DEPARTMENT OF CIVIL ENGINEERING

JNTU GV

M.Tech. (Structural Engineering: Course Code:87) Program

I YEAR I – SEMESTER

S.No	Course Code	Course Title	L	T	P	C
1	M258701	Theory of Elasticity	3	1	0	4
2	M258702	Structural Dynamics	3	1	0	4
3	M258703	Design of RCC Foundations	3	1	0	4
4		Program Elective - I	3	1	0	4
	M258704	a) Matrix Analysis of Structures				
	M258705	b) Analytical & Numerical Methods fr Structural Engineering				
	M258706	c) Advanced Concrete Technology				
	M258707	d) Design of High-Rise Structures				
5		Program Elective - II	3	1	0	4
	M258708	a) Bridge Engineering				
	M258709	b) Repair and Rehabilitation of Structures				
	M258710	c) Advanced Reinforced Concrete Design				
	M258711	d) Design of Pre stressed Concrete structures				
6	M258712	Advanced Concrete Technology Laboratory	0	1	2	2
7	M258713	Advanced Structural Engineering Laboratory	0	1	2	2
8	M258714	Seminar-I	0	0	2	1
		Total	15	7	6	25

II YEAR II – SEMESTER

S.No.	Course Code	Course Title	L	T	P	C
1	N258701	Finite Element Methods in Structural Engineering	3	1	0	4
2	N258702	Theory of Plates and Shells	3	1	0	4
3	N258703	Design of Form Work	3	1	0	4
4		Program Elective - III	3	1	0	4
	N258704	a) Stability of Structures				
	N258705	b) Advanced Steel Design				
	N258706	c) Analysis of Offshore Structures				
	N258707	d) Industrial Structures				
5		Program Elective - IV	3	1	0	4
	N258708	a) Earthquake-Resistant Design of Buildings				
	N258709	b) Precast and Prefabricated Structures				
	N258710	c) Earth Retaining Structures				
	N258711	d) Structural Health Monitoring				
6	N258712	Computer-Aided Design Laboratory	--	--	4	2
7	N258713	Structural Design laboratory	--	--	4	2
8	N258714	Seminar-II	0	0	2	1
		Total	15	5	11	25

II YEAR I – SEMESTER

Sl.No	Course Code	Course Title	L	T	P	Credits
1	O258701	Research Methodology and IPR Swayam 12 weeks MOOC course-RM&IPR	3	0	0	3
2	O258702	Summer Internship/ Industrial training (8-10 weeks)*	0	0	0	3
4	O258703	Dissertation Part-A$	0	0	20	10
	Total		**3**	**0**	**20**	**16**

Student attended during summer/ year break and assessment will be done in 3rd Semester.
 # Comprehensive viva can be conducted courses completed upto 2nd Semester.
$ Dissertation -Part A, Internal assessment.

II YEAR II – SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1.	P258701	Dissertation Part-B%	0	0	28	14
	Total		**0**	**0**	**28**	**14**

% External Assessment

I Year - I Semester		L	T	P	C
		3	0	0	3
THEORY OF ELASTICITY (Program Core1)					

UNIT: I

Elasticity – Notation for forces and stresses – components of stresses and strains – Hooke‟s Law - Plane Stress – Plane strain – Differential Equations of equilibrium – Boundary conditions – Compatibility equations - Stress function – Boundary Conditions.

UNIT: II

Two dimensional problems in rectangular co- ordinates – Solution by polynomials – Saint Venant‟s principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading.

UNIT: III

Two dimensional problems in polar co- ordinates - General equations in polar co- ordinates – Stress distribution for problems having symmetrical about an axis - Strain components in polar co- ordinates– Displacements for symmetrical stress distributions - Stresses for plates withcircular holes subjected to far field tension – stress concentration factor.

UNIT: IV

Analysis of stress and strain in three dimension - Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses - Maximum shear stress – Homogeneous Deformation – General Theorems - Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution – Reciprocal theorem..

UNIT: V

Torsion of Prismatic bars – Bars with elliptical cross section – Other elementary solution – Membrane analogy – Torsion of rectangular bars – Solution of Torsional problems by energy method.

TEXT BOOKS

1.Theory of Elasticity- Stephen Timoshenko & J. N. Goodier, Mc.Grawhill Publishers
2.Advanced Mechanics of Solids L.S. Srinath, McGraw Hill Publishers

REFERENCES

1.Elasticity: Theory, Applications and Numeric- Martin H. Sadd, Wiley Publishers
2.Theory of Elasticity -Sadhu Singh 3rd Edition, Khanna Publishe

I Year - I Semester		L	T	P	C
		3	0	0	3
STRUCTURAL DYNAMICS (Program Core2)					

UNIT I:

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

UNIT II

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

Single Degree of Freedom Systems : Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III

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

UNIT IV

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

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

UNIT V

Introduction to Earthquake Analysis: Deterministic Earthquake Response: Systems on Rigid Foundations -Types of Earthquake Excitations – Lumped SDOF Elastic Systems, Translational Excitations -Generalized coordinate -SDOF Elastic Systems, Translational Excitations, Linear Static Method – Analysis for obtaining response of multi storied RC Building.

