USHARAMA

COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Approved by A.I.C.T.E & Permanently Affiliated to JNTU, Kakinada)
Accredited by NAAC with "A" Grade
on NH 16, Telaprolu, Krishna Dist – 521109

M.Tech
Structural Engineering
Course Structure & Syllabus

(Applicable for the batches admitted from the Academic Year 2019-20)

DEPARTMENT OF CIVIL ENGINEERING

M.Tech - Semester I

S.No	Course Type	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credits
1	PCC	UR19PCSE101	Matrix analysis of structures	3	0	0	3	3
2	PCC	UR19PCSE102	Theory of Elasticity and Plasticity	3	0	0	3	3
3	PCC	UR19PCSE103	Structural Dynamics	3	0	0	3	3
4	PCC	UR19PCSE104	Advanced theory and Design of Structures	3	0	0	3	3
5	PEC		**PROGRAM ELECTIVE – I**	3	0	0	3	3
		UR19PESE105	Fracture Mechanics of concrete					
		UR19PESE106	Experimental stress analysis and motion measurement					
		UR19PESE107	Soil dynamics and machine foundations					
6	PEC		**PROGRAM ELECTIVE – II**	3	0	0	3	3
		UR19PESE108	Computational method in engineering					
		UR19PESE109	Design of High rise Structures					
		UR19PESE110	Plastic analysis and design					
7	PCC	UR19PCSEL101	Advanced concrete technology and structural engineering laboratory	0	0	3	3	1.5
8	PROJ	UR19PROJSE101	Seminar-I	0	2	0	2	2
9	AD		**AUDIT COURSE-I***	0	0	0	0	0
		UR19ADSE101	English for research paper writing					
		UR19ADSE102	Disaster management					
		UR19ADSE103	Value Education					
			Total	**18**	**2**	**3**	**23**	**21.5**

***Internal Evaluation – Self Learning Course**

M.Tech - Semester II

S.No	Course Type	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credits
1.	PCC	UR19PCSE201	Finite element analysis	3	0	0	3	3
2.	PCC	UR19PCSE202	Theory of plates and shells	3	0	0	3	3
3	PCC	UR19PCSE203	Stability of structures	3	0	0	3	3
4	PCC	UR19PCSE204	Earthquake Resistant Design of Structures	3	0	0	3	3
3	PEC		**PROGRAM ELECTIVE–III**	3	0	0	3	3
		UR19PESE205	Design of Pre-Stressed Concrete Structures					
		UR19PESE206	Mechanics of composite materials					
		UR19PESE207	Fibre reinforced concrete					
4	PEC		**PROGRAM ELECTIVE–IV**	3	0	0	3	3
		UR19PESE208	Repair, Retrofitting and Rehabilitation of structures					
		UR19PESE209	Optimization techniques in structural engineering					
		UR19PESE210	Principles of Bridge engineering					
5	PCC	UR19PCSEL201	Computer applications in structural engineering lab	0	0	3	3	1.5
7	PROJ	UR19PROJSE201	Seminar-II	0	2	0	2	2
8	AD		**AUDIT COURSE-II***	0	0	0	0	0
		UR19ADSE201	Constitution of India					
		UR19ADSE202	Pedagogy studies					
		UR19ADSE203	Personality development through life Enlightenment skills					
			Total	**18**	**2**	**3**	**23**	**21.5**

***Internal Evaluation – Self Learning Course**

SEMESTER - III

S.No	Course Type	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credits
1.	PROJ	UR19PROJSE301	Project work – Phase - I	0	0	20	20	10
			Total	**0**	**0**	**20**	**20**	**10**

SEMESTER - IV

S.No	Course Type	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credits
1.	PROJ	UR19PROJSE401	Project work – Phase - II	0	0	30	30	15
			Total	**0**	**0**	**30**	**30**	**15**

Total credits for the Programme = 21.5+21.5+10+15=68

M.Tech. I Semester **COURSE CODE: UR19PCSE101** **L T P C**
3 0 0 3

MATRIX ANALYSIS OF STRUCTURES

Internal Marks:30
External Marks:70

COURSE OBJECTIVES:

- To study the concepts, characteristics and transformation of structures using matrix approach
- To study the concepts of Flexibility and Stiffness Methods
- To study the Flow Charts the Analysis of Beams, Plane Truss, in computer oriented Stiffness Method

UNIT-I:Basic Concepts of Structural Analysis : Introduction; Types of Framed Structures; Deformations in Framed Structures; Actions and Displacements; Equilibrium; Compatibility; Static and Kinematic Indeterminacy; Structural Nobilities; Principle of Superposition; Action and Displacement Equations; Flexibility and Stiffness Matrices; Equivalent Joint Loads; Energy Concepts; Virtual Work.

UNIT-II Fundamentals of the Flexibility Method:
Introduction; Flexibility Method; Temperature changes; Prestrains and Support Displacements; Joint Displacements; Member End Actions and support reactions; Flexibilities of prismatic members; Formalization of the Flexibility method.

UNIT-III Fundamentals of the Stiffness Method:
Introduction; Stiffness Method; Temperature changes; Prestrains and Support Displacements; Stiffness of Prismatic Members; Formalization of the Stiffness Method.

UNIT –IV
Space trusses and frames - Member stiffness for space truss and space frame– Transformation matrix from Local to Global – Analysis of simple trusses, beams and frames

UNIT-V Computer Oriented Direct Stiffness Method:
Introduction; Direct Stiffness Method; Complete Member Stiffness Matrices; Formation of Joint Stiffness Matrix; Formation of Load Vector; Rearrangement of Stiffness and Load Arrays; Calculation of Results; Analysis of Continuous Beams; Plane Truss Member Stiffness; Analysis of Plane Trusses; Rotation of Axes in Two Dimensions; Application to Plane Truss Members; Rotation of Axes in Three Dimensions; Plane Frame Member Stiffness; Analysis of Plane Frames. Flow Chart for the analysis of the following structures: i) Continuous Beam ii) Plane Truss iii) Plane Frame

Text Books:

1. Matrix Analysis of Framed Structures by W. Weaver &J.M.Gere, CBS Publishers, 1986.
2. Matrix methods of structural analysis by PN Godbole, RS Sonparote, SU Dhote, PHI, 2014.
3. Matrix methods of structural analysis by AS Meghre and SK Deshmukh, Charotar Publishing House,2003.

Reference Books:

1. Computer analysis of framed structures by DamoderMaity, IK International, 2007.
2. Matrix analysis of structures by P.K.Singh, Cengage Learning India , 2013.
3. Matrix methods of structural analysis by SS Bhavikatti, IK International Publishing House Pvt.Ltd.,2011.

Course Outcomes:

CO1: On completion of this course students will be able to use matrix approach for solving structural engineering problems

CO2: Students will have a thorough understanding of both flexibility and stiffness approach of analysis.

CO3: Students will have a thorough understanding of stiffness approach of analysis.

CO4: Students will be able to understand the stiffness method for continuous beams, plane trusses in computer oriented.

CO5: Student will be able to understand the write the flowcharts for solving the problems in computer programs for continuous beams and frame.

CO6: Student will be able to understand the write the flowcharts for solving the problems in computer programs for trusses

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M.Tech. I Semester **COURSE CODE: UR19PCSE102** **L T P C**
3 0 0 3

THEORY OF ELASTICITY AND PLASTICITY

Internal Marks: 30
External Marks: 70

Course Objectives

To make the students

- Impart knowledge of principal stresses and strains
- Analytical skills of solving problems using plane stress, plane strain and Torsion.

UNIT–I: Analysis of Stress and Strain in Three Dimensions

Principal stresses–Stress ellipsoid–Stress-director surface–Determination of principal stresses–Stress invariants-Max shear stress–Homogeneous deformation Principal axes of strain rotation. General Theorems: Differential equation of equilibrium–Boundary conditions for compatibility–Displacements–Equations of equilibrium in terms of displacements–Principle of superposition.

UNIT–II: Two Dimensional Problems in Rectangular Co-ordinates

Solution by polynomials – Saint-Venant's principle– Determination of displacements bending of cantilever loaded at the end–Bending of a beam by uniform load.

UNIT–III: Two Dimensional Problems in Polar Co-ordinates

General equations in polar co-ordinates–Stress distribution symmetrical about an axis–Pure bending of curved bars-Strain components in polar co-ordinates–Displacements for symmetrical stress distributions–Stress in a circular disc– The effect of circular holes on stress distribution in plates.

UNIT–IV: Torsion

Torsion of Straight bars – Bars with elliptical cross section – Other elementary solution–Membrane analogy–Torsion of narrow rectangular bars–Solution of torsional problems by energy method – Use of soap films in solving torsional problems.

UNIT-V: Plasticity

Yield criteria – Introduction, The Tresca yield criterion, The von Mises yield criterion; Stress-Strain relations – Introduction, Plastic potential and plastic flow, Levy-Mises equations, Prandtl-Reuss equations.

Text Books:

1. S P Timoshenko & J N Goodier, "Theory of Elasticity", Mc GrawHill Publications.(UnitsI,II,III,IV,V)
2. Sadhu Singh," Theory of Elasticity",Khanna Publications.

