ADVANCED STRUCTURAL ENGINEERING LABORATORY [ASE(P)]

II Semester : SE						**Scheme : 2022**		
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
CE 808	**PCL**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
		-	**-**	**3**	**2**	**40**	**60**	**100**
						End Exam Duration : 3 Hrs		

Course Outcomes: The student shall be able to

CO1: Determine the Workability Properties of Self Compacting Concrete by advanced methods.

CO2: Develop, Design and perform tests on Geopolymer Concrete for specific uses.

CO3: Determine the Stress-Strain relationship and Elastic Properties of Rolled Steel Joist.

CO4: Carryout Destructive and Non Destructive test on Concrete to find the Strength of Concrete.

CO5: Determine the Durability of Concrete using Advanced Methods.

CO6: Study the Advanced Instruments used to find the behavior of Structure.

List of Experiments

1. Fresh properties of Self Compacting Concrete.
   a) Slump Flow Test &J-Ring Test
   b) V-Funnel Test
   c) L-Box Test
2. Mix proportions of Geopolymer concrete for compressive strength.
3. Split tensile strength and Modulus of rupture for Geopolymer Concrete.
4. Design Mix of High Strength Concrete.
5. Development of correlation between Non Destructive and Destructive tests using Rebound Hammer and UPV instruments.
6. Determination of Permeability of Self Compacting Concrete/Geopolymer Concrete/High Strength Concrete.
7. Study of behavior of Rolled Steel Joist under Flexure.
8. Core Cutter Extraction and Testing of Concrete.
9. Demonstration experiment on location of Rebars and Cover Depth using Profometer.
10. Demonstration of Rapid Chloride Permeability Test.

COMPUTER AIDED ANALYSIS AND DESIGN LAB –II [CAAD(P)]

II Semester : SE						Scheme : 2022		
Course Code	Category	Hours / Week			Credits	Maximum Marks		
CE 809	PCL	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		-	-	3	2	40	60	100
						End Exam Duration : 3 Hrs		

Course Outcomes: The student shall be able to

CO1: Understand the basic commands of structural analysis, design and detailing using three dimensional analysis of buildings software.

CO2: Analyse and design RCC beams and columns for various loading and support conditions.

CO3: Analyse and design RCC framed structures for gravity, wind and seismic loads.

CO4: Understand the basic commands and fundamentals of ANSYS usage in structural analysis.

CO5: Analyse the stresses in beams for different loading and support conditions, plate with a circular hole.

List of Experiments

(A) Using Advanced Structural Engineering Software:

1. Introduction to ETABS software usage.
2. Analysis and Design of RCC beam subjected to gravity forces.
3. Analysis and Design of RCC column subjected to axial forces, uniaxial bending & biaxial Bending.
4. Analysis and Design of RCC building space frame subjected to Gravity and Wind Loads.
5. Analysis and Design of RCC building space frame subjected to Gravity and Earth Quake Loads.
6. Analysis and Design of Retaining Wall.

(B) Using ANSYS:

1. Introduction to ANSYS.
2. Stress Analysis of Beams with Different Loading and Support Conditions.
3. Stress Analysis of Plate with a Circular Hole.

List of Professional Elective Courses

Description	Subject Title
PE-I	Applications of Cement & Composites
	Rehabilitation & Retrofitting of Structures
	Low-Cost Housing Techniques
PE-II	Bridge Engineering
	Advanced Prestressed Concrete
	Advanced Foundation Engineering
PE-III	Stability of Structures
	Structural Optimization
	Design of High Rise Structures
PE-IV	Earthquake Resistant Design of Structures
	Theory of Shells and Folded Plates
	Design of Masonry Structures
PE-V	Structural Dynamics
	Advanced Steel Design
	Building Construction and Management

APPLICATIONS OF CEMENT AND COMPOSITES (ACC)

(Elective – I for M. Tech-I Semester)

I Semester: SE					**Scheme : 2022**		
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: 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.

Modern Building Materials

Introduction – Properties and uses of modern building materials – Fly ash bricks, soil – cement blocks, AAC blocks, calcium silicate bricks – Red mud jute fibre polymer composite (RFPC) – Glass reinforced gypsum.

Fire Resistant and Waste based Materials

Introduction – Properties and use of Geosynthetics – Bituminous material – Fire resistant materials (chemicals, paints, tiles, bricks, glass) – Metals, light-weight concrete, mass concrete, and waste material based concrete.