TEXT BOOKS:

1.Structural Dynamics Anil K Chopra, 4edition, Prentice Hall Publishers
2.Structural Dynamics Theory & Computation – Mario Paz, CBS Publishes and Distributors

3.Elementary Structural Dynamics- V.K. Manika Selvam, Dhanpat Rai Publishers

REFERENCE:

1.Dynamics of Structures by Clough & Penzien 3e, Computers & Structures Inc.
2.Theory of Vibration -William T Thomson, Springer Science.
3.Mechanical Vibrations- S. S. Rao, 5e, Pearson Publications.
4.Structural Dynamics of Earthquake Engineering - Theory and Application using Mathematicaand Matlab- S. Rajasekharan

I Year - I Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
MATRIX ANALYSIS OF STRUCTURES (Program Core-3)					

UNIT: 1

Introduction of matrix methods of analysis – Static and kinematic indeterminacy – Degree of freedom– Structure idealization- stiffness and flexibility methods – Suitability: Element stiffnessmatrix for truss element, beam element and Torsional element- Element force - displacement equations.

UNIT: 2

Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly – structure stiffness matrix equation – analysis of simple pin jointed trusses – continuous beams – rigid jointed plane frames

UNIT: 3

Stiffness method for Grid elements – development of stiffness matrix – coordinate transformation. Examples of grid problems – tapered and curved beams

UNIT: 4

Additional topics in stiffness methods – discussion of band width – semi band width – static condensation – sub structuring –Loads between joints- Support displacements- inertial and thermal stresses- Beams on elastic foundation by stiffness method.

UNIT: 5

Analysis of plane truss - continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using *system approach*

TEXT BOOKS

1.Matrix analysis of structures, Robert E Sennet- Prentice Hall- Englewood cliffs- New Jercy
2.Advanced structural analysis, P. Dayaratnam- Tata McGraw hill publishing companylimited.
3.Structural Analysis Matrix Approach - Pandit and Gupta, Mc Graw Hil Education

REFERENCES

1.Indeterminate Structural analysis, C K Wang, Amazon Publications
2.Analysis of Tall buildings by force – displacement – Method M. Smolira Mc. Graw Hill.
3.Foundation Analysis and design, J.E. Bowls, 5e, Amazon Publications.
4.Matrix Analysis of Framed Structures 3e-William Weaver, Jr, James M. Gere, Van Nostrand Reinhold, Newyork
5.Matrix Methods of Structural Analysis Madhu B. Kanchi, Wiley Publications.
6.Indeterminate Structural Analysis by K. U. Muthu, IK International Publishing House

I Year - I Semester		L	T	P	C
		3	0	0	3
DESIGN OF REINFORCED CONCRETE FOUNDATIONS(ELECTIVE -1)					

UNIT – I

Foundation Structures & Design of Centrally Loaded Isolated Footings and Column Pedestals – Introduction, Rigid and Flexible Foundations, Loads and their Effects, Design Requirements, Geotechnical Design, Empirical and Exact Methods of Analysis of foundations, Design Loads for Foundations, Recommended Approach to Structural Design of Foundations.

Introduction, General Procedure for Design, Design of Square Footing of Uniform Depth (Pad Footing), Design of sloped Rectangular Footings, Design Procedure, Detailing of Steel, Design ofRectangular Pad Footings, Design of Plain Concrete Footings, Design of Pedestals, DesignCalculation for Pedestals.

UNIT - II

Wall Footings – Introduction Simple Plain Concrete Wall Footings, Reinforced Concrete Continuous Strip Wall Footings, Design of continuous Strip Wall Footings, Design for Longitudinal Steel, R.C. T Beam Footings in Shrinkable Soils, Foundations of Partition Wall in Ground Floors, Summary.

Strip Footings Under Several Columns – Introduction, Design Procedure for Equally loaded and Equally Spaced Columns, Analysis of Continuous Strip Footing for Unsymmetric Loading, Analysis of Strip Footing with Unsymmetrical Loads, Detailing of Members.

UNIT – III

Raft Foundations – Introduction, Rigid and Flexible Foundations, common Types of Rafts, Deflection Requirements of Beams and Slabs in Rafts, General considerations in Design of Rigid

Rafts, Types of Loadings and Choice of Rafts, Record of Contact Pressures Measured Under Rafts, Modern Theoretical Analysis.**Design of Flat Slab Rafts-Mat Foundations –** Introduction, Components of Flat Slabs, Preliminary Planning of Flat Slab Rafts, Analysis of Flat Slab by Direct Design Method, Method of Analysis, Values for Longitudinal Distribution and Transverse, Redistribution, Shear in Flat Slabs, Bending of Columns in flat Slabs, Limitations of Direct Design Method for Mats, Detailingof Steel, Design of Edge Beam in Flat Slabs.**Beam and Slab Rafts –** Introduction, Planning of the Raft, Action of the Raft, Approximate Dimensioning of the Raft, Design of the Beam and Slab Raft under Uniform Pressure, Structural Analysis for the Main Slab, Design of Secondary and Main Beams, Analysis by Winkler Model, Detailing of Steel.

UNIT - IV

Combined Piled Raft Foundations (CPRF) – Introduction, Types and uses of Piled Rafts, , Interaction

of Pile and Raft, Ultimate Capacity and Settlement of Piles, Estimation of Settlement of Raft in Soils, Allowable Maximum and Differential Settlement in Buildings, Design of CPRF System, conceptual Method of Design, Conceptual Method of Analysis, Distribution of Piles in the Rafts, Theoretical Methods of Analysis.