Reference Books:

1. C.T. Wang ,"Applied Elasticity" , McGraw-Hill Publications.
2. Martin H. Sadd, "Elasticity Theory, Applications and Numeric", Oxford Publications.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Apply the knowledge of plane stress and plane strain in a given problem.
CO2: Understanding the concept of boundary conditions for compatibility
CO3: Analyze the structure using principle of elasticity.
CO4: Explain the principles of stress-train relations for linearly elastic solids and Torsion.
CO5: Explain the principles of stress-strain relations for Torsion.
CO6: Understand and analyze the structure using principle of Plasticity

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M.Tech. I Semester **COURSE CODE: UR19PCSE103** **L T P C**
3 0 0 3

STRUCTURAL DYNAMICS

Internal Marks:30
External Marks:70

Course Objectives

To make the students

- Create an understanding on degrees of freedom & dynamic loading and ability to formulate the equations of motion and apply them to simple dynamic problems.
- Familiarize on obtaining the natural frequencies & mode shapes and impart the knowledge on mode superposition method to undamped forced motion of multi degree freedom system.

UNIT–I:Theory of Vibrations

Introduction-Elements of vibratory system-Degrees of Freedom-Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion-Vectorial representation of S.H.M.-Free vibrations of single degree of freedom system–Undamped and Damped vibrations-Critical damping-Logarithmic decrement.

UNIT–II: Single Degree of Freedom Systems

Fundamental objectives of dynamic analysis -Types of prescribed loading –Formulation of equations of motion by different methods–Direct equilibration using Newton's law of motion D'Alembert's principle,Formulation and solution of the equation of motion-Free vibration response-Response to Harmonic, Impulsive and general dynamic loadings –Duhamel integral.

UNIT–III: Multi Degree of Freedom Systems –Free vibrations

Selection of the degrees of Freedom- concept of shear building - Evaluation of structural property matrices - Formulation of the MDOF equations of motion - Undamped free vibrations-Solutions of Eigen value problem for natural frequencies and mode shapes. Examples on two degree freedom systems.

UNIT–IV: Continuous Systems

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

UNIT –V : Introduction to Earthquake Analysis and Wind forces: Introduction - Excitation by rigid base translation -Lumped mass approach - SDOF and MDOF systems – Theory of Response Spectrum Method - analysis for obtaining response of multi storeyed buildings- Wind effects on structures - static and dynamic - analysis for wind loads using BIS codes - quasi static method and gust factor method

Text Books:

1. Mario Paz and Leigh ,"Structural dynamics", CBS Publishers, 1st edition 1985.(Units-II,III,IV&V)
2. S.R.Damodarasamy&S.Kavitha,"StructuralDynamicsandAseismicDesign", PHIL earning private Ltd. ,New Delhi.(Units-I,II,III&IV)

Reference Books:

1. Anil K. Chopra ,"Dynamics of Structures", Pearson Education (Singapore), Delhi.
2. RaymondW. Clough, Joseph Penzien,"Dynamics of Structures",M.C. GrawHill Book Company.
3. RoyR.C. Craig "Structural Dynamics–An introduction to computer methods", John Wiley &sons.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Develop differential equation of motion for an undamped single degree freedom system.

CO2: Understand different types of damping and concept of logarithmic decrement.

CO3: Formulate the equations for response against harmonic, Periodic and Impulsive loadings & Duhamel integral.

CO4:Understand how to formulate stiffness and mass matrices and carry out free Vibration analysis.

CO5:Obtain response against forced motion applying mode superposition method.

CO6:Wind loads effects on structures and wind load analysis by Quasi Static method.

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M.Tech. I Semester **COURSE CODE: UR19PCSE104** **L T P C**
3 0 0 3

ADVANCED THEORY AND DESIGN OF STRUCTURES

Internal Marks: 30
External Marks: 70

Course Objective:

- To impart knowledge on the behavior and design on various reinforced concrete structural elements.

UNIT – I Design of beams in Combined shear, bending and Torsion
Behavior of RCC members in Shear and Torsion Kani's theory for shear; Skew bending theory for torsion; Different modes of failure; Design of beams in combined shear, bending and torsion

UNIT – II Detailing of RCC structures
Basic principles of detailing – Truss analogy, Directional changes, General layout of reinforcement; Beam-column joints – Strut- and-Tie model, Detailing; Beam-to- girder joints; Corners and T-Joints; Brackets and corbels

UNIT – III Flat slabs
Shear in flat slabs and flat plates – One-way shear, Two-way (punching) shear, Shear due to unbalanced moment, Shear reinforcement design; Equivalent frame analysis of flat slabs – Historical development and definition of equivalent frame, Moment of inertia of slab-beams, Theoretical column stiffness's, Use of published data for flat \ slabs, equivalent column method, arrangement of live load, Reduction in negative moments, Design procedure.

UNIT – IV Wind loads on buildings (as per IS875 Part 3 : 2016)
Wind load on pitched roofs; Wind loads on the walls of rectangular clad buildings
Analysis and design of gable frames Elastic analysis and limit state design of gable frames subjected dead, live and wind loads; Plastic analysis and design of gable frames subjected to dead, live and wind loads

UNIT –V Low-rise Multi-storey buildings
Limit state design of a three-storey braced (pin-jointed) building subjected to dead, live and wind loads –Design of composite beam, Design of column, Design of brace

Text Books:

1. Advanced reinforced concrete design by P.C.Varghese, Prentice-Hall of India, 2005.
2. Reinforced concrete structural elements by P.Purushothaman, Tata McGraw-Hill, 1984.
3. Design of steel structures by K.S.Sai Ram, Pearson Education, 2015.
4. Structural steel work – Design to limit state theory by Dennis Lam, Thien-Cheong Ang and Sing-Ping Chiw, Elsevier, 2004.

Reference Books:

1. Design of reinforced concrete structures by N.Subramanian, Oxford University Press, 2013.
2. Design of concrete structures by A.H.Nilson, McGraw-Hill, 1997.
3. Steel Structures – Practical design studies by HK Al Nageim and TJ Macginley, Taylor & Francis, 2005

4. Plastic design of steel frames by LS Beedle, John Wiley & Sons, 1958

Course Outcomes:

At the end of semester the student will be able to

CO1: Design the reinforced concrete elements like beams when Shear, Bending Moment

CO2: Design the reinforced concrete elements like beams when Torsion effected

CO3: Know the Detailing of a Concrete Structures for different joint members.

CO4: know the design of one-way shear and two-way shear flat slabs and plates

CO5: Know the wind load analysis and design of Industrial buildings

CO6: know the analysis and design of low rise buildings with steel structure.

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M.Tech. I Semester **COURSE CODE: UR19PESE105** **L T P C**
3 0 0 3

FRACTURE MECHANICS OF CONCRETE STRUCTURES

(PE-I)

Internal Marks:30
External Marks:70

Course Objectives:

- To impart knowledge on the mechanisms of failure and fracture mechanics of concrete
- To impart knowledge on the principles of linear elastic fracture mechanics
- To impart knowledge on the principles of nonlinear fracture mechanics.
- To impart knowledge on the fracture propagation in structure

UNIT – I Introduction to fracture mechanics

Introduction to fracture mechanics of concrete Structural failure based on material performance; Concepts of linear elastic fracture mechanics; Fracture mechanics of concrete

UNIT – II Principles of linear elastic fracture mechanics

Airy stress functions for problems in elasticity; Complex stress function; Elastic stress and displacement fields at crack tip; Stress intensity factors and crack opening displacements for useful geometries; Superposition of stress intensity factors; Plastic zone at crack tip; Griffith's fracture theory; Strain energy release rate for crack propagation; Relationship between stress intensity factor and strain energy release rate; Design based on linear elastic fracture mechanics.

UNIT – III Principles of non-linear fracture mechanics

Energy principles for crack propagation in non-linear materials; J-integral for non- linear elastic materials; Fracture resistance (R curve); Crack tip opening displacement.

UNIT – IV Structure and fracture process of concrete

Constituents and microstructure of concrete; Fracture behavior and strain localization of concrete; Fracture process zone and toughening mechanisms; Experimental determination of fracture zone; Influence of fracture process zone on fracture behavior of concrete.

UNIT – V Non-linear fracture mechanics for Mode I Quasi-Brittle Fracture

General description of quasi-brittle fracture; Fictitious approach – Energy dissipation for fictitious crack, Fictitious crack model by Bazant and Oh, Determination and influence of (w) relationship, Some comments on fictitious crack approach; Effective elastic approach – Energy dissipation for effective-elastic crack, Two- parameter fracture model by Jenq and shah, Size effect model by Bazant and Kazemi, Effective crack model by Karihaloo and Nallathambi, Effective crack model by Refai and Swartz, Some comments on effective-elastic crack approach; Comparison between Fictitious and effective-elastic crack approaches; Finite element analysis – Discrete crack approach, Smeared crack approach , Software available.

Concept of CTOD and CMD, material models, crack models, band models and models based on continuum damage mechanics

Text Books :

1.Fracture Mechanics of Concrete: Applications of Fracture Mechanics to Concrete, Rock and Other Quasi-Brittle Materials by Surendra P. Shah, Stuart E. Swartz, Chengsheng Ouyang, Publisher : Wiley , 1995.
2.Analysis of Concrete Structures by Fracture Mechanics by L. Elfgren, Publisher**:** Routledge, 1990.

Reference Books:

1. Fracture mechanics Applications in concrete, Edited by Christian Gaedicke, ACI SP 300, 2015.
2. Applications of fracture mechanics to reinforced concrete by A. Carpinteri, Taylor & Francis, 1992.