Special Concretes

Light weight concrete and types – Fly ash concrete – Sulphur concrete – Sulphur impregnated concrete – Polymer concrete & its types – Super plasticized and hyper plasticized concretes – Epoxy resins and screeds, properties – Their applications in rehabilitation works – High performance concrete – Roller compacted concrete – Self-compacting concrete and its applications – Bacterial concrete – Recycled aggregate concrete – Smart concrete – Geopolymer concrete, mix proportioning and its development.

Cement Composites

Types of Cement Composites – Terminology – Constituent Materials and their Properties – Mechanical Properties of Cement Composites – Behavior of Ferro cement – Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact – Durability and Corrosion.

Application of Cement Composites

FRC, Ferrocement and SIFCON – Housing, Water Storage, Boats and Miscellaneous Structures

– Composite Materials – Orthotropic and Anisotropic behavior – Constitutive relationship – Elastic Constants.
Text Books :
1. Ghambhir M.L., *Concrete Technology*, Tata McGraw Hill Education Private Limited.
2. A.R. Santhakumar, *Concrete Technology*, Oxford University Press.
3. Nevile. A.M., *Concrete Technology*, Prentice Hall, New York.
4. P.C. Varghese, *Building Materials*, Prentice.
5. Jones R. M, *Mechanics of Composite Materials*, Taylor and Francis, BSP Books.
6. Pama R. P., *Ferro cement – Theory and Applications*, IFIC.
7. Swamy R.N., *New Concrete Materials*, Blackie, Academic and Professional, Chapman & Hall.
Reference Books :
1. Shetty, M. S., *Concrete Technology*, S. Chand Publication.
2. Dr. U. K. Shrivastava, *Building Materials Technology*, Galgotia Publication Pvt. Ltd.
3. Eds. J.M. Illston and P.L.J. Domone, *Construction materials: Their Nature and Behaviour*, Spon Press.
4. P.K. Mehta and P.J.M.Monteiro, *Concrete: Microstructure, Properties and Materials*, McGraw Hill.
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.

REHABILITATION AND RETROFITTING OF STRUCTURES (RRS)

(Elective – I for M. Tech-I Semester)

I Semester : SE							**Scheme : 2022**
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 students will be able to

CO1: Understand the different maintenance and repair strategies.

CO2: Understand the quality assurance aspects; Analyse the mechanical, durability and thermal behaviour of concrete.

CO3: Understand the preparation methodologies of various types of concretes and design special concretes.

CO4: Understand the various repair techniques and protection methods for RCC structures.

CO5: Understand the various repair and strengthening techniques for structural elements, various case studies involving repair, rehabilitation and retrofitting.

Maintenance and Repair Strategies

Maintenance, Repair and Rehabilitation – Facets of Maintenance, Importance of Maintenance – Inspection – Various aspects of Inspection – Assessment procedure for evaluating a damaged structure –Causes of deterioration.

Strength and Durability of Concrete

Quality assurance for concrete – Strength, Durability and Thermal properties of concrete – Cracks - different types, causes for cracks – Effects due to climate, temperature, Sustained elevated temperature – Corrosion – Effects of cover thickness.

Special Concretes

Sulphur infiltrated concrete – Vacuum concrete – Self compacting concrete –Geopolymer concrete – Reactive powder concrete – Concrete made with industrial wastes.

Techniques for Repair and Protection Methods

Non-destructive Testing Techniques – Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors – Corrosion resistant steels – Coatings to reinforcement – Cathodic protection.

Repair, Rehabilitation And Retrofitting of Structures

Strengthening of Structural elements – Repair of structures distressed due to corrosion, fire, leakage, and earthquake – Demolition Techniques – Engineered demolition methods – Case studies.

Text Books :
1. Denison Campbell, Allen and Harold Roper, *Concrete Structures, Materials, Maintenance and Repair*, Longman Scientific and Technical UK.
2. Allen R.T. & Edwards S.C, *Repair of Concrete Structures*, Blakie and Sons, UK.
Reference Books :
1. Shetty M.S., *Concrete Technology – Theory and Practice*, S. Chand and Company.
2. DovKominetzky. M.S., *Design and Construction Failures*, Galgotia Publications Pvt. Ltd., 2001.
3. Ravishankar K., Krishnamoorthy, T.S, *Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures*, Allied Publishers.
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers.
5. Gambhir. M.L., *Concrete Technology*, McGraw Hill.
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 : 2022		
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 precast 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

Introduction – 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*, New Age 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.