Circular and Annular Rafts – Introduction, Positioning of chimney Load on Annular Raft, Forces Acting on Annular Rafts, Pressures Under Dead Load and Moment, Methods of Analysis, Conventional Analysis of Annular Rafts, Analysis of Ring Beams Under circular Layout of Columns, Analysis of Ring Beam Transmitting Column Load to Annular Rafts, Detailing of Annular Raft Under Columns of a Circular Water Tank.

UNIT – V

Under-reamed Pile Foundations – Introduction, Safe Loads on Under-reamed Piles, Design of Under-reamed Pile Foundation for Load Bearing Walls of Buildings, Design of Grade Beams, Design of Under-reamed Piles Under Columns of Buildings, Use of Under-reamed Piles for Expansive Soils.

Design of cantilever and Basement Retaining Walls – Introduction, Earth Pressure and Rigid Walls, Calculation of Earth Pressure on Retaining Walls, Design of Rigid Walls, Design of Ordinary R.C. cantilever Walls, Design of cantilever Walls without Toe, Design of Basement Walls, Calculation of Earth Pressures in Clays, Design of Free Standing Basement Walls.

TEXT BOOKS

1.Design of Reinforced Concrete Foundations by P. C Varghese, PHI Learning Private Limited., New Delhi.

REFERENCE

1.Design of Reinforced Concrete Structures by N. Subramaniam- Oxford University.
2.Reinforced Concrete Design by Unnikrishna Pillai and Devdas Menon, Tata Mc Graw Hill

I Year - I Semester		L	T	P	C
		3	0	0	3

ANALYTICAL & NUMERICAL METHODS FOR STRUCTURAL ENGINEERING (Elective-I)

UNIT-I

Transform Methods- Laplace transform methods for one-dimensional wave equation - Displacements in a long string - Longitudinal vibration of an elastic bar - Fourier transforms methods for one-dimensional heat conduction problems in infinite and semi-infinite rod

UNIT-II

Elliptic Equations-Laplace equation - Properties of harmonic functions - Fourier transformmethods for Laplace equation

Calculus Of Variations- Variation and its properties - Euler's equation - Functionals dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables - Some applications - Direct methods - Ritz and Kantorovich methods

UNIT-III

Integral Equations- Fredholm and Volterra integral equations - Relation between differential and integral equations - Green's function -Fredholm equation with separable kernel - Iterative method for solving equations of second kind

UNIT-IV

Random Variables And Estimation Theory Probability - Probability distributions - moments, M.G.F-Two dimensional random variables correlation, regression multiple and partial correlation and regression - Curve fitting - Principle of least squares - Fitting of straight line and parabola. Estimation theory basic concepts (Review) - Estimation of parameters - Maximum likelihood estimates - method of moments

TEXT BOOKS

1.Introduction to Partial Differential Equations, Sankara Rao. K, , PHI, New Delhi, 1995
2.Elements of Partial Differential Equations, Sneddon. I.N, Mc Graw Hill, 1986

REFERENCE

1.
Differential Equations and Calculus of Variations Elsgolts. L, Mir Publishers, Moscow, 1966
2.Fundamentals of Mathematical Statistics Gupta. S.C, & Kapoor. V.K, Sultan Chand & Sons, Reprint 1999.
3.Higher Engineering Maths for Engg. And Sciences Venkataraman. M. K, National Publishing Company, Chennai
4.Numerical Methods for Engineering Problems N. Krishna Raju, K.U. Muthu MacmillanPublishers

I Year - I Semester		L	T	P	C
		2	0	0	3
ADVANCED CONCRETE TECHNOLOGY					

UNIT – I

Concrete Making Materials : Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alakali Silica Reaction – Admixtures – Chemical and Mineral Admixtures. Bureau of Indian Standards (BIS) Provisions.

UNIT – II

Fresh And Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Timesof Fresh Concrete – Segregation and bleeding.

Hardened Concrete : Abrams Law, Gel space ratios, Maturity concept – Stress strain Behaviour – Creep and Shrinkage – Durability Tests on Concrete – Non Destructive Testing of Concrete.BIS Provisions.

UNIT – III

High Strength Concrete – Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete.

High Performance Concrete – Requirements and Properties of High Performance Concrete – Design Considerations. BIS Provisions.

UNIT – IV

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete – Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications.

Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design Method – BIS Method – IS.10262 – 2019 Concrete Mix proportion guidelines. DOE Method– Light Weight Concrete, Self Compacting Concrete.

UNIT – V

Form work – materials – structural requests – form work systems – connections – specifications –design of form work – shores – removal for forms - shores – reshoring – failure of form work.

TEXT BOOKS

1.Properties of Concrete by A. M. Neville, ELBS publications Oct 1996.

2.Concrete Technology by A. R. Santhakumar, 2nd Edition, Oxford University Press.

3.Concrete Technology by M.S. Shetty, S.Chand & Co 2009.

REFERENCES

1.Concrete: Micro Structure, Properties and Materials by P. K. Mehta and P. J.Monteiro,. Mc.Graw-Hill Publishing Company Ltd. New Delhi

2.Design of Concrete Mixes by N. Krishna Raju, CBS Publications, 2000.

3.Special Structural concretes by Rafat Siddique, Galgotia Publications
2000.IS 10262-2009,Relevant BIS Codes

I Year - I Semester		L	T	P	C
		3	0	0	3
DESIGN OF HIGH-RISE STRUCTURES (Elective –I)					

UNIT: I

Wind Loads on Structures: Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, wind pressures and forces in buildings/structures, External pressure coefficients for various roofs, dynamic effects.