Course Outcomes:

The learner will be able to

CO1: Understand the behavior of fracture mechanics of concrete and Concepts of linear elastic fracture mechanics

CO2: know the crack propagation and Design based on linear elastic fracture mechanics

CO3: understand the principles for crack propagation in non-linear materials

CO4: understand the microstructure and fracture process of the concrete.

CO5: understand the concept of Non-linear fracture mechanics for Mode I Quasi-Brittle Fracture.

CO6: understand the concept of CTOD, COD and Crack, band Models.

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M.Tech. I Semester **COURSE CODE: UR19PESE106** **L T P C**
3 0 0 3

EXPERIMENTAL STRESS ANALYSIS AND MOTION MEASUREMENT

(PE-I)

Internal Marks:30
External Marks:70

Course Objectives:

- To impart knowledge on the strain measurement, brittle coating and photo elasticity.
- To impart knowledge on the Model Analysis of Structures
- To impart knowledge on the Motion Measurement

Unit - I Experimental determination of strain

Introduction to Strain Measurements Experimental determination of strain; Properties of strain gage systems; Types of strain gages

Unit -II Strain Measurement using Electrical Resistance Strain Gages

Strain Measurement using Electrical Resistance Strain Gages Introduction; Strain sensitivity in metallic alloys; Gage construction; Strain gage adhesives and moulding methods; Gage sensitivities and gauge factor; The Wheatstone bridge ; Wheatstone bridge sensitivity; Temperature compensation ; Static recording and data logging – Manual strain indicators, Automatic data acquisition systems, PC based data acquisition systems; Strain analysis methods – Three element rectangular rosette

Unit –III Stress analysis using Photo elasticity Wave theory of light

Stress analysis using Photo elasticity Wave theory of light; Refraction of light; The Polariscope – Plane polarisers, wave plates; Plane polariscope; Circular polariscope; Diffused light polariscope; The stress optic law for two-dimensional plane-stress bodies;

Unit—IV Two-dimensional photoelastic stress analysis

Two-dimensional photoelastic stress analysis – Isochromatic fringe patterns, Isoclinic fringe patterns, Calibration methods, Principal stress separation methods, Scaling model-to-prototype stresses; Materials for two dimensional photoelasticity; Three-dimensional photoelasticity – Stress freezing

Unit - V Model analysis of Structures and Motion Measurement

Introduction – Objectives of structural model studies, Some basic definitions, Types of similitude , Classification of model studies, Model materials, Size effects; Principles of similitude – Dimensional analysis, Buckingham π Theorem, Variables in structural behaviour; Requirements of similitude; Direct approach ; Introduction; Vibrometers and Accelerometers; the seismic instrument; General theory of the seismic instrument; the seismic accelerometer; Practical accelerometers.

Text Books:

1. Experimental Stress Analysis by Dally and Riley, McGraw-Hill, 1991.
2. Model analysis of Structures by T.P. Ganesan, Universities Press, 2000.
3. Mechanical measurements by Bechwith, Merangoni & Lienhard, Pearson Education, 2003.

Reference Books:

1. Experimental Stress Analysis by Dove and Adams 2006, Macmillan Publishing Company

2. Experimental stress analysis by Sadhu Singh, Khanna Publishers, 2014

Course Outcomes: The learner will be able

CO1:to understand the properties of strain-gauge systems and the computation techniques.

CO2: to understand Strain Measurement using Electrical Resistance Strain Gauges

CO3: to understand Stress analysis using Photo elasticity Wave theory of light and scale modeling for Two and Three dimensional Photo elasticity

CO4: to study Model analysis using Buckingham π Theorem

CO5: to study the concept of stress freezing.

CO6:to understand Motion Measurement using Vibro-meters and Accelerometers

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M.Tech. I Semester **COURSE CODE: UR19PESE107** **L T P C**
3 0 0 3

SOIL DYNAMICS AND MACHINE FOUNDATIONS

(PE-I)

Internal Marks: 30
External Marks: 70

Course Objectives:

- To understand the wave propagation in soils,
- To determine dynamic properties of soil for analyzing
- Designing foundations subjected to vibratory loading.

UNIT I : Fundamentals of Vibration: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.

UNIT II : Wave Propagation and Dynamic Soil Properties: Propagation of seismic waves in soil deposits - Attenuation of stress waves, Stress-strain behavior of cyclically loaded soils, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field Testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays.

UNIT III : Foundation Vibration Analyses: Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Vertical vibration of circular foundations resting on Elastic Half Space- Lambs, Reissner, Quinlan &Sungs Hsiehs and Lysmers analogies.

UNIT IV: Design of Machine Foundations: Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

UNIT V: Machine Foundations on Piles and Special Foundations: Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation. Foundation on expansive soils – choice of foundation – under-reamed pile foundation. Foundation for concrete Towers, chimneys – Design of anchors- Reinforced earth retailing walls

Text Books:

1. Swami Saran - Soil Dynamics and Machine Foundation, Galgotia Publications Pvt. Ltd.(2010)
2. Prakash, S. - Soil Dynamics, McGraw Hill Book Company (1981)

Reference Books:

1. I.Chowdhary and S P Dasgupta - Dynamics of Structures and Foundation, 2009.
2. Arya, S. D, O'Neil, M. and Pincus, G.- Design of Structures and Foundations for Vibrating Machines, Gulf Publishing Co., 1979.
3. Prakash, S. and Puri, V. K. - Foundation for Machines: Analysis and Design, John Wiley& Sons, 1998.

4. Kameswara Rao, N. S. V. - Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.

Course Outcomes : The learner will be able

CO1: to understand the fundamentals of wave propagation in soil media,

CO2: to evaluate the dynamic properties of soil,

CO3: to study the Foundation Vibration Analysis of a rigid foundation block, vertical vibration of circular foundations

CO4: to study the design the foundation for reciprocating and Impact machines.

CO5 : to study the Analysis of Machine Foundations on Piles: under vertical vibrations, translation and rocking

CO6 : to study the Analysis of Machine Foundations on concrete towers, chimneys and design of anchors.

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M.Tech. I Semester **COURSE CODE: UR19PESE108** **L T P C**
3 0 0 3

COMPUTATIONAL METHODS IN ENGINEERING

(PE-II)

Internal Marks:30
External Marks:70

Course Objectives

To make the students

- Know how to solve system of equations, ordinary differential equations and partial differential equations numerically.
- Understand correlation and regression.
- Know optimization techniques in solving linear and fractional programming problems.

UNIT-I Applied partial Differential Equations:

One-dimensional Heat equation Cartesian, cylindrical and spherical coordinates (problems having axi-symmetry). Two-dimensional Laplace Equation in Cartesian, cylindrical and spherical coordinates (problems having axi-symmetry) –Analytical solution by separation of variables technique

UNIT–II: Introduction to Numerical Methods Applied to Engineering Problems: Solving system of linear equations by Gauss Seidel and Relaxation methods. Solving system of non-linear equations by Newton-Raphson method. Fitting of non-linear curves by the method of least squares.

UNIT–III: Numerical Solutions of Ordinary Differential Equations

Conversion of initial value problem to boundary value problem using shooting method, solution through a set of equations-derivative boundary conditions-Rayleigh Ritz method.

UNIT–IV: Numerical Solutions of Partial Differential Equations

Finite-difference approximations to derivatives; Laplace equation: Jacobi Method- ADI method, Parabolic Equation–Crank Nicolson method.

UNIT–V: Applied Statistics and Optimization Techniques

Bi variate Data-simple correlation-Correlation analysis-correlation coefficient– coefficient of correlation for ungrouped and grouped bi-variate data–coefficient of determination–Test of significance for correlation coefficient. Regression Analysis Simple linear regression-multiple linear regression; Linear Programming: Mathematical formulation-graphical solution of two variable simplex method-artificial variable technique- Big M method- linear fractional programming problem.

Text Books:

1. S.S.Sastry,IntroductoryMethodsofNumericalAnalysis,PrenticeHallIndia,3rd Edition.(UNITS –I,II,III)
2. Agarrval,B.L.,BasicStatistics,Wiley,2nd edition.(UNIT-IV)
3. S.D.Sharma,OperationsResearch,KedarnathRamNadh,1972(Unit-V)

Reference Books:

1. Ward Cheney and David Kincaid M, Numerical Mathematics and Computing, Brooks/ColePublishingCompany1999,Fourthedition.
2. Riley K.F,.M.P. Hobson and Bence S.J, Mathematical Methods for Physics andEngineering,CambridgeUniversitypress,1999.
3. Steven C.Chapra, Raymond P.Canale Numerical Methods for Engineers Tata Mc-Graw Hill
4. Curtis F.Gerald, Partick.O.Wheatly,Applied Numerical analysis, Addison- Wesley,1989
5. Kantiswarup, GuptaP.K. and Manmohan , Operations Research , S.chand and sons,2004.

Course Outcomes:

Upon successful completion of the course ,the students will be able to

CO1 : Find the solutions of system of linear and non linear equations.

CO2 : Solve ordinary and partial differential equations numerically.

CO3 : Determine the correlation coefficient and regression.

CO4 : Optimize linear programming problems.

CO5 : Optimize fractional programming problems.

CO6 : Optimize using graphical methods.