BRIDGE ENGINEERING (BE)

(Elective – II for M. Tech- I Semester)

I Semester :SE					Scheme : 2022		
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: 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 McGraw 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*, McGraw 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.

ADVANCED PRESTRESSED CONCRETE (APSC)

(Elective – II for M. Tech-I Semester)

I Semester: SE					Scheme : 2022		
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 various types of prestressed structural elements.

CO2: Analyze and determine loads and stresses in PSC Members.

CO3: Apply knowledge of analytical solution in problem solving.

CO4: Design and detailing of Prestressed structural elements.

CO5: Analyze the Continuous Beams and Simple Portal Frames.

Design of Section for Flexure

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, sloping and vertical prestressing – Analysis of rectangular and I-beam – Design of shear reinforcement – Indian code provisions, Importance of modulus of elasticity of Prestressing tendons, failures of prestressed concrete.

Design for Shear and Torsion

Shear and Torsional resistance –Ultimate shear resistance – Design of shear reinforcement in torsion.

Design of Composite Sections

Composite sections of prestressed concrete beam and cast in situ RC slab – Analysis of stresses– Differential shrinkage deflections –Flexural and shear strength of composite sections –Design of composite sections.

Transfer of Prestress in Members

Transfer of Prestress in Pretensioned Members : Transmission of prestressing force by bond Transmission length –Flexural bond stresses – I S code provisions – Anchorage zone stresses in post tensioned members –Stress distribution in End block – Analysis by approximate, Guyon and Magnel methods –Anchorage zone reinforcement.

Statically Indeterminate Structures

Statically indeterminate Structures : Advantages & disadvantages of continuous Prestressed 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 McGraw 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.

ADVANCED FOUNDATION ENGINEERING (AFE)

(Elective – II for M. Tech-I Semester)

I Semester :SE					Scheme : 2022		
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: 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

Principles of Design of Foundations – Types of shear failures in foundation soils – Types of foundations – Design Loads – Basic Concepts of safe and allowable bearing capacity – Shallow Foundations Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods – Bearing capacity evaluation from Standard Penetration test and Plate load test.

Settlement Analysis

Uniform and Differential Settlements – Elastic and Consolidation Settlements – Settlement analysis in cohesionless soils by Schemartmann and Hartman method – Penetration tests – Permissible settlements as per IS 1904-1978 – Causes of settlement – Settlement Control.

Proportioning of Footings

Isolated column footings, Strip, combined Footings and Strap Footing – Raft Foundations: Bearing capacity of raft foundation – Floating raft – Types of rafts – Beam on Elastic foundation and Conventional methods of Design – Determination of modulus of subgrade reaction.

Deep Foundations

Pile Foundations: Types, load capacity – Dynamic formulae – Static formula – Pile load tests – Vertical load test, lateral load test, Cyclic load test – Settlement of piles and pile groups – Negative skin friction on single pile and pile groups – Laterally loaded piles - Broom's Analysis, IS Code method – Under reamed piles – Load capacity, design and construction.

Well Foundations: Types – Bearing Capacity of well foundations – Construction of pneumatic caissons – Tilts and Shifts: precautions, Remedial measures – Lateral stability analysis by Terzaghi's Method – Design aspects of Components of well foundation.

Foundations in Expansive Soils

Introduction – Identification of expansive soils – Swell potential and swelling pressure – Active

depth – Foundation Problems – Foundation practices in expansive soils – Soil Replacement and CNS concepts – Foundations of Transmission Line Towers – Introduction – Necessary information – Forces on tower foundations – General design criteria – Choice and type of foundation – Design procedure.

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. J.E.Bowles, *Analysis and Design of Foundations*, Tata McGraw 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.

STABILITY OF STRUCTURES (SS)

(Elective – III for M. Tech-II Semester)

II Semester :SE					**Scheme : 2022**		
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: 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 lateral 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*, McGraw Hill.
2. Chem. &Atsute, *Theory of Beam Columns*, *Vol I*, McGraw Hill.
3. Smitses, *Elastic Stability of Structures*, Prentice Hall.
4. Brush and Almorth, *Buckling of Bars, Plates and Shells*, McGraw Hill.
5. Chajes, A., *Principles of Structural Stability Theory*, Prentice Hall.
6. Ashwini Kumar, *Stability theory of Structures*, Tata McGraw Hill Publishing Company Ltd.
7. Bleaigh, *Elastic Stability*, Tata McGraw Hill Publishing Company 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.