UNIT: II

Lateral load Analysis of Multistory Building Frames: Analysis of Multistory Building Frames for lateral loads, Cantilever method, Portal method and Factor method.

UNIT: III

Design of Shear Wall: Introduction, Types of shear walls, Behavior of cantilever wall with rectangular cross-section, flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid joined frames, Shear walls with openings, Coupled shear walls.

UNIT-IV

Design of Chimneys (RCC): Introduction, Wind pressure, Stress in chimney shaft due to self weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference. Design of RC chimney. Multistory Building Frames: Analysis of multistory frames, Method of substitute frames, Bending moments in beams and columns.

UNIT: V

Bunkers and Silos: Introduction, Differences between bunker and silo, Design of square or rectangular bunkers, Design of circular bunkers, Design of silos, Silos for storage of cement.

REFERENCES:

1. “Reinforced Concrete Structures” by Park, R. & Paulay, T.
2. “Advanced Reinforced Concrete Design”, byN. Krishna Raju
3. “Reinforced Concrete Structures” by Punmia, Jain & Jain.
4. “Tall Chimneys” by Manohar, S.N.
5. “Design of Steel Structures” by N.Subramanian

I Year - I Semester		L	T	P	C
		3	0	0	3
BRIDGE ENGINEERNG (Elective –II**)**					

UNIT: I

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

UNIT: II

Pigeaud‟s method- design of longitudinal girders- Guyon- Messonet method- Hendry Jaegar method-Courbon‟s theory. (Ref: IRC- 21), voided slabs,

Super Structure: Slab bridge- Wheel load on slab- effective width method- slabs supported on two edges-cantilever slabs- dispersion length- Design of interior panel of slab- T- Beam bridges.

UNIT: III

Box Culverts- Single Cell Box Culvert – Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

UNIT-IV

Plate girder bridges- Elements of plate girder and their design- web- flange- intermediate stiffener-vertical stiffeners- bearing stiffener- design problem

UNIT: V

Sub structure- Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers-Design problem(Ref: IRC- 13, IRC- 21, IRC- 78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment- culvert entrance structure- Hydraulic design and structural design of pipe culverts-reinforcements in pipes .(Ref: IRC: SP- 13)

TEXT BOOKS

1.Design of Bridges by N. Krishna Raju CBS Publishers and Distributors
2.Design of Concrete Bridges- M.G. Aswini, V.N. Vazirani, M.M Ratwani, Khanna Publishers
3.Essentials of Bridge Engineering- Jhonson Victor D, 7e, Oxford IBH Publications

REFERENCES:

1.Bridge Deck Behavior- E.C. Hambly 2e- CRC Press
2.Concrete Bridge Design and Practice- V.K. Raina, Tata McGraw- Hill Publishing Company Limited
3.Bridge Engineering by S. Ponnuswamy, Mc Grawhill Publications
4.IRC 6- 2016 Standard Specifications and Code of Practice for Road bridges
5.IRC 112-2011 Code of Practice for Concrete Road Bridges

I Year - I Semester		L	T	P	C
		3	0	0	3
REPAIR AND REHABILITATION OF STRUCTURES (Elective –II**)**					

UNIT: 1

Materials for repair and rehabilitation - Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps-Steel Plates- Non destructive evaluation: Importance-Concretebehaviorunder corrosion,disintegrated mechanisms- moisture effects and thermal effects– Visual investigation-Acoustical emission methods-Corrosion activity measurement- chloridecontent – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

UNIT: II

Strengthening and stabilization- Techniques- design considerations- Beam shear capacity strengthening- Shear Transfer strengthening- stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening, Crack stabilization.

UNIT: III

Bonded installation techniques- Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms- intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures

UNIT: IV

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods- Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes- Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete- Introduction- classification of flyash- properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes

UNIT: V

High performance concretes-Introduction-Development of high performance concretes- Materials of high performance concretes-Properties of high performance concretes-SelfConsolidating concrete- properties- qualifications.

TEXT BOOKS

1.Maintenance Repair Rehabilitation & Minor works of Buildings- P.C. Varghese, PHIPublications
2.Repair and Rehabilitation of Concrete Structures – P.I. Modi, C.N. Patel, PHI Publications
3.Rehabilitation of Concrete Structures- B. Vidivelli, Standard Publishers Distributors
4.Concrete Bridge Practice Construction Maintenance & Rehabilitation- V.K. Raina, Shroff Publishers and Distributors.

REFERENCE:

1.Concrete Technology Theory and Practice- M.S. Shetty, S Chand and Company
2.Concrete Repair and Maintenance illustrated- Peter H Emmons
3.Concrete Chemical Theory and Applications- Santa Kumar A.R. , Indian Society for Construction Engineering and Technology, Madras
4.Handbook on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

I Year - I Semester		L	T	P	C
		3	0	0	3

ADVANCED REINFORCED CONCRETE DESIGN (Elective-II)

UNIT : I

Limit Analysis of R C Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams. Inelastic Analysis of Slabs, Moment Redistribution.

UNIT :II

Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions.

UNIT: III

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

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

Distribution of moments in column strips and middle strip sketch showing reinforcement details.

UNIT : IV

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

UNIT : V

Design of Slender Columns – Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method, Procedure for Design of Slender Columns. Detailing of reinforcement.