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M.Tech. I Semester **COURSE CODE: UR19PESE109** **L T P C**
3 0 0 3

DESIGN OF HIGH RISE STRUCTURES

(PE-II)

Internal Marks:30
External Marks:70

Course Objectives

To make the students

- Impart the overall knowledge about the material, elements and systems with planning in High Rise Structures
- Analysis and design involved in Tall Buildings.

UNIT –I Introduction to High rise buildings and Types of Loads

Design Criteria Philosophy, Materials – Modern concepts – High Performance Concrete, Fibre Reinforced Concrete, Light weight concrete, Self-Compacting Concrete.Gravity Loading – Dead load, Live load, Impact load, Construction load, Sequential loading. Wind Loading – Static and Dynamic Approach, Analytical method, Wind Tunnel, Experimental methods. Earthquake Loading – Equivalent lateral Load analysis, Response Spectrum Method, Combination of Loads.

UNIT-II Behavior of Structural Systems

Behavior of Structural Systems- Factors affecting the growth, height and structural form, Behavior of Braced frames, Rigid Frames, In-filled frames, Shear walls, Coupled Shear walls, Wall–Frames, Tubular, Outrigger braced, Hybrid systems.

UNIT—III Analysis and Design of High Rise Buildings

Analysis and Design- Modeling for approximate analysis, accurate analysis and reduction techniques, Analysis of structures as an integral unit, Analysis for member forces, drift and twist. Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

UNIT-IV Stability Analysis

Stability Analysis- Overall buckling analysis of frames, wall–frames, Approximate methods, Second order effect of gravity loading, P–Delta Effects, Simultaneous first order and P-Delta analysis, Translational instability, Torsional Instability, Out of plumb effects, Effect of stiffness of members and foundation rotation in stability of structures.

UNIT V Structural systems for future generation buildings

Structural systems for future generation buildings - Expert systems for consultations - Economics - Research needs in tall building materials, systems and designs.

Text Books:

1. Bryan Stafford Smith and Alex Coull, “Tall Building Structures - Analysis and Design”, John Wiley and Sons, Inc., 1991.
2. Taranath B.S, “Structural Analysis and Design of Tall Buildings”, McGraw-Hill, 1988.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: introduce various systems of tall buildings

CO2: know about different types of loads, materials and design philosophy

CO3: impart knowledge about behavior of Structural Systems like Braced frames, Rigid Frames,

CO4: know about Computerized 3D analysis. Design for differential movement, Creep and Shrinkage effects, Temperature Effects and Fire Resistance.

CO5: impart knowledge about Stability Analysis by using Second order effect of gravity loading, P–Delta Effects, Simultaneous first order and P-Delta analysis

CO6: impart knowledge about Translational and Torsional Instability

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M.Tech. I Semester **COURSE CODE: UR19PESE110** **L T P C**
3 0 0 3

PLASTIC ANALYSIS AND DESIGN

(PE-II)

Internal Marks:30
External Marks:70

Course Objective:

- To impart knowledge on the analysis of steel structures like continuous beams, steel frames and connection, using Plastic Analysis.

UNIT –I Introduction to basic concepts

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

UNIT –II Method of Limit Analysis for beams

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

UNIT – III Basic theorems of limit analysis for frames

Basic theorems of limit analysis, rectangular portal frames, gable frames, grids, superposition of mechanisms, drawing statistical bending moment diagrams for checks.

UNIT-IV Limit design Principles for beams and frames

Limit design Principles: Basic principles, limit design theorems, application of limit design theorems, trial and error method, method of combining mechanisms, plastic moment distribution method, load replacement method, continuous beams and simple frames designs using above principles.

UNIT –V Deflection in Plastic beams and frames and Minimum Weight Design

Deflection in Plastic beams and frames: Load deflection relations for simply supported beams, deflection of simple pin based and fixed based portal frames, method of computing deflections; Minimum weight Design: Introduction to minimum Weight and linear Weight functions-Foulkes theorems and its geometrical analogue and absolute minimum weight design.

Text Books:

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

Course Outcomes: Upon successful completion of the course, the students will be able to

CO1: understand the Concepts of stress and strain – relation of steel Moment curvature relation
CO2: to know the Method of Limit Analysis for rectangular portal frames, gable frames, grids
CO3 : to design continuous beams and steel frames
CO4 : to understand the deflections in Plastic beams and frames
CO5 : to understand the minimum weight design
CO6 : to understand the concept of partial fixity

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M.Tech. I Semester **COURSE CODE: UR19PCSEL101** **L T P C**
0 0 3 1.5

ADVANCED CONCRETE TECHNOLOGY AND STRUCTURAL ENGINEERING LAB

Internal Marks:20

External Marks:30

Course Objectives

To make the students

- Familiarize the students to the advanced equipment for Testing of materials.
- Familiarize the students to the Special Concrete like Self – Compacting Concrete
- Familiarize the students in mix design of Concrete
- Familiarize the students in the determination of horizontal thrust of Two ,Three hinged arches

List of Experiments:

1. Strain measurement-Electrical resistance strain gauges.
2. Non –destructive Testing-Rebound Hammer test
3. Non –destructive Testing-UPV test.
4. Qualifications tests on Self compaction concrete-LBox test,
5. Qualifications tests on Self compaction concrete JBox test,
6. Qualifications tests on Self compaction concrete U box test,
7. Qualifications tests on Self compaction concrete Slump test.
8. Mix design methods using a)I.S. Code method b)ACI Code method.
9. Measurement of cover and bar diameter by poroscope /re-bar locator.
10. Buckling of columns.
11. Chemical Analysis of water for suitability in concreting with Reinforcement.
12. Chemical Analysis of water for suitability in concreting without Reinforcement.
13. Chemical Analysis of sand and Aggregate for Suitability in Construction.
14. Repair and rehabilitation of concrete beam.

Reference Books:

1. Process manual by Millennium Technologies.
2. N.Krishna Raju,“Design of Concrete Mixes”.
3. M. S. Shetty,” Concrete Technology (Theory And Practice)”, S. Chand Publication

Note: Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 : Gain the knowledge on concept of NDT.

CO2 : to know the difference between the Normal concrete and Self Compacting

CO3 : Compare the strengths of concrete by different mix design methods.

CO4 : Analyze different characteristics of a structure for dynamic loadings.

CO5 : Learn Measurement of cover and bar diameter by poroscope.

CO6 : Analyze different Repair and rehabilitation methods.

M.Tech. I Semester **COURSE CODE: UR19PROJSE101**

L	T	P	C
0	2	0	2

SEMINAR – I

Internal Marks: 50
External Marks: 0

The students are required to search / gather the material / information on a specific topic, comprehend it, submit report and present in the class.

Course Outcomes:

The Students will be able to

1. Understand of contemporary / emerging technology for various processes and systems.
2. Share knowledge effectively in oral and written form and formulate documents.

M.Tech. I Semester **COURSE CODE: UR19ADSE101** **L T P C**
3 0 0 3

ENGLISH FOR RESEARCH PAPER WRITING

(AUDIT COURSE-I)

Internal Marks:100

External Marks: 0

Course objectives: Students will be able to

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT –II: Clarifying Who Did What, High lighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction. Review of the Literature, Methods, Results, Discussion, Conclusions.

UNIT – III: The Final Check key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT-IV: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT-V: Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission

Text Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

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

Course Outcomes:

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

CO1: understand that how to improve writing skills and level of readability

CO2: learn about what to write in each section

CO3: understand key skills are needed when writing a Title, when writing an Abstract.

CO4: understand skills when writing a Title Ensure the good quality of paper at very first-time submission.

CO5: understand skills for writing conclusions

CO6: understand skills for writing references

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M.Tech. I Semester **COURSE CODE: UR19ADSE102** **L T P C**
0 0 0 0

DISASTER MANAGEMENT

(AUDIT COURSE-I)

Internal Marks: 100

External Marks: 0

Course Objectives: -Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict Situations.
- Critically understand the strengths and weaknesses of disaster management approaches, 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

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 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 – IV

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 –V

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.

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 AK, "Disaster Management in India: Perspectives, issues and strategies New Royal book Company.

2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L. , Disaster Administration And Management Test And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

Course Outcomes:

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

CO1: understand key concepts in disaster risk reduction and humanitarian response.

CO2: gain the knowledge Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis

CO3: understanding the methods of Industrial Accidents .

CO4: understand Disaster Prone Areas In India Study Of Seismic Zones .

CO5: understand the application Of Remote Sensing, Data From Meteorological.

CO6: learn about Structural Mitigation And Non-Structural Mitigation

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M.Tech. I Semester **COURSE CODE: UR19ADSE103** **L T P C**
0 0 0 0

VALUE EDUCATION

(AUDIT COURSE-I)

Internal Marks: 100

External Marks: 0

Course Objectives :

Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT – I

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT –II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT – III

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labor.

UNIT – IV

Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Co operation. Doing best for saving nature.

UNIT – V

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, studying effectively

Text Book:

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course Outcomes : Students will be able to

CO1: Knowledge of self-development.

CO2: Learn the importance of Human values .

CO3: Developing the overall personality.

CO4: Learn about Universal brotherhood .

CO5: Learn the importance of Character and Competence.

