SYLLABUS

AUTONOMOUS SYSTEM

For
M.Tech. I to IV Semester

Structural Engineering

Hyderabad Karnataka Education Society's

Poojya Doddappa Appa College of Engineering, Kalaburagi

A Govt. Aided Autonomous College, Affiliated to VTU Belagavi, and Approved by AICTE, New Delhi

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M.TECH. STRUCTURAL ENGINEERING

PROPOSED SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. DEGREE (STRUCTURAL ENGINEERING)—2018-19

Code No.	Course	Hours/Week					Maximum Marks		
		Lecture	Tutorial	Practical	Self study	Credits	CIE	SEE	Total
SEMESTER I									
THEORY									
19PSE11	STRUCTURAL DYNAMICS	4	2	0		5	50	50	100
19PSE12	MATRIX METHODS OF STRUCTURAL ANALYSIS	4	0	0	1	5	50	50	100
19PSE13	THEORY OF ELESTICITY & PLASTICITY	4	2	0		5	50	50	100
19PSE14	RESEARCH METHODOLY	4	--	0		4	50	50	100
19PSE15X	ELECTIVE – 1	4	0	0		3	50	50	100
19PSE16X	ELECTIVE – 2	4	0	0		3	50	50	100
PRACTICAL									
19PSE17	ADVANCED STRUCTURE LAB			3		1	50	50	100
		24	04	03	01	26	350	350	700

CIE – CONTINUOUS INTERNAL EVALUATION; **SEE** – SEMESTER END EXAMINATION

ELECTIVE – 1:

19PSE151 – ADVANCED DESIGN OF R.C.C. STRUCTURES

19PSE152 – RELIABILITY ANALYSIS IN ENGINEERING

19PSE153 –ADVANCED STRUCTURAL ANALYSIS

19PSE154 – ADVANCED DESIGN OF STEEL STRUCTURES

ELECTIVE – 2:

19PSE161 – ADVANCED PRE-STRESSED CONCRETE

19PSE162 – ADVANCED FOUNDATION ENGINEERING

19PSE163 – SPECIAL CONCRETES

19PSE164 – VALUATION ENGINEERING

19PSE165 – REPAIR AND REHABILITATION OF STRUCTURES

PROPOSED SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. DEGREE (STRUCTURAL ENGINEERING)

2018-19

Code No.	Course	Hours/Week					Maximum Marks		
		Lecture	Tutorial	Practical	Self study	Credits	CIE	SEE	Total
SEMESTER II									
THEORY									
19PSE21	THEORY OF PLATES & SHELLS	4	2	0		5	50	50	100
19PSE22	STABILITY OF STRUCTURES	4	0	0	1	5	50	50	100
19PSE23	FINITE ELEMENT METHOD OF STRUCTURAL ANALYSIS	4	2	0		5	50	50	100
19PSE24X	ELECTIVE – 4	4	--	0		4	50	50	100
19PSE25X	ELECTIVE – 5	4	--	0		3	50	50	100
18OPE26X	OPEN-ELECTIVE	4	--	0		3	50	50	100
PRACTICAL									
19PSE27	CAD LAB	0	0	3		1	50	50	100
		24	04	03	01	26	350	350	700

CIE – CONTINUOUS INTERNAL EVALUATION; **SEE** – SEMESTER END EXAMINATION

ELECTIVE – 4:
19PSE241 – OPTIMISATION METHODS IN ENGINEERING DESIGN
19PSE242 – DESIGN OF BRIDGES
19PSE243 – DESIGN OF MASONRY STRUCTURES

ELECTIVE –5:
19PSE251 – COMPOSITE AND SMART MATERIALS
19PSE253 – **DESIGN OF EARTHQUAKE RESISTANT STRUCTURES**
19PSE252 – DESIGN OF TALL STRUCTURES

OPEN ELECTIVE:
18OPE261 – BUILDING SCIENCE
18OPE262 – SOFT COMPUTING TOOLS
18OPE263 – **REMOTE SENSING.**

PROPOSED SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. DEGREE

(STRUCTURAL ENGINEERING)—2018-19

Semester III

Code No.	Course	Hours/Week					Maximum Marks		
		Lecture	Tutorial	Practical	Self study	Credits	CIE	SEE	Total
SEMESTER III									
THEORY									
19PSE31	INDUSTRIAL INTERNSHIP	6 WEEKS				5	50	50	100
19PSE32	PROJECT PHASE I					5	50	50	100
19PSE33	SEMINAR					1	100	---	100
19PSE34	CERTIFICATE COURSE					2	--	--	--
	TOTAL					13	200	100	300

CIE – CONTINUOUS INTERNAL EVALUATION; **SEE** – SEMESTER END EXAMINATION

EXPERT COMMITTEE: CONSISTS OF MINIMUM OF 3 AND MAXIMUM OF 5 FACULTY MEMEBERS IN THE RELEVANT FIELD.