Eccentrically Loaded columns- development of interaction Diagrams

TEXT BOOKS

1.Advanced Reinforced Concrete Design, by P.C. Varghese Prentice Hall India Limited

2.Design of Reinforced Concrete Structures by N.Subramanian, Oxford University Press.

3.Reinforced Concrete Design, by S. Unnikrishna Pillai & Devdas Menon Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.

REFERENCE

1.Limit State Theory and Design of Reinforced Concrete S. R. Karve and V.L Shah. Standard Publishers

2.Reinforced concrete structural elements – behavior, Analysis and design by P. Purushotham, Tata Mc.Graw-Hill, 1994.

3.Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.

4.Reinforced Concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.

5.Design Reinforced Concrete Foundations P.C. Varghese Prentice Hall of INDIA Private Ltd.

6.IS 456-2000 Plain and Reinforced concrete book of Practice.

7.SP 16- Design Aids for Reinforced Concrete to IS 456

8.SP 34 - Hand Book as Concrete Reinforcement and retaining

I Year - I Semester		L	T	P	C
		3	0	0	3

Program Elective 5- DESIGN OF **PRE- STRESSED CONCRETE STRUCTURES**

UNIT I:

Introduction – Prestressing Systems – Pretensioning Systems – Postensioning Systems – High Strength Steel and Concrete - Analysis of Prestress - Resultant Stresses at a Section – Pressure Line or Thrust Line – Concept of Load Balancing - Losses of Prestress – Loss Due to Elastic Deformation of Concrete – Shrinkage of Concrete – Creep – Relaxation of Stress in Steel – Friction – Anchorage Slip.

UNIT II:

DEFLECTIONS OF PRESTRESSED CONCRETE MEMBERS : Importance of Control of Deflections – Factors Influencing Deflection – Short-term Deflections of Uncracked Members – Prediction of Long-time Deflections – Deflections of Cracked Members – Requirements of IS 1343-2012.**Ultimate Flexural Strength of Beams:** Introduction, Flexural theory using first principles – Simplified Methods – Ultimate Moment of Resistance of untensioned.

UNIT III:

COMPOSITE CONSTRUCTIONS: Introduction, Advantages, Types of Composite Construction, Analysis of Composite beams- Differential shrinkage- Ultimate Flexural and shearstrength of composite sections- Deflection of Composite Beams. Design of Composite sections.

UNIT IV:

PRESTRESSED CONCRETE SLABS: Types Of Prestressed Concrete Floor Slabs- Design of Prestressed Concrete One Way and Two Way Slabs.

Prestressed Concrete Pipes and Poles : Circular prestressing- Types of Prestressed ConcretePipes- Design of Prestressed Concrete Pipes - Prestressed Concrete Poles.

UNIT V:

CONTINUOUS BEAMS: Advantage of Continuous Members – Effect of Prestressing Inderterminate Structures – Methods of Achieving Continuity – Methods of Analysis of Secondary Moments – Concordant Cable Profile – Guyon‟s Theorem. Redistribution of momentsin a continuous beam.

Anchorage Zone Stresses in Beams : Introduction, Stress distribution in End Block – Anchorage zone stresses –Magnel‟s method- Guyon‟s Method - Anchorage zone Reinforcement.

TEXT BOOKS

1.Prestressed Concrete, 6e by N. Krishna Raju, Mc Graw Hill Publishers

2.0Prestressed Concrete by K. U.Muthu, PHI Learning Pvt Limited

REFERENCES:

1.Prestressed Concrete Analysis and Design, Antone E. Naaman 2e, Techno Press 3000

2.Design of Prestressed Concrete- T. Y. Lin, Ned H. Burns 3e, Wiley Publications

I Year - I Semester		L	T	P	C
		0	1	2	2
ADVANCED CONCRETE TECHNOLOGY LABORATORY					

List of Experiments:

1. Study on Water / Cement Ratios Vs Workability of different concretes
2. Study on Water / Cement Ratios Vs Strength of different concretes
3. Study of variation of Coarse Aggregate to Fine Aggregates on Workability
4. Study of variation of Coarse Aggregate to Fine Aggregates on Strength
5. Strain measurement - Electrical resistance strain gauges
6. Non destructive testing- Impact Hammer test, UPV test
7. Qualifications tests on Self compaction concrete- L Box , J Box , U box and Slump tests

NOTE: A minimum of five experiments from the above set have to be conducted

I Year - I Semester		L	T	P	C
		0	1	2	2
ADVANCED STRUCTURAL ENGINEERING LABORATORY					

List of Experiments:

1. Study on Deflection and Cracks on a Under Reinforced Over Reinforced and Balanced

Sections

2. Study on Performance of RCC Beams designed for Bending and failing in Shear
3. Study on Performance of RCC Beams designed for Shear and failing in Bending
4. Study on Performance of RCC One way slabs
5. Study on Performance of RCC Two way slabs with simply supported edge conditions
6. Study on Performance of RCC Two way slabs with fixed edge conditions
7. Calculation of Young‟s Modulus of Elasticity of Concrete
8. Extraction and Study of Concrete Core samples from pavements

NOTE: A minimum of five experiments from the above set have to be conducted asdemonstration to entire class.