STRUCTURAL OPTIMIZATION (SO)

(Elective – III for M. Tech-II Semester)

II Semester: SE					**Scheme : 2022**		
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: 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 and Integer programming methods.

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

CO6: Analyse the various Network concepts.

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.

Network Analysis

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

Text Books :
1. 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, McGraw 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.

DESIGN OF HIGH RISE STRUCTURES (DHRS)

(Elective – III for M. Tech-II Semester)

II Semester : SE					**Scheme : 2022**		
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: Understand the concepts of high rise building structures.

CO2: Analyse and design high rise structures subjected to wind loads.

CO3: Familiarize with the different structural systems used in high rise buildings.

CO4: Analyse and design high rise structures subjected to earthquake loads.

CO5: Understand the behaviour and response of slab column frames.

Introduction to High Rise Structures

Design Principles for Lateral Load resistance – Ductility considerations in earthquake resistant design of concrete buildings – Construction methods – Choice of materials – Cladding systems and their design principles – Types of foundations for tall buildings.

Wind

Introduction to wind – Characteristics of wind – Impact on structures – Wind pressure – Internal and external wind – Dynamic action of wind – Aerodynamic forces – Natural frequencies – Wind tunnels – Types of wind tunnel tests.

Introduction to Computational Fluid Dynamics

Behavior of tall buildings subjected to wind – National standards – Maximum design loads for buildings and other structures – Calculation of wind loads – Special winds, gust – Wind speed data and importance – Wind resistant design.

Earthquake

Introduction to earthquake – Characteristic – Impact of earthquake on ground – Foundations and structural elements – Response of elements attached to buildings – Ground motion – Quasi-static approach – Dynamic analysis – Performance criteria – Vibration Control – Active control and passive control – Liquefaction effects of earthquakes – Introduction to time history analysis and pushover analysis.

Special Structural Systems

Necessity of special structural systems for tall buildings – Structural Systems for Steel Buildings – Braced frames – Staggered Truss System – Eccentric Bracing System – Outrigger & Belt truss system – Tube Systems – IS 16700 - 2017: Criteria for Structural Safety of Tall

Concrete Buildings – Important Specifications.

Structural Systems for Concrete Buildings & Special Topics

Shear walls – Frame tube structures – Bundled tube structures – Design of shear wall as per IS code – Second order effects of gravity loading – Creep and shrinkage in columns – Differential shortening of columns – Floor levelling problems – Panel zone effects – P-Delta analysis.

Text Books :

1. Smith, B. S. and Coull, A, *Tall Building Structures: Analysis and Design*, John Wiley & Sons.

2. Simiu, E. and Yeo, D., *Wind Effect on Structures: Modern Structural Design for Wind*, Wiley Blackwell.

Reference Books :

1. Taranath, B. S., *Reinforced Concrete Design of Tall Buildings*, CRC Press.

2. Taranath, B. S., *Tall Building Design: Steel, Concrete and Composite Systems*, CRC Press.

3. M. Fintel, *Handbook of Concrete Engineering*, Von Nostrand Reinhold Company.

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)

II Semester : SE					Scheme : 2022		
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 – 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 – Basics of Response Spectrum Analysis.

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*, McGraw 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.

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 SHELLS AND FOLDED PLATES (TSFP)

(Elective – IV for M. Tech-II Semester)

II Semester : SE					**Scheme : 2022**		
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*, McGraw 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*, McGraw Hill Co.
3. N.K. Bairagi, *Shell Analysis*, Khanna Publishers.
4. 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

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.

DESIGN OF MASONRY STRUCTURES

(Elective – IV for M. Tech-II Semester)

II Semester : SE					**Scheme : 2022**		
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 masonry design approaches.

CO2: Analyse Reinforced Masonry Members.

CO3: Determine interactions between members.

CO4: Determine shear strength and ductility of Reinforced Masonry members.

CO5: Check the stability of walls and Perform elastic and Inelastic analysis of masonry walls.

Introduction

Historical Perspective – Masonry Materials – Masonry Design Approaches – Overview of Load Conditions – Compression Behaviour of Masonry – Masonry Wall Configurations – Distribution of Lateral Forces.

Flexural Strength

Reinforced Masonry Members: In plane and Out-of-plane Loading.