CO6: Develop Honesty

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M.Tech. II Semester **COURSE CODE: UR19PCSE201** **L T P C**
3 0 0 3

FINITE ELEMENT ANALYSIS

Internal Marks: 30
External Marks: 70

Course objectives

To make the students

- Apply the concepts of Finite Element Method (FEM) for solving structural Engineering problems and familiarize the usage of the software.

UNIT–I: Fundamental Concepts of FEM : Introduction, need of FEM, applications of FEM, advantages & disadvantages- Energy principles, discretization – Rayleigh-Ritz method, method of functional approximation-Weight Residual Techniques ,basic steps of FEM, finite element modelling-Application to structural problems

UNIT–II: One Dimensional Problems- Bars,Beams,Frames& Trusses

Co-ordinates & shape functions, one dimensional scalar variable problems, element stiffness of bar element due to axial loading, formulation of stiffness matrix of bar element by direct stiffness method, minimum potential energy principle, beams derivation of stiffness matrix for beams by strain energy concept & direct stiffness method and problems on the strain Energy Concept.

Derivation of stiffness matrix for trusses, stress calculations, temperature effects and problems on these concepts. Derivation of stiffness matrix for a plane frame element, formulation of finite element equation and analyzing procedure for frame structure-Problems.

UNIT–III: Two Dimensional Problems

Finite element modeling of 2-D elements, derivation of shape functions for two dimensional linear element (Triangular)by area coordinates, Problems on these concepts. Derivation of shape functions for CST element, stress strain relationship matrix formulation for 3D & 2D systems, stiffness matrix for CST element.

UNIT–IV: axi symmetric Problems

Introduction, axi symmetric formulation, derivation of shape function for axi symmetric triangular element, stress-strain relationship matrix, strain &stress displacement matrices & Problems on these concepts.

UNIT –V: Iso - parametric Problems

Isoperimetric formulation, higher order elements, derivation of shape functions for a four nodded quadrilateral element using natural coordinates, strain displacement matrix for four nodded quadrilateral element, stress-strain relationship matrix, stiffness matrix for isoperimetric element, numerical integration , gauss quadrature method for rectangular elements, simple problems.

Text books:

1. Sk.Md ,Jalaludin ,"Finite Element Analysis", Anuradha Publishers (Units I,II,III,IV&V)
2. Tirupati R. Chandrapatla and Ashok D.Belgaundu," Finite Elements Methods in Engineering" by(UnitsII,III&IV)

Reference Books:

1. C.S.Krishna Murthy,"FEA–Theory & Programming" ,Tata Mcgraw Hill, New Delhi.
2. S.S. Bhavakatti,"FEA" ,Newage international publishers
3. FEA by David V Hutton, Tata Mcgraw Hill, NewDelhi.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 : Understand the fundamentals of Finite element method.

CO2 : Derive the solution of the problems of bars and beams by FEM.

CO3 : Derive the solution of the problems of Frames and Trusses by FEM.

CO4: Derive the shape functions for higher order elements.

CO5 : Apply the concept of iso-parametric formulation for solving problems.

CO6 : Understanding the concept of relationship matrix.

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M.Tech. II Semester **COURSE CODE: UR19PCSE202** **L T P C**
3 0 0 3

THEORY OF PLATES AND SHELLS

Internal Marks:30
External Marks:70

Course objective

To make the students

- Familiarize the behavior of the plates and shells with different geometry under various types of loads.

UNIT – I: Rectangular Plates

Pure bending of Plates–Relations between bending moments and curvature–Derivation of governing differential equation for plate–Slope and curvature of slightly bent plates. Rectangular Plates: Plates under uniformly distributed load with different boundary conditions. Naiver and Levy's type of solutions for various boundary condition.

UNIT – II: Circular Plates & Folded Plates

Circular plates: Symmetrically loaded, Circular plates under various loading conditions, Circular plate with a circular hole at center.

Structural behavior of folded plates; Equation of three shears; Application of Simpson's and Whitney's methods.

UNIT – III: Introduction to Shells

Introduction to shells-Classification of shells-Equations of Equilibrium of shells: Derivation of stress resultants, principles of membrane theory.

UNIT IV - Bending Theory of Thin Shells

General - differential equations of equilibrium in terms of displacements. Bending analysis of translational shells - Hyperbolic paraboloids bounded by straight lines.

UNIT – V: Cylindrical Shells

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Beam method of analysis.

Text Books:

1. Timoshenko and Krieger,"Theoryofplates and shells", McGraw-Hill book company,INC,NewYork.[Unit–I,II]
2. P.C. Varghese, "Design of Reinforced Concrete Shells and Folded plates", PHI Learning Private Limited, NewDelhi(2010).[Unit-III]
3. S.S.Bhavikatti ,"Theory of plates and shells", New Age International, New Delhi.[Unit –III,IV,V]

Reference Books:

1. J. Ramchandran ,"Thin Shells Theory and Problems", Universities Press. "Stressesinshells",Flugge,2ndEdition,Springer.
2. Bairagi.K,"PlateAnalysis ",KhannaPublisher,NewDelhi.
3. Ramaswamy. G.S ,"Design and Construction of Concrete Shell Roofs" ,Mc GrawK. Chandrasekhara.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: Evaluate the deflection of Rectangular plates for different loadings.
CO2: Evaluate the deflection of Circular plates for different loadings
CO3: Understand the concept of folded plates.
CO4: Determine various forces in shells.
CO5 : Understand the theory of cylindrical shells
CO6: To gain knowledge on details of Schorer's theory for Beam method of analysis.

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M.Tech. II Semester **COURSE CODE: UR19PCSE203** **L T P C**
3 0 0 3

STABILITY OF STRUCTURES

Internal Marks:30
External Marks:70

Course Objectives

To make the students

- Impart the knowledge on linear and nonlinear behavior of structures.
- Familiarize the student with stability of plates under combined loads.

UNIT–I: Criteria for Design of Structures

Concept of stability, strength, and stiffness-Stability of discrete systems-Linear and nonlinear behavior. Beam columns: Differential equation for beam columns – Beam column with concentrated loads–Continuous with lateral load–Couples–Beam column with built in ends – Continuous beams with axial load – Determination of allowable stresses.

UNIT–II: Elastic Buckling

Elastic buckling of bars: Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway & Non Sway mode-Energy methods–Buckling of a bar on elastic foundation–Buckling of bars with change in cross section–Effect of shear force on critical load–Built up columns–Effect of Initial curvature on bars–Buckling of frames–Sway & Non Sway mode.

UNIT–III: In-Elastic Buckling

In-elastic buckling: Buckling of straight bars – Double modulus theory, Tangent modulus theory. Empirical formulae of design–various end conditions–Design of columns based on buckling–Rayleigh Ritz method–Stiffness method and formulation of Geometric stiffness matrix-Applications to simple frames.

UNIT–IV: Torsional Buckling

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

UNIT–V: Lateral Buckling and Buckling of Plates

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, buckling of I Section subjected to pure bending.Governing differential equation - Navier's solution for rectangular plates, circular plates with clamped and free edge conditions - supporting concentrated central load, edge moment and uniform load.

Text Books:

1. Alexander Chajes,"Principles of Structural Stability Theory", PHI Publications.(UnitI,II,III&IV,V)
2. Timshenko & Gere,"Theory of Elastic stability" ,McGraw Hill Publications.

Reference Books:

1. Simitses, G.J.,"An introduction to the elastic stability of structures",2nd Edition, Prentice Hall.
2. Bazant, Z.P. and Cedolin, L., "Stability of structures", 1st Edition, OxfordUniversity Press,Oxford.
3. Brush, B.O., and Almoroth, B.O.," Buckling of Bars, Plates and Shells",3rd Edition, McGraw Hill, NY.
4. Galambos,T.V., "Guide to stability design criteria for metal Structures",2nd Edition, Wiley,NY.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 : Know the differential equation for Beam- Column.
CO2 : .know the Elastic buckling of straight columns.
CO3: Distinguish between elastic buckling and in-elastic buckling.
CO4 : study Pure torsion of thin walled bars of open cross section.
CO5 : study the concept of buckling due to torsion and flexure.
CO6 : study Lateral Buckling of simply supported Beams rectangular cross section

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M.Tech. II Semester **COURSE CODE: UR19PCSE204** **L T P C**
3 0 0 3

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Internal Marks: 30
External Marks: 70

Course objectives
To make the students

- Impart the knowledge of designing earthquake resistant structures and familiarize the codal provisions and carry out an analytical problem.

UNIT–I: Engineering Seismology

Introduction, structure of earth, plate tectonics, elastic rebound theory, earthquake terminology-source, focus, epicenter, hypo center, earthquake size, magnitude &intensity, seismic waves, seismic zones, seismic zoning map of India, seismograms and accelerograms–Causes and effects of earthquakes.

Codal Provisions:Review of Indian Seismic code IS:1893–2002(Part-I)provisions-Earthquake design philosophy. Introduction-Design forces for buildings by Equivalent static method and Response spectrum method.

UNIT–II: Structural Irregularities and Shear Walls

Structural Irregularities: Vertical discontinuity in load path, irregularities in strength and stiffness, mass irregularities, vertical geometric irregularity, proximity of adjacent buildings, plan configurations, torsion irregularities re-entrant corners, non-parallel systems, diaphragm discontinuity.

UNIT –III: Shear Walls: Introduction, types of shear walls, description of building, determination of lateral forces in buildings, design of shear walls as per Indian Standard Code: 13920, detailing of reinforcement of shear walls.