I Year - I Semester		L	T	P	C
		0	0	2	1
Seminar-I					

I Year - II Semester		L	T	P	C
		3	0	0	3

FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING

UNIT: I

Introduction: Review of stiffness method- Principle of Stationary potential energy- Potential energy of an elastic body- Rayleigh- Ritz method of functional approximation - variational approaches - weighted residual methods

UNIT: II

Finite Element formulation of truss element: Stiffness matrix- properties of stiffness matrix – Selection of approximate displacement functions- solution of a plane truss- transformation matrix and stiffness matrix for a 3- D truss- Inclined and skewed supports- Galerkin‟s method for 1- D truss – Computation of stress in a truss element.

UNIT: III

Finite element formulation of Beam elements: Beam stiffness- assemblage of beam stiffness matrix- Examples of beam analysis for concentrated and distributed loading- Galerkin‟s method - 2- D Arbitrarily oriented beam element – inclined and skewed supports –rigid plane frame example.

UNIT: IV

Finite element formulation for plane stress, plane strain and axi- symmetric problems- Derivation of CST and LST stiffness matrix and equations- treatment of body and surface forces- Finite Element solution for plane stress and axi- symmetric problems-

comparison ofCST and LST elements –convergence of solution- interpretation of stresses.

UNIT: V

Iso- parametric Formulation: Iso- parametric bar element- plane bilinear Iso- parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature- appropriate order of quadrature – element and meshinstabilities – spurious zero energy modes, stress computation- patch test.

TEXT BOOKS

1.A first course in the Finite Element Method – Daryl L. Logan, Thomson Publications.

2.Concepts and applications of Finite Element Analysis – Robert D. Cook, Michael E Plesha,John Wiley & Sons Publications

3.Fundamental Finite Element Analysis and Applications: with Mathematica and Matlab Computations, Bhatti, M.A. Wiley Publications

I Year - II Semester		L	T	P	C
		3	0	0	3
THEORY OF PLATES AND SHELLS					

UNIT: I

Derivation of governing differential equation for plate– in plane bending and transverse bending effects- Rectangular plates: Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier and Levy‟s type of solutions for various boundary condition.

UNIT: II

Circular plates: Symmetrically loaded, circular plates under various loading conditions, Annular plates.

UNIT: III

Introduction to Shells- Single and double curvature- Equations of Equilibrium of Shells: Derivation of stress resultants, Principles of membrane theory and bending theory

UNIT: IV

Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer‟s theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

UNIT: V

Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms - Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

TEXT BOOKS

1.Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw- Hillbook company, INC, New York.

2.Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications

3.Analysis of Thin Concrete Shells by K. Chandrasekhara, New Age International (P) Ltd

REFERENCES:

1.Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press

2.A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.

3.Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill,New York.

I Year - II Semester		L	T	P	C
		3	0	0	3
Design of Formwork					

UNIT: I

Introduction: Definition of Form Work, Difference between Form Work and False Work, Requirements and Selection of Formwork, Difficulties while Erection.

UNIT: II

Formwork Materials- Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

UNIT: III

Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

UNIT: IV

Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

UNIT: V

Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award. Formwork Failures: Causes and Case studies in Formwork Failure, Formwork Issues in Multi Story Building Construction

TEXT BOOKS

1.Theory of Plates and Shells 2e –S. Timoshenko and S. Woinowsky Krieger, McGraw- Hill book company, INC, New York.

2.Reinforced Concrete Shells and Folded Plates by P.C. Varghese, Prentice Hall India Publications

3.Analysis of Thin Concrete Shells by K. Chandrasekhara, New Age International (P) Ltd

REFERENCES:

1. Theory and Analysis of Elastic Plates and Shells by J. N. Reddy, CRS Press
2. A Text Book of Shell Analysis – Bairagi, K, Khanna Publisher, New Delhi.
3. Design and Construction of Concrete Shell Roofs – Ramaswamy, G.S, Mc Graw Hill,New York

I Year - II Semester		L	T	P	C
		3	0	0	3
STABILITY OF STRUCTURES (Elective - III)					

UNIT: I

Beam columns: Differential equation for beam columns – Beams column with concentrated loads – continuous lateral load – couples – Beam column with built in ends – continuous beams with axial load – application of Trigonometric series – Determination of allowable stresses

UNIT: II

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 bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section – Effect of shear force on critical load – Built up columns – Effect of Initial curvature on bars – Buckling of frames – Sway & Non Sway mode

UNIT: III

In- elastic buckling: Buckling of straight bars – Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram – Empirical formulae of design – various end conditions – Design of columns based on buckling. Mathematical Treatment of stability problems: Buckling problem orthogonality relation – Ritz method –Stiffness method and formulation of Geometric stiffness matrix- Applications to simple frames

UNIT: IV

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 of Torsion and Flexure

UNIT: V

Lateral Buckling of simply supported Beams: Beams of rectangular cross section subjected for pure bending, Buckling of I Section subjected to pure bending

TEXT BOOKS

1. Theory of Stability of Structures by Alexander ChaJes.
2. Theory of Elastic Stability by S. P. Timshenko & J.M. Gere- Mc Graw Hill Publications
3. Theory of Elastic Stability by Manikaselvam

REFERENCES:

1. Fundamentals of Structural Stability by George J Smith & Dewey H. Hodges, Elsevier

Publications

2. Elastic Stability of Structural Elements, N.G.R. Iyengar Macmillan Publications

I Year - II Semester		L	T	P	C
		3	0	0	3
Elective III - ADVANCED STEEL DESIGN					

UNIT-I

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

UNIT-II

Plastic Analysis: Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli - shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single story portal frame at different level subjected to vertical and horizontal loads.