Interactions

Structural Wall – Columns and Pilasters – Retaining Wall – Pier and Foundation.

Shear Strength

Shear Strength and Ductility of Reinforced Masonry Members.

Prestressed Masonry

Stability of Walls – Coupling of Masonry Walls – Openings – Columns – Beams.

Elastic and Inelastic Analysis

Modeling Techniques – Static Push Over Analysis and use of Capacity Design Spectra.

Text Books :

1. Hamid Ahmad A. and Drysdale Robert G., *Masonry Structures: Behavior and Design*.

Reference Books :

1. Narendra Taly, *Design of Reinforced Masonry Structures*, ICC.
2. Editor: Maurizio Angelillo, *Mechanics of Masonry Structures*.

3. Toma_evi_Miha, *Earthquake Resistant Design of Masonry Buildings*, Imperial College Press.
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)
(Elective – V for M. Tech-II Semester)

II Semester :SE					**Scheme : 2022**		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 822	**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*, McGraw 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.

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 STEEL DESIGN (ASD)

(Elective – V for M. Tech-II Semester)

II Semester SE					Scheme : 2022		
Course Code	Hours/Week			Credits	Maximum Marks		
CE 823	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 McGraw 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*, McGraw Hill.
6. Institute for Steel Development & Growth, *Structural Steel Design INSDAG Vol. I*, 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.

BUILDING CONSTRUCTION AND MANAGEMENT (BCM)

(Elective – V for M. Tech-II Semester)

II Semester : SE					**Scheme : 2022**		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
CE 824	**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.

Contract Management, Tenders and Contract

Introduction – Types constructions public and private contract management – Scrutinizing tenders and acceptance of tenders, contracted, changes and terminating of contract – Subcontracts construction organizations – Organizational chart – Decentralization pay rolls and records – Organization chart of a construction company.

Project Management

Construction practices – Times management – Bar chart, CPM, PERT – Progress report

Resource Allocation and Utilisation

Resources management and inventor – Basic concepts equipment management – Material management inventory control.

Project Auditing and Quality Control

Accounts management – Basic concepts – Accounting system and book keeping – Depreciation – Balance sheet – Profit and loss account – Internal auditing – Quality control by statistical methods – Sampling plan and control charts – Safety requirements.

Project Financial Management

Cost and financial management – Cost volume relationship – Cost control system – Budget concept of valuation – Cost of equity capital management cash – Labor and industrial laws – Payment of wages act. – Contract labor – Workmen's compensation – Insurance, industrial disputes act.

Text Books :

1. Jha, *Construction Project Management*, Pearson Publications, New Delhi.
2. Subir K. Sarkar & Subhajit Saraswati, *Construction Technology*, Oxford Higher Education,

University Press, Delhi.

Reference Books :

1. B.C.Punmia, K.K. Khandelwal, *Project Planning And Control With PERT And CPM*, Lakshmi Publications, New Delhi.

2. P.R. Bhave, *Optimal Design Of Water Distribution Networks*, Narosa Publishing House.

3. P.K. Joy, *Total Project Management, The Indian Context*, MacMillan Publishers India Limited.

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.

List of Audit Courses

AC-I	Disaster Management
	English for Research Paper Writing
	Sanskrit for Technical Knowledge
AC-II	Pedagogy Studies
	Personality Development through Life Enlightenment Skills
	Stress Management by Yoga

DISASTER MANAGEMENT

(Audit Course – I for M. Tech-I Semester)

I Semester: SE					Scheme : 2022		
Course Code	Hours/Week			Credits	Maximum Marks		
AU 101	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	2	-	-	0	-	-	-

Course Objectives : This course will enable students

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

4. Critically understand the strengths and weaknesses of disaster management approaches.

5. Planning and programming in different countries, particularly their home country or the countries they work in.

UNIT – I

Introduction: Disaster: Definition – Factors and Significance – Difference Between Hazard and Disaster – Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India: Study of Seismic Zones – Areas Prone to Floods and Droughts – Landslides and Avalanches – Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami – Post-Disaster Diseases and Epidemics.

UNIT – II

Repercussions of Disasters and Hazards: Economic Damage – Loss of Human and Animal Life – Destruction of Ecosystem – Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches – Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills – Outbreaks of Disease and Epidemics – War and Conflicts.