PROJECTWORK WILL BE FOR A PERIOD OF 8 MONTHS OUT OF WHICH 3 MONTHS WILL BE DURING THIRD SEMESTER. DURING THIS SEMESTER STUDENT HAS TO CARRY OUT LITERATURE SURVEY AND FINALISE THE OBJECTIVES OF THE PROJECT WORK

.

CIE WILL BE EVALUATED BY CONCERNED GUIDE ON THE BASIS OF REGULAR PERFORMANCE OF THE CANDIDATE THROUGHOUT THE SEMESTER.

STUDENT HAS TO PRESENT A SEMINAR ON PHASE I BEFORE THE EXPERT COMMITTEE FOR EVALUATION OF **SEE.**

INDUSTRIAL INTERNSHIP: STUDENT HAS TO VISIT AT LEAST ONE INDUSTRY FOR STIPULATIED PERIOD OF TWO MONTHS AND SUBMIT A REPORT OF THEIR EXPOSURE IN RESPECTIVE FIELDS.

PROPOSED SCHEME OF TEACHING AND EXAMINATION FOR M.TECH. DEGREE (STRUCTURAL ENGINEERING)—2018-19

Code No.	Course	Hours/Week				Maximum Marks		
		Lecture	Tutorial	Practical	Credits	CIE	SEE	Total
SEMESTER IV								
THEORY								
19PSE41	PROJECT PHASE - II INTERNAL ASSESMENT	---	----	----	23	50 + 50		100
19PSE42	PROJECT PHASE – II FINAL	---	---	---		125* + 75**		200
	TOTAL				23	100	200	300

CIE – CONTINUOUS INTERNAL EVALUATION; **SEE** – SEMESTER END EXAMINATION

EXPERT COMMITTEE: CONSISTS OF MINIMUM OF 3 AND MAXIMUM OF 5 FACULTY

MEMEBERS IN THE RELEVANT FIELD.

CIEDURING FOURTH SEMESTER STUDENT HAS TO PRESENT TWO SEMINARS (ONE AT THE MID SEM, ANOTHER AT THE END OF SEM) ON **PHASE-II** BEFORE THE EXPERT COMMITTEE FOR EVALUATION.

SEE

CANDIDATE HAS TO APPEAR VIVA- VOCE EXAMINATION IN THE PRESENCE OF INTERNAL AND EXTERNAL EXAMINAR

Proposed Syllabus for I Semester M.Tech.

STRUCTURAL DYNAMICS

Subject Code : 19PSE11	Credits : 05	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs. (Theory) + 2 Hrs. (Tutorial)		Total Hours : 56

MODULE-I

Introduction: Objectives, types of dynamic problems, degree of freedom, D'Alemberts principle, principle of virtual displacement and Hamilton's principle. Single degree of fre edom systems**.** Un-damped and damped free vibrations; force vibration- response to harmonic loading. 12 Hours

MODULE-II

Support motion, evaluation of damping, vibration isolation, transmissibility, response to periodic forces. Numerical methods applied to SDOF, Direct integration and Duhamel Integral. 12 Hours

MODULE-III

Multi degree freedom systems**-** Natural modes - Orthogonality conditions, Modal analysis - free and forced vibration with or without damping.

8 Hours

MODULE-IV

Approximate Method: Rayleigh's method, Dunkarly's method, Stodola's method, Rayleigh - Ritz method, Matrix method. 12 Hours

MODULE-V

Continuous system - Free longitudinal vibration of bars, flexural vibration of beams with different end conditions - forced vibration-response of beams under moving loads.

Response to earthquake - techniques for analyzing earthquake response - design, principles for earthquake resistant structures. 12 Hours

Extent of teaching: It is clearly defined in the syllabus

Scheme of SEE: i) Two questions are to be set from each module

ii) Total five questions are to be answered by selecting minimum One question from each module.

Reference Books:

1. M. Mukhopadhay **"Vibrations, Dynamics and Structural Systems"** Oxford and IBH publishing Co. Pvt. Ltd. New Delhi
2. Anil K. Chopra **"Dynamics of Structures (Theory and Applications to Earthquake Engineering)"** Prentice ball of India Private limited, New Delhi
3. Mario Paz **"Structural Dynamics (Theory and Computation second Edition)"** CBS Publishers and Distributors, New Delhi
4. R.W.Clough and Y.Pengiln – **"Dynamics of Structures"**, Mcgraw Hill

MATRIX METHODS OF STRUCTURAL ANALYSIS

Subject Code : 19PSE12	Credits : 05	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs. + 1 Hrs. (SS)		Total Hours : 56

MODULE-I

Stiffness method: Fundamentals of Direct Stiffness method. Introduction to local and global coordinate system, transformation of variables.

Truss analysis using stiffness method: Member stiffness matrix (truss member) . Member global stiffness matrix for truss element. Application of the stiffness method for truss analysis (2-D only). 10 Hours

MODULE-II

Beam analysis using stiffness method : Member global stiffness matrix for beam. Application of the direct stiffness method for beam analysis.