UNIT-III

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

UNIT-IV

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

UNIT-V

Design Of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on toplateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

TEXT BOOKS

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private

Ltd. New
Delhi.
2. Design of steel structures by N. Subramanian, Oxford University Press
3. Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, Scientific Pub
lishes
Journals Department..

REFERENCE

1. Design of Steel Structures. P. Dayaratnam, S. Chand, Edition 2011-12.
2. Design of Steel Structures Galyord & Gaylord, Tata Mc Graw Hill, Education, Edition 2012.
3. Indian Standard Code – IS – 800-2007.
4. Indian Standard Code – IS – 875 – Part III – 2015

I Year - II Semester		**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**
Elective III – **ANALYSIS OF OFFSHORE STRUCTURES**					

UNIT: I

Introduction to different types of offshore structures, Concept of fixed, compliant and floating structures, Law of floatation, fluid pressure and centre of pressure, estimation of centre of gravity, hydrostatic particulars, stability criteria of floating bodies, and motions of a floating body.

UNIT: II

Conservation mass and momentum, Euler equation, Bernoullis Equation, Potential flow, Classification of waves, small amplitude or Linear Airy‟s theory, dispersion relationship, water particle kinematics, wave energy.

UNIT: III

Wave force estimation- Wave force on small bodies- Morison equation, Estimation of wave force on a vertical cylinder, Force due to current, Effect of marine growth on vertical cylinders

UNIT: IV

Wave force on large bodies- Froude- krylov theory, Diffraction theory.

UNIT: V

Static and dynamic analysis of fixed offshore structures.

TEXT BOOKS

1. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981.
2. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.

REFERENCES

1. Hand book of offshore Engineering, Vol I, Subrata Chakrabarti, Offshore Structure Analysis,Inc., Plainfield, Illinois, USA.
2. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.
3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.

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II Year - I Semester		L	T	P	C
		3	0	0	3
Program Elective 5 – **INDUSTRIAL STRUCTURES**					

UNIT: I

Planning and functional requirements- classification of industries and industrial structures- planning for layout-requirements regarding lighting ventilation and fire safety- protectionagainst noise and vibrations

UNIT: II

Industrial buildings- roofs for industrial buildings (Steel) - design of gantry girder- design of corbels and nibs- machine foundations

UNIT: III

Design of Pre Engineered Buildings

UNIT: IV

Power plant structures- Bunkers and silos- chimney and cooling towers- Nuclear . containmentstructures

UNIT: V

Power transmission structures- transmission line towers- tower foundations- testing towers

TEXT BOOKS

1. Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, StructuralEngineering Research Center
2. Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill PublishingCompany

REFERENCES:

1. Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2. SP 32: 1986, Handbook on functional requirements of Industrial buildings

Design of steel structures by N. Subramanyam.

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I Year - II Semester		L	T	P	C
		3	0	0	3

EARTHQUAKE RESISTANT DESIGN OF BUILDINGS (Elective - 4) -

UNIT: I

Engineering seismology – rebound theory – plate tectonics – seismic waves - earthquake size and various scales – local site effects – Indian seismicity – seismic zones of India – theory of vibrations – near ground and far ground rotation and their effects

UNIT: II

Seismic design concepts – EQ load on simple building – load path – floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration – pounding effects – mass and stiffness irregularities – torsion in structural system- Provision of seismic code (IS 1893 & 13920) – Building system – frames – shear wall – braced frames – layout designof Moment Resisting Frames(MRF) – ductility of MRF – Infill wall – Non-structural elements

UNIT: III

Calculation of EQ load – 3D modeling of building systems and analysis (theory only) Design andductile detailing of Beams and columns of frames Concept of strong column weak beams, Designand ductile detailing of shear walls

UNIT: IV

Cyclic loading behavior of RC, steel and pre- stressed concrete elements - modern concepts- Base isolation – Adaptive systems – case studies

UNIT: V

Retrofitting and restoration of buildings subjected to damage due to earthquakes- effects of earthquakes – factors related to building damages due to earthquake- methods of seismic retrofitting- restoration of buildings

TEXT BOOKS

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish ShriKhande, Prentice

– Hall of India, 2007, New Delhi.

2. Earthquake Resistant Design of Structures- S.K. Duggal, Oxford Publications

REFERENCE

1. Seismic design of reinforced concrete and masonry buildings by Paulay and Priestley
2. Earthquake Resistant Design and Risk Reduction- David Dowrick
3. IS 4326 -1998: Earthquake Resistant Design and Construction of Buildings
4. IS 1893 (Part 1 to 5)- 2016: General Provisions and Building
5. IS 4928–1993: Code of practice for Earthquake Resistant Design and

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Construction of Buildings

6. IS 13920-2016: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
7. IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building.

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I Year - II Semester		L	T	P	C
		3	0	0	3
PRECAST AND PREFABRICATED STRUCTURES (Elective IV)					

UNIT -I

Need for prefabrication – General Principles of Prefabrication - Comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – Materials – Modular coordination – Systems – Production – Transportation – Erection.

UNIT -II

Prefabricated Load Carrying Members-Planning for components of prefabricated structures, disuniting of structures, design of simple rectangular beams and I-beams, handling and erection stresses, elimination of erection stresses, beams, columns, symmetric frames. Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls.

UNIT -III

Joints - Joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction.