UNIT–IV: Retrofitting Techniques

Introduction, seismic valuation methods, consideration in retrofitting of structures, classification of retrofitting techniques, retrofitting strategies of R.C. buildings – structural level and member level retrofit methods.

UNIT–V: Masonry Buildings

Introduction, determination of design lateral load, distribution of lateral forces on shear wall, determination of wall rigidities, determination of torsional forces, determination of pier loads, moments and shear, design of shear walls for shear, structural details**.**

Text Books:

1. pankaj Agarwal & shrikhande Manish, "Earthquake Resistant Design of Structures",Eswar Press.(UnitsII,III,IV&V)
2. Duggal S.K.,"Earthquake Resistant Design of Structures",Oxford University Press,2nd Edition. (Units I &V)

Reference Books:

1. Anil K. Chopra, "Dynamics of Structures, Theory and Applications to Earthquake Engineering" ,4th Edition,Prentice Hall of India.
2. Jai Krishna AR Chandrasekharan, and Brijesh Chandra, "Elements of Earthquake Engineering" ,3rd Edition, Saritha Prakasham,Meerut.
3. Relevant Indian Standard Codes:IS-875,IS-1893,IS-4326,IS-13920

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1: describe various terms of engineering seismology.
CO2: gain the knowledge on seismic codal provisions and detailing.
CO3: design earthquake-resistant structures by using different methods.
CO4: Aquire knowledge on Seismo-Resistant Architecture by different methods.
CO5: acquire the knowledge in structural irregularities in seismic planning and shear wall concept.
CO6: Understand the retrofitting techniques and base isolation of structure.

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M.Tech. II Semester **COURSE CODE: UR19PESE205** **L T P C**
3 0 0 3

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

(PE-III)

Internal Marks: 30
External Marks: 70

Course objectives

To make the students

- Impart the knowledge on pre-stressing techniques and materials required for pre-stressing.
- Familiarize with the losses of pre-stress, design of beams & slabs and deflections.

UNIT - I: Introduction

Historic development–Need for High strength steel and concrete-Advantages and limitations of pre-stressed concrete –Materials: High strength steel and concrete .I.S. Code provisions, methods and systems of pre-stressing; Pre- tensioning and post-tensioning methods and its applications–systems of pre- stressing-Hoyer system, Magnel- Blaton system, Freyssinet system and Gifford– Udall system.

UNIT - II: Losses of Prestress

Loss of pre-stress in pre-tensioned and post-tensioned members-elastic Deformation of concrete, shrinkage of concrete, creep of concrete, Relaxation of stress in steel, Anchorage slip and frictional losses.-Total losses allowed for design. Analysis of sections for flexure; Elastic analysis of concrete beams pre-stressed with straight, concentric, eccentric, bent and parabolic tendons-Pressure line-load balancing concept.

UNIT - III: Design of Section for Flexure and Shear

Types of flexural failures-determination of flexural strength using IS code method— Shear and Principle stresses-ultimate shear resistance of pre-stressed concrete-design of shear reinforcement–Design of section for flexure.

UNIT- IV: Deflections

Importance of control of deflections, factors influencing deflection, codal provisions, short term and long term deflections of un cracked members Continuous Beams: advantages of continuous members- code provisions – Analysis of two span continuous beams-concordant cable profiles.

UNIT V – Design of Tension Members, Compression Members and Slabs

Design Of Tension Members : Design for shear, bond and torsion Design of End blocks - Design of Tension Members - Design of prestressed concrete cylindrical water tanks - Design of prestressed concrete pipes. Compression Members: Introduction – design of PSC

short columns Slabs: Introduction–types of pre-stressed concrete floor slabs-code provisions-design of PSC floor slabs-one way and two way slabs.

Text Books:

1. N. Krishnam Raju, "Prestressed Concrete ", TMH, 5th Edition. (Units I,II,III,IV,V).

Reference Books:

1. Lin.,T.Y.,"Design of Prestressed Concrete Structures",John Wiley & Sons, 3rdEdition.
2. Edward G.Nawy,"Prestressed Concrete A Fundamental Approach", Prentice Hall, 5thEdition.
3. Rajagopalan N, "Prestressed Concrete",Narosa publications,2nd Edition.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Gain the knowledge on materials, pre-stressing Systems, end anchorages.

CO2 : Gain the knowledge on losses of pre-stress.

CO3 : Analyze and design of sections for flexure and shear.

CO4 : Compute deflections in pre-stressed concrete.

CO5: Design of structural members for max serviceability

CO6 :Apply the concept to pre-stress for designing of compression members and slabs.

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M.Tech. II Semester **COURSE CODE: UR19PESE206** **L T P C**
3 0 0 3

MECHANICS OF COMPOSITE MATERIALS

(PE-III)

Internal Marks: 30
External Marks: 70

Course Objective:

- To impart knowledge on the properties of composite materials, their uses and advantages.

UNIT – I Introduction to Structural Materials

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

UNIT – II Mechanical Properties and analysis of Composite Lamnae

Macro mechanical Properties of composite Laminae

Macro mechanical Properties of composite Laminae: Introduction, Assumptions and Idealizations, Stress Strain relationships for composite Laminae- Isotropic, Orthotropic laminae, Strength Characteristics- Basic concepts, Strength hypothesis for isotropic and Orthotropic laminae.

Macro mechanical Analysis of composite Laminae

Macro mechanical Analysis of composite Laminae: Introduction, Assumptions and Limitations, Stiffness characteristics of glass reinforced laminae- Stress-Strain relationships in continuous, discontinuous fibre laminae, Strength characteristics of glass reinforced laminae- Strengths in continuous, discontinuous fibre laminae.

UNIT – III Behavior of Glass Fibre-Reinforced laminates

Behavior of Glass Fibre-Reinforced laminates: Introduction, Stiffness characteristics of laminated composites-Behavior of Laminated beams and plates, Strength characteristics of laminated composites- Strength analysis and failure criteria, Effect of inter laminar structures. Glass Reinforced Composites: Introduction, Continuously reinforced .laminates uni-directionally and multi directionally continuously reinforced laminates, discontinuously reinforced laminates – Stiffness and Strength properties.

UNIT –IV Glass Reinforced Plastic Properties relevant to Structural Design

GRP properties relevant to structural Design: Introduction, Short-term strength and stiffness-Tensile, Compressive, Flexural and Shearing. Long term strength and stiffness properties, Temperature effects, Effect of fire, Structural joints- Adhesive, mechanical, Combinational, Transformed sections.

UNIT – V Design of GRP Box Beams

Design of GRP Box Beams: Introduction, loading, span and cross-sectional shape, Selection of material, Beam manufacture, Beam stresses, Experimental Behavior, Effect on Beam performance- Modulus of Elasticity, Compressive Strength, I value, prevention of compression buckling failure, Behavior under long term loading. Design of Stressed skinned roof structure: Introduction, loading and material properties,
Preliminary design, and computer analysis.

Text Books:

1. Mechanics of Composite Materials and Structures by Madhujith Mukhopadhyay
2. Materials characterization, Vol. 10, ASM hand book
3. Mechanical Metallurgy by G. Dieter Mc-Graw Hill

Reference Books:

1. Thermal Analysis of Materials by R.F. Speyer, Marcel Decker
2. Engineering Materials: Polymers, Ceramics and Composites A.K Bhargava Prentice Hall India
3. Mechanics of Composite materials and Structures by Madhujith Mukhopadhyay; Universities Press 2007.

Course Outcomes:

The learner will be able to

CO1: understand use of different composite materials.

CO2 : understand the Macro mechanical Properties of composite Lamina.

CO3: understand the behavior of Glass Fibre-Reinforced laminates.

CO4: understand the behavior of combinational transformed sections..

CO5 : know the GRP properties relevant to structural Design

CO6 : design GRP Box beams.

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M.Tech. II Semester **COURSE CODE: UR19PESE207** **L T P C**
3 0 0 3

FIBRE REINFORCED CONCRETE
(PE-III)

Internal Marks:30
External Marks:70

Course Objectives:

- To impart knowledge on the properties of fibre materials, their uses and advantages.
- To impart knowledge on the properties and their Advantages to use the fibre reinforced concrete.