UNIT – III

Disaster Preparedness and Management: Preparedness – Monitoring of Phenomena Triggering A Disaster or Hazard – Evaluation of Risk – Application of Remote Sensing – Data from Meteorological and Other Agencies – Media Reports – Governmental and Community Preparedness.

UNIT – IV

Risk Assessment Disaster Risk: Concept and Elements – Disaster Risk Reduction – Global and National Disaster Risk Situation – Techniques of Risk Assessment – Global Co-Operation in

Risk Assessment and Warning – People's Participation in Risk Assessment – Strategies for Survival.

UNIT – V

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation – Emerging Trends In Mitigation – Structural Mitigation and Non-Structural Mitigation – Programs of Disaster Mitigation in India.

Text Books :

1. R. Nishith, Singh A K, *Disaster Management in India : Perspectives, issues and strategies*.
2. Sahni, Pardeep et. al. (Eds.), *Disaster Mitigation Experiences And Reflections*, New Royal book Company, Prentice Hall Of India, New Delhi.
3. Goel S.L., *Disaster Administration And Management Text And Case Studies*, Deep & Deep Publication Pvt. Ltd., New Delhi.

Reference Books :

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course–I for M. Tech-I Semester)

I Semester : SE					Scheme : 2022		
Course Code	Hours/Week			Credits	Maximum Marks		
AU 101	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	2	-	-	0	-	-	-

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

CO1: Understand the significance of writing skills and the level of readability.

CO2: Analyze and write title, abstract, different sections in research paper.

CO3: Develop the skills needed while writing a research paper.

UNIT – I

Overview of a Research Paper – Planning and Preparation – Word Order – Useful Phrases – Breaking up Long Sentences – Structuring Paragraphs and Sentences – Being Concise and Removing Redundancy – Avoiding Ambiguity.

UNIT – II

Essential Components of a Research Paper – Abstracts – Building Hypothesis – Research Problem – Highlight Findings – Hedging and Criticizing – Paraphrasing and Plagiarism – Cauterization.

UNIT – III

Introducing Review of the Literature – Methodology – Analysis of the Data – Findings – Discussion – Conclusions – Recommendations.

UNIT – IV

Key skills needed for writing a Title – Abstract – Introduction.

UNIT – V

Appropriate language to formulate Methodology – Incorporate Results – Put forth Arguments and draw Conclusions

Text Books :

1. Goldbort. R (2006), *Writing for Science*, Yale University Press (available on Google Books)Model Curriculum of Engineering & Technology PG Courses [Volume-I].
2. Day. R (2006), *How to Write and Publish a Scientific Paper*, Cambridge University Press.
3. Highman. N (1998), *Handbook of Writing for the Mathematical Sciences*, SIAM. Highman's book.
4. Adrian Wallwork , *English for Writing Research Papers*, Springer New York Dordrecht Heidelberg London, 2011.

Reference Books :

SANSKRIT FOR TECHNICAL KNOWLEDGE

(Audit Course – I for M. Tech-I Semester)

I Semester : SE							**Scheme : 2022**
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
AU 101	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
	2	**-**	**-**	**0**	**-**	**-**	**-**

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

CO1: Understanding basic Sanskrit language.

CO2: Ancient Sanskrit literature about science & technology can be understood.

CO3: Being a logical language will help to develop logic in students.

Unit – I

Alphabets in Sanskrit.

Unit – II

Past/Present/Future Tense – Simple Sentences.

Unit – III

Order – Introduction of roots.

Unit – IV

Technical information about Sanskrit Literature.

Unit – V

Technical concepts of Engineering – Electrical, Mechanical, Architecture, Mathematics.

Text Books :

1. Dr.Vishwas, Samskrita, *Abhyaspustakam*, Bharti Publication, New Delhi.
2. Vempati Kutumbshastri, *Teach Yourself Sanskrit* Prathama Deeksha, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3. Suresh Soni, *India's Glorious Scientific Tradition*, Ocean Books (P) Ltd., New Delhi.

Reference Books :

PEDAGOGY STUDIES

(Audit Course – II for M. Tech-II Semester)

II Semester : SE					Scheme : 2022		
Course Code	Hours/Week			Credits	Maximum Marks		
AU 102	L	T	P	C	Continuous Internal Assessment	End Exam	Total
	2	-	-	0	-	-	-

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

CO1: What pedagogical practices are being used by teachers in formal and informal classrooms in Developing countries?

CO2: What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

CO3: How can teacher education (curriculum and practicum) and the school curriculum and Guidance materials best support effective pedagogy?