UNIT -IV

Production Technology - Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology - Equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT -V

Applications - Designing and detailing of precast UNIT for factory structures, purlins, principal rafters, roof trusses, lattice girders, gable frames, singe span single storied simple frames, single storied buildings, slabs, beams and columns. Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TEXT BOOKS

1. Precast Concrete Structures- Kim S Elliott, CRC Press
2. CBRI, Building materials and components, India, 1990
3. Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning forconstruction and manufacturing, Academic Press Inc., 1994
4. Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag,

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GMBH,1971.

REFERENCES

1. Structural design manual, Precast concrete connection details, Society for the studies in theuse of precast concrete, Netherland Betor Verlag, 1978.
2. Mokk. L, (1964), Prefabricated Concrete for Industrial and Public Structures, PublishingHouse of the Hungarian Academy of Sciences, Budapest.

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I Year - II Semester		L	T	P	C
		3	0	0	3
EARTH RETAINING STRUCTURES (Elective - IV **)**					

UNIT: I

Earth pressures – Different types and their coefficients- Classical Theories of Earth pressure – Rankine‟s and Coulomb‟s Theories for Active and Passive earth pressure- Computation of Lateral Earth Pressure in Homogeneous and Layered soils- Graphical solutions for Coulomb‟s Theory in active and passive conditions.

UNIT: II

Retaining walls – different types - Type of Failures of Retaining Walls – Stability requirements – Drainage behind Retaining walls – Provision of Joints – Relief Shells.

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UNIT: III

Sheet Pile Structures – Types of Sheet piles – Cantilever sheet piles in sands and clays – Anchored sheet piles – Free earth and Fixed earth support methods – Rowe‟s moment reduction method – Location of anchors and Design of Anchorage system.

UNIT: IV

Soil reinforcement – Reinforced earth **-** Different components – their functions – Design principles of reinforced earth retaining walls.

UNIT: V

Braced cuts and Cofferdams: Lateral Pressure in Braced cuts – Design of Various Components of a Braced cut – Stability of Braced cuts – Bottom Heave in cuts. – types of cofferdam, suitability, merits and demerits – Design of single – wall cofferdams and their stability aspects – TVA method and Cummins‟ methods.

TEXT BOOKS

1. Principles of Foundation Engineering 7e by Braja Das, Cengage Learning
2. Foundation analysis and design by Bowles, J.E. – McGraw Hill

REFERENCES

1. Soil Mechanics in Engineering Practice – Terzaghi, K and Ralph, B. Peck 2^{e}. – John Wiley &Sons.,
2. Analysis and Design of Foundations and Retaining Structures, Samsher Prakash, GopalRanjan and Swami Saran, Saritha Prakashan, New Delhi.
3. NPTEL course materials on Geo-synthetics and Earth Retaining Structures

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II Year - I Semester		L	T	P	C
		3	0	0	3
Program Elective 5 - STRUCTURAL HEALTH MONITORING					

UNIT-I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures

UNIT-II

Structural Health Monitoring: Concept, Various Measures, Structural Safety in Alteration

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures

UNIT-III

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT-IV

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), Piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

TEXT BOOKS

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.

REFERENCES

1. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
2. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

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I Year - II Semester		L	T	P	C
		0	0	4	2
COMPUTER AIDED DESIGN LABORATORY					

Analysis and Design using STADD, STADD FOUNDATION, ETABS, ANSYS

1. Programming for beams subject to different loading
2. Analysis and Design of reinforced concrete multistoried building
3. Analysis of plane and space truss
4. Analysis of plane and space frame
5. Determination of mode shapes and frequencies of tall buildings using lumped mass (stickmodel) approximation

NOTE: A minimum of Four from the above set have to be

conducted.

REFERENCE:

Computer-aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

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I Year - II Semester		L	T	P	C
		0	0	4	2
STRUCTURAL DESIGN LABORATORY					

Analysis and Design using STADD, STADD FOUNDATION, ETABS, ANSYS

1. Wind analysis on tall structure
2. Analysis of pre stressed concrete bridge girder
3. Analysis of Cylindrical shell
4. Analysis of Bridge Pier and Abutment
5. Dynamic Analysis of Multistory structure

NOTE: A minimum of Four from the above set have to be

conducted.REFERENCE:

Computer aided design laboratory (Civil Engineering) by Shesha Prakash and Suresh.S

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I Year - II Semester		L	T	P	C
		0	0	4	2
SEMINAR-II					

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Semester - III		Program Elective - V	L	T	P	C
Course Code		**RESEARCH METHODOLOGY AND IPR**	3	0	0	3

Unit 1 : RESEARCH PROBLEM AND SCOPE FOR SOLUTION

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

Unit 2 : FORMAT

Effective literature studies approaches, analysis, Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 3 : PROCESS AND DEVELOPMENT

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

Unit 4 : PATENT RIGHTS

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

Unit 5 : NEW DEVELOPMENTS IN IPR

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Textbooks :

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edn, “Research Methodology: A Step by Step Guide for beginners”

References :

1. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
2. Mayall, “Industrial Design”, McGraw Hill, 1992.
3. Niebel, “Product Design”, McGraw Hill, 1974.
4. Asimov, “Introduction to Design”, Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
6. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

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II Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**3**	**3**
SUMMER INTERNSHIP/ INDUSTRIAL TRAINING					

II Year - I Semester		**L**	**T**	**P**	**C**
		0	**0**	**20**	**10**
DISSERTATION -PartA					

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II Year - II Semester		L	T	P	C
		0	0	32	16
DISSERTATION / THESIS-PartB					

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