Unit - I

1. Introduction

Historical development; Specifications and recommended procedures

2.Interaction between fibres and matrix

Fibre interaction with homogeneous uncracked matrix; Fibre interaction in cracked matrix; Interpretation of test data and analytical models; Composition of the matrix

3. **Basic concepts and mechanical properties** : Tension Basic concepts; Strong brittle fibres in ductile matrix; Strong fibres in a brittle matrix; Tension behaviour of fobre cement composites; Experimental evaluation of conventional fibre-cement composites; Elastic response in tension; Prediction of composite strength based on empirical approaches; Experimental evaluation of high- volume fraction fibre composites; Fracture mechanics approach; Apllications based on linear elastic fracture mechanics

Unit -II

Basic concepts and mechanical properties : Bending

Mechanism of fibre contribution to bending; Flexural toughness; Prediction of load-deflection response

Unit-III

Properties of constituent materials Cement; aggregates; water and water-reducing admixtures; Mineral admixtures; Other chemical admixtures; Special cements; Metallic fibres; Polymeric fibres; Carbon fibres; Glass fibres

Mixture Proportioning , Mixing and Casting procedures Mix proportions for FRC containing coarse aggregates; Mixing and casting procedures

Unit-IV

Properties of freshly mixed FRC Containing coarse aggregates Workability tests; Tests for air content; Yield and unit weight; Steel fibre-reinforced concrete; Polmeric fibre-reinforced concrete; Other fibres

Unit-V

Properties of Hardened FRC Behaviour under compression –FRC with steel fibres and FRC with polymeric fibres; Behaviour under tension – FRC with steel fibres and FRC with polymeric fibres; Behaviour under flexure – FRC with steel fibres and FRC with polymeric fibres; Behaviour under shear, torsion and bending – FRC with steel fibres and FRC with polymeric fibres

Text Books :

1.Fibre reinforced cementitious Composities 2nd Edition by Arnon Bentur,Modern concrete Technology.
2.Fiber Reinforced Plastic(FRP) Reinforcement for concrete structures by A.Nanni,Elsevier.
3.Steel Fiber Reinforced Concrete,Behaviour Modeling and Design by Springer

Reference Books:

1. Fibre reinforced cement composites by P.N.Balaguru and S.P.Shah, McGraw-Hill, 1992.
2. Fibre reinforced cementious composites by A. Benturand and S.Mindess, Taylor & Francis, 1990.
3. Structural applications of fibre reinforced concrete , SP-182, ACI, 1998.

Course Outcomes:

CO1: The student can able to understand the concept of fibre and its applications.
CO2: Understand the concept of mechanical properties of bending.
CO3: Understand the concept of Properties of constituents in the fibre reinforced concrete.
CO4: Understand the concept of batching and mixing of polymer based reinforced concrete.
CO5: Understand the concept of batching and mixing of fibre reinforced concrete.
CO6: Understand the concept of Properties of hardened concrete

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M.Tech. II Semester **COURSE CODE: UR19PESE208** **L T P C**
3 0 0 3

REPAIR, RETROFITTING AND REHABILITATION OF STRUCTURES

(PE-IV)

Internal Marks:30
External Marks:70

Course Objectives:

- To impart knowledge about different types of determination of structures Testing the structures for the deterioration of structures
- Testing the structures for the diagnosis defects and different types of repairing methods.

UNIT - I

Durability and deterioration of structures:

Physical causes: Introduction, Durability of concrete, Causes of distress in concrete structures, shrinkage in concrete, Freeze and thaw on concrete, weathering on concrete, creep on concrete, Abrasion, Erosion and cavitation's on concrete, Temperature changes, Construction errors, Accidental loadings, Design errors.

Chemical causes: Chemical attack on concrete, Carbonation attack on concrete, Sulfate attack on concrete, Physical and chemical mechanisms, Acid attack on the concrete, Alkali reaction on the concrete, Aggregate reaction and alkali silica reaction, Chloride attack on the concrete.

Corrosion: Basic principle of corrosion, Corrosion mechanisms of embedded metal, Corrosion process, Damages due to corrosion, Codal provisions for different exposure conditions, Corrosion protection techniques, Relative symptoms to causes of distress and deterioration.

UNIT – II

Damage assessment:

Destructive Testing systems: Introduction, Purpose of assessment, Rapid assessment, monitoring, Investigation of damage, observation, Damage assessment procedure, Visual inspection, Testing of hardened concrete.

Non – Destructive testing systems: Introduction, NDT methods, Surface hardness method, Ultra pulse velocity method, pulse echo method, radioactive method, Electromagnetic method, Electrical methods, Acoustic emission Techniques, Recent development on NDT instruments.

Semi – Destructive testing systems: Penetration techniques, Pullout TEST& Pull off TEST, Core sampling and Testing, Permeability TEST, Carbonation pH value TEST, Chemical Testing of concrete, diagnostic methods for corrosion damage.

UNIT - III

Repair Materials:

Construction Chemicals: Introduction, Evolution of Portland cement concrete and concrete chemicals, Epoxy, Polymers and Latex, Acrylic Polymer, Polyester Resins, Applications of repair chemicals, Polymer modification on addition of polymer to cement concrete and mortar.

Concrete repair chemicals: Bonding coats, Steel corrosion inhibitor paint for steel in reinforced concrete construction, Rust remover paints. Ferro cement, Fibre reinforced concrete, Fibre reinforced polymer, Cement Crete, Geopolymer concrete, Portland pozzolana

cement, silica fume concrete, self-compacting concrete, Pre-placed aggregate concrete, Shotcrete/ Gunite, High performance concrete.
Examples of concrete chemicals for repair: Zentritix KMH (Corrosion protection and bonding coat), Nafufill BB2 (Bonding agent and polymer), Sika latex power (Water resistant bonding agent), Sun epoxy 358 (Epoxy bond coat), New coat (Roof waterproofing coating).

UNIT - IV

Repair and Rehabilitation:

Repair of Structural Elements: Repair of RC slabs, Repair of RC beams and columns damaged by steel corrosion, Repair of rising dampness in walls of ground floors in old buildings constructed without DPC, Efflorescence in buildings. Repair of cracks in concrete members: Introduction, Investigations to find cause of cracks, Sealing of cracks by injection and crack filling, Blanketing inactive cracks by using elastic sealants, Repair of crack by stitching, Treatment of active structural cracks
. Strengthening Techniques: Introduction, Need for strengthening, Terms of repair, Structural concrete repair, Structural repair techniques for reinforced concrete, Structure concrete strengthening, Jacketing technique, externally bonding technique, externally bonded mild steel plats, strengthening with external reinforcement.

UNIT - V

Seismic Retrofitting of reinforced concrete buildings:

Introduction, Considerations in retrofitting of structures, Source of weakness in RC frame buildings- Structure damage due to discontinuous load path, Structural damage due to lack of deformation, Quality of workmanship and materials, Classification of retrofitting techniques, Retrofitting strategies for RC buildings, Structural level (global) retrofit methods, Member level (local) retrofit methods, Comparative analysis of methods of retrofitting.

Text books:

1. Rehabilitation of concrete structures by B.Vidivelli, Published by Standard Publications-New Delhi, 2009.
2. Maintenance Repair & Rehabilitation & Minor works of Buildings by P.C.Varghese, Published by PHI Learning Pvt, Ltd, Delhi-2014.
3. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.
4. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002 (freely available through Internet).

Reference Books:

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildingts, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University Press
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
6. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B. A. Richardson, (1991).

Course Outcomes:

The learner will be able to

CO1: understand about Causes of distress in concrete structures, shrinkage in concrete, Freeze and thaw on concrete.

CO2: study the Destructive Testing and NDT, Semi- Destructive systems.

CO3: suggest suitable repair materials like chemicals, Epoxy, Polymers and Latex, Acrylic Polymer, Polyester Resins, Applications of repair chemicals

CO4: know the different repair techniques and methods for the beams, columns etc.

CO5: to understand the Seismic retrofitting techniques for the structural elements.

CO6: to understand the Strengthening techniques using epoxys.

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M.Tech. II Semester **COURSE CODE: UR19PESE209** **L T P C**
3 0 0 3

OPTIMIZATION TECHNIQUES IN STRUCTURAL ENGINEERING

(PE-IV)

Internal Marks: 30
External Marks: 70

Course Objectives:

- To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.

UNIT I: Introduction to Optimization: Introduction - Historical developments – Engineering applications of Optimization - Statement of an Optimization problem - Classification of Optimization problems - Optimization Techniques. Optimization by calculus: Introduction - Unconstrained functions of a single variable - Problems involving simple constraints -Unconstrained functions of several variables - treatment of equality constraints – Extension to multiple equality constraints - Optimization with inequality constraints - The generalized Newton-Raphson method.

UNIT II : Linear Programming: Introduction - Applications of linear programming – standard form of a linear programming problem - Geometry of linear programming problems -Definitions and theorems - Solution of a system of Linear simultaneous equations – Pivotal Reduction of a general system of equations - Motivation of the Simplex Method – Simplex Algorithm - Two phases of the simplex method.

UNIT III : Non-Linear Programming: Introduction -Unimodal Function - Unrestricted search - Exhaustive search - Dichotomous search -Interval Halving method - Fibonacci method - Golden section method - Comparison of Elimination methods - Unconstrained optimization techniques - Direct search methods -Random search methods - grid search method - Univariate method - Powell's method -Simplex method - Indirect search methods - Gradient of a function - Steepest descent method - Conjugate gradient - Newton's method.

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

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

Application of Optimization techniques to trusses, Beams and Frames.

Text Books:

1. Optimization: Theory and Applications by S.S.Rao. New Age International (p) Ltd.
2. Numerical Optimization Techniques for Engineering Design with applications by G.N. Vanderplaats 2007.
3. Elements of Structural Optimization by R.T.Haftka and Z.Gurdal Kluwer academic publishers.

Reference Books:

1. Optimum Structural Design by U.Kirsch. Tata Mc Graw Hill
2. Optimum Design of Structures by K.I.Majid.
3. Introduction to Optimum Design by J.S.Arora. Academic press, 2012 ISBN : 978-0-12-381375-6.

Course Outcomes:

The student will be able to

CO1: Understand the basic principles of optimization for the civil engineering problems using Newton-Raphson method.

CO2: Application of linear programming for the civil engineering problems

CO3: application of dynamic programming by using concept ofsub-optimization and the principle of optimality

CO4: formulate optimization models and network analysis for a wide range of civil engineering problems and able to solve them beams, trusses and frames.