Unit – I

Introduction and Methodology: Aims and rationale – Policy back ground – Conceptual frame work and terminology – Theories of learning – Curriculum – Teacher education – Conceptual framework – Research questions – Overview of methodology and Searching.

Unit – II

Thematic Overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries – Curriculum – Teacher education.

Unit – III

Evidence on the effectiveness of pedagogical practices – Methodology for the in depth stage: Quality assessment of included studies – How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change – Strength and nature of the body of evidence for effective pedagogical practices – Pedagogic theory and pedagogical approaches – Teachers' attitudes and beliefs and Pedagogic strategies.

Unit – IV

Professional Development: Alignment with classroom practices and follow-up support – Peer support – Support from the head teacher and the community – Curriculum and assessment – Barriers to learning: limited resources and large class sizes.

Unit – V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy – Teacher education – Curriculum and assessment – Dissemination and research impact.

Text Books :
1. Ackers J, Hardman F, *Classroom Interaction in Kenyan Primary Schools*, Compare, 31(2): 245-261.
2. Agrawal M (2004), *Curricular Reform in schools: The importance of Evaluation*, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003), *Teacher Training in Ghana - does it count*, Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong. K, Lussier K, Pryor J, Westbrook J (2013), *Improving Teaching and Learning of Basic Maths and Reading in Africa: Does Teacher Preparation Count?*, International JournalEducationalDevelopment,33 (3): 272–282.
5. Alexander RJ (2001), *Culture and pedagogy: International Comparisons in Primary Education*. Oxford and Boston: Blackwell.
6. Chavan M (2003), *Read India: A Mass Scale, Rapid, 'Learning to Read' Campaign*.
Reference Books :

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(Audit Course – II for M. Tech-II Semester)

II Semester : SE							**Scheme : 2022**
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
AU 102	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
	2	**-**	**-**	**0**	**-**	**-**	**-**

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

CO1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.

CO2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity.

CO3: Study of Neetishatakam will help in developing versatile personality of students.

Unit – I

Neetisatakam – Holistic development of personality

- Verses – 19, 20, 21, 22 (wisdom)
- Verses – 29, 31, 32 (pride & heroism)
- Verses – 26, 28, 63, 65 (virtue)

Unit – II

Neetisatakam – Holistic development of personality

- Verses – 52, 53, 59 (dont's)
- Verses – 71, 73, 75, 78 (do's)

Unit – III

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2 – Verses 41, 47, 48,
- Chapter 3 – Verses 13, 21, 27, 35,
- Chapter 6 – Verses 5, 13,17, 23, 35,
- Chapter 18 – Verses 45, 46, 48.

Unit – IV

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter 2 – Verses 56, 62, 68
- Chapter 12 – Verses 13,14,15,16,17,18

Unit – V

Personality of Role model. Shrimad Bhagwad Geeta:

- Chapter 2 – Verses 17,

• Chapter 3 – Verses 36, 37, 42, • Chapter 4 – Verses 18, 38, 39 • Chapter 18 – Verses 37, 38, 63
Text Books :
1. Swami Swarupananda, *Srimad Bhagavad Gita*, AdvaitaAshram (Publication Department), Kolkata.
2. P. Gopinath, *Bhartrihari's Three Satakam (Niti-sringar-vairagya)*, Rashtriya Sanskrit Sansthanam, New Delhi.
Reference Books :

STRESS MANAGEMENT BY YOGA

(Audit Course – II for M. Tech-II Semester)

II Semester : SE					**Scheme : 2022**		
Course Code	**Hours/Week**			**Credits**	**Maximum Marks**		
AU 102	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exam**	**Total**
	2	**-**	**-**	**0**	**-**	**-**	**-**

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

CO1: Develop healthy mind in a healthy body thus improving social health also.

CO2: Improve efficiency

Unit – I

Definitions of Eight parts of yoga. (Ashtanga)

Unit – II

Yam and Niyam.

Unit – III

Do`s and Don't's in life.

i)Ahinsa, satya, astheya, bramhacharya and aparigraha

ii)Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit – IV

Asan and Pranayam

Unit – V

i) Various yoga poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects – Types of pranayam

Text Books :

1. Janardan Swami, *Yogic Asanas for Group Training- Part-I*, Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, *Raja yoga or conquering the Internal Nature*, Advaita Ashrama (Publication Department), Kolkata.

Reference Books :