Frame analysis using stiffness method: Member stiffness matrix for frame element.. Member global stiffness matrix for frame element. Application of direct stiffness method for frame analysis (2-D only).

12 Hours

MODULE-III

Programming concept Bandwidth minimization technique, assembly of global stiffness matrices computer program. (beam, truss and frame)

06 Hours

MODULE-IV

Flexibility method: Introduction to flexibility method. Choice of redundant. Compatibility. Equilibrium equation for indeterminate system. Relationship between nodal displacement and nodal loads.

Application of flexibility method for truss analysis. 14 Hours

MODULE-V

Application of Flexibility method (beams and frames): Application of flexibility method for beam analysis and frame analysis (2-D only).

14 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

i) M Mukhopadhyay **"Matrix, finite elements, Computer and Structural analysis"**, Oxford &IBW, 1984

ii) W. Weaver J.M. Gere **"Matrix Analysis of framed structures"**, CBS publishers and Distributors, 1986

iii) S Rajshekharan. G Sankara Subramanian **"Computational structural Mechanics"**, PHI, 2001

iv) G.S Pandit & S P Gupta **"Structural Analysis A Matrix Approach"** Tata McGrawHill,1981

v) C.S Reddy **"Basic structural Analysis"**, Tata Mc Graw-Hill,1996

vi) L S Negi and R S Jangid **"Structural Analysis"**, Tata Mc Graw-Hill,l997

vii) H C Martin **"Introduction to Matrix Methods of Structural analysis"**, International text book Comoanv.1996.

THEORY OF ELASTICITY AND PLASTICITY

Subject Code : 19PSE13	Credits : 05	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs. + 2 Hrs. (Tutorial)		Total Hours : 56

MODULE-I

Stress and strain at a. point, Lame's Constants, Generalized Hook's Law, Strain- displacement relations. Differential equations of equilibrium, boundary conditions, Compatibility equations for 2D & 3D cases, Airy's stress function, problems, Stress polynomials, St. Venant's principle.

12 Hours

MODULE-II

Plane stress and plane strain, Evaluation of stress invarients and principal stresses for a given stress matrix in 3D, Two-dimensional problems in rectangular coordinates, bending of a cantilever beam subjected to end load, effect of shear deformation in beams, simply supported beam subjected to UDL. 14 Hours

MODULE-III

Two-dimensional problems in polar coordinates, strain-displacement relations, equations of equilibrium, compatibility equation, stress function. Problems. 10 Hours

MODULE-IV

Stress distribution symmetrical about an axis, Lame's problem, Effect of circular hole in an infinite plate-high stress concentration factors.

Torsion: stress function, torsion of circular, elliptical and equilateral triangular sections. 10 Hours

MODULE-V

Plasticity: General concept – yield criteria – flow laws for perfectly plastic and strain hardening material – simple applications. Theories of failure, Problems. 10 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

TEXT BOOKS:

1. Timoshenko. S.P. and Goodier.J.N. – **"Theory of Elasticity"** , International Students' Edition, McGraw Hill Book Co. Inc., New Delhi.
2. Wang. P.C.- **"Applied Elasticity"**
3. Sadhu singh – **"Theory of Plasticity"**

REFERENCE BOOKS:

1. Valliappan. C- **"Continuum Mechanics Fundamentals"**, Oxford and IBH Publishing Co.Ltd., New Delhi.
2. Srinath.L.S. – **"Advanced Mechanics of Solids"**, Tata McGraw Hill Publications Co.Ltd., New Delhi.
3. Venkataraman and Patel- **"Structural Mechanics with Introduction to Elastity and Plasticity"**, McGraw Hill Book Inc., New York.

RESEARCH METHODOLOGY

Subject Code:19PSE14	Credits 04	
CIE: 50 Marks	SEE: 50 Marks	SEE:04 Hrs
Hours / Week: 4 Hrs (Theory)		Total Hours: 52

Module - I

Meaning, Objectives and characteristic of research Research methods Vs Methodology. Types of Research - Descriptive Vs Analytical, Applied Vs Fundamental Quantities Vs Qualitative, Conceptual Vs Empirical -- Research process.- Criteria of good research-Developing a research plan. 10 Hrs

Module - II

Defining the research problem - Selecting the problem. Necessity of defining the problem Techniques involved in defining the problem- Importance of literature review in defining a problem- Survey of literature - Primary and Secondary sources Reviews, treatise monographs patents- web as a source-searching the web-Identifying gap areas from literature review Development of working hypothesis. 10 Hrs

Module -III

Research design and methods - Research design - Basic principles. Need of research design Features of good design- Important concepts relating to research design - Observation and Facts. Laws and Theories, Prediction and explanation, Induction, Deduction m Development of models, Developing a research plan- Exploration. Description. Diagnosis and Experimentation Determining Experimental and