CO5: Learn dynamic programming

CO6: Learn Network Analysis

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M.Tech. II Semester **COURSE CODE: UR19PESE210** **L T P C**
3 0 0 3

PRINCIPLES OF BRIDGE ENGINEERING

(PE-IV)

Internal Marks: 30
External Marks: 70

Course Objectives:

- To impart knowledge about different types of bridges
- To impart knowledge about their analysis.
- To impart knowledge about design for combination of different loading condition as per codal provisions.

UNIT I Concrete Bridges

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

UNIT II - Slab Bridges

Design of slab bridges - skew slab culverts - box culverts. T - Beam bridges - Pigeaud curves - Courbon's theory - Hendry Jaegar method - analysis and design of T - beam bridges

UNIT III T – Beam Bridges

Analysis and design of T - beam bridges

UNIT IV Girder Bridges

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

UNIT V Pre-Stressed Concrete Bridges

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in prestressed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unpropped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges – Design of Beams and Expansion Joints.

Text Books

1. Essentials of Bridge Engineering by D.Johnson Victor, Oxford and IBH Publishing Co.Pvt. Ltd
2. Design of Concrete Bridges by M.G.Aswani, V.N.Vazirani and M.M.Ratwani. Khanna Publications 2004
3. Bridge Deck Behaviour by E.C.Hambly.

Reference Books:

1. Concrete Bridge Design and Practice by V.K.Raina Tata Mc Graw Hill Publishing co
2. Bridge Engineering by Ponnusamy Tata Mc Graw Hill Publishing co
3. Design of Bridges by N.Krishna Raju, Oxford and IBH Publishing Co. Pvt. Ltd
4. Bridge Engineering by V.V. Sastry, DhanPat Rai & Co.

Course Outcomes:
The Student will be able to

CO1 : know the concept of types of forces acting on the bridges.

CO2 : analyze and design of Solid slab bridges.

CO3 : analyze and design of girder bridges based on Courbon's Theory, Grillage analogy

CO4: know the principles of design for prestressed concrete bridge.

CO5: design of sub-structure of bridge and their loadings.

CO6: understanding the design of slabs using prestressing methods

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M.Tech. II Semester **COURSE CODE: UR19PCSEL201** **L T P C**
0 0 3 1.5

COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING LAB

Internal Marks:20
External Marks:30

Course Objectives

To make the students

- Apply the civil engineering software to some of the structural engineering problems.

Any 12 of the following problems are to be solved using Computer Programs/Application of software's like STAAD/SAP/ETABS/NISA(Civil)etc.

List of Experiments:

1. Introduction to software.
2. Analysis of determinate beam subjected to different types of loading.
3. Analysis of continuous beam subjected to different types of loading.
4. Analysis of Fixed beam subjected to different types of loading.
5. Analysis of 2-D building frame for gravity loads.
6. Analysis of 3-Dframe for gravity loads.
7. Lateral forces on a building due to an earthquake using equivalent static method.
8. Lateral forces on a building due to an earthquake using Response Spectrum Method.
9. Time history Analysis of a Building.
10. Wind analysis of 3-Dframes.
11. Analysis and Design of steel girder.
12. Analysis of pin jointed plane trusses.
13. Analysis and design of simple bridge deck.
14. Design of reinforced concrete retaining wall(cantilever type).

Reference Books:

1. Prof. Sham Tickoo,"Learning Bentley Staad.ProV8I for Structural Analysis" dream tech press.
2. S.Ramamrutham, R. Narayan, "Theory of structures" Dhan patrai publishing company.
3. Punmia.B.C, Design of steel structures, Laxmi publications List of Experiments:

Note: Minimum 12 experiments of duration 3 periods must be completed for the eligibility to appear for the semester end examinations. In case if the student fails to get eligibility for semester end exams in the current semester, he has to take the permission of HOD and complete the required number of experiments and appear for semester end exam as and when conducted.

Course Outcomes

Upon successful completion of the course, the students will be able to

CO1 : Analysis the structural elements using software designs.

CO2 : Design the structures for the dynamic loads using software.

CO3 : Solve the finite elements application problems of structural engineering by software.

CO4 : Solving complicated Truss problems of higher order can be done by software.

CO5 : Seismic evaluation in addition to lateral forces can be analysed easily with software.

CO6 : Design and analysis of bridge structure can be easily modeled and designed easily with software.

* * *

M.Tech. II Semester **COURSE CODE: UR19PROJSE201**

L	T	P	C
0	2	0	2

SEMINAR – II

Internal Marks: 50
External Marks: 0

The students are required to search / gather the material / information on a specific topic, comprehend it, submit report and present in the class.

Course Outcomes:

Students will be able to

1. Understand of contemporary / emerging technology for various processes and systems.
2. Share knowledge effectively in oral and written form and formulate documents.

M.Tech. II Semester **COURSE CODE: UR19ADSE201** **L T P C**
0 0 0 0

CONSTITUTION OF INDIA

(AUDIT COURSE-II)

Internal Marks: 100

External Marks: 0

Course Objectives:

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT – I History of Making of the Indian Constitution

History of Making of the Indian Constitution: History Drafting committee, (Composition& Working) Philosophy of the Indian Constitution: Preamble, Salient Features

UNIT – II Contours of Constitutional Rights & Duties

Contours of Constitutional Rights & Duties: Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation-Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies-Directive Principles of State Policy-Fundamental Duties.

UNIT – III Organs of Governance

Organs of Governance: Parliament-Composition-Qualifications and-Disqualifications-Powers and Functions-Executive-President-Governor- Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications-Powers and Functions

UNIT – IV Local Administration

Local Administration: District's Administration head: Role and Importance-Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zilla Panchayat. Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different

departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT – V Election Commission

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women

TEXT BOOKS

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO4: Understand the Role and Importance of Local Administration.

CO5: Understand the Role and Functioning of Election Commission

CO6: Understand the Role and Functioning of Organizational Hierarchy

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M.Tech. II Semester **COURSE CODE: UR19ADSE202**

L T P C
0 0 0 0

PEDAGOGY STUDIES

(AUDIT COURSE-II)

Internal Marks: 100

External Marks: 0

Course Objectives:

Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT – I Introduction and Methodology

Introduction and Methodology: aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching

UNIT – II Thematic overview

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

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

Professional development: alignment with classroom practices and follow-up support Peer 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 gaps and future directions: Research design-Contests Pedagogy-Teacher education-Curriculum and assessment- Dissemination and research impact.

References:

1. Ackers J, Hardman F (2001) 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.

Course Outcomes:

Students will be able to understand:

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

CO4: What are the theories of learning and conceptual framework

CO5: What are the applications of pedagogy strategies

CO6: How quality assessment of Included studies is done

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M.Tech. II Semester **COURSE CODE: UR19ADSE203**

L T P C
0 0 0 0

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(AUDIT COURSE-II)

Internal Marks: 100

External Marks: 0

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT – I Neetisatakam-Holistic development of personality

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT- II Approach to day to day work and duties.

Approach to day to day work and duties.

- Shrimad BhagwadGeeta:
- 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 –III Statements of basic knowledge

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:
- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,

- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

Text Books:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes :

Students 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 Neeti shatakam will help in developing versatile personality of students.

CO4: Inculcation of self awareness in students

CO5: To improve focus and effectiveness in students

CO6: To impart Motivation and Resilience in students

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PROJECT WORK PHASE – I AND PHASE – II

Phase	M.Tech Semester	Course Code	L	T	P	C	Marks
I	III	UR19PROJSE301	0	0	20	10	100
II	IV	UR19PROJSE401	0	0	30	15	

Syllabus Contents:

The project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The project should have the following

1. Relevance to social needs of society
2. Relevance to value addition to existing facilities in the institute
3. Relevance to industry need
4. Problems of national importance
5. Research and development in various domain

The student should complete the following:

1. Literature survey Problem Definition
2. Motivation for study and Objectives
3. Preliminary design / feasibility / modular approaches
4. Implementation and Verification
5. Report and presentation

The project phase II is based on a report prepared by the students on project topic allotted to them. It may be based on:

1. Experimental verification by testing of specimens, Field data/ Proof of concept.
2. Analysis, Design, Estimation and project implementation.
3. The viva-voce examination will be based on the above report and work.

Guidelines for Project Phase – I and II at M. Tech. (SE):

1. As per the AICTE directives, the project is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase– II: January to June.
2. The project may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
3. After continuous interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define project objectives. The referred literature should preferably include Elsevier/Springer/Science Direct/ASCE/Scopus indexed journals in the areas of Civil & Structural Engineering any other related domain. In case of Industry sponsored projects, the relevant application notes/dairy, white papers, product catalogues should be referred and reported.
4. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
5. Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of

concept/functionality, part results, A record of continuous progress.

6. Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

7. During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

8. Phase – II deliverables: A project report as per the specified format, developed system in the form of soft and hard copy of report, a record of continuous progress.

9. Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work.

Course Outcomes:

At the end of the course, the student will be able to

1. Synthesize knowledge and skills previously gained.
2. Apply an in-depth study and execution of new technical problem.
3. Select from different methodologies, methods.
4. Form analysis to produce a suitable research design, and justify their design.
5. Present the findings of their technical solution in a written report.
6. Present the work in International/ National conference or reputed journals.

****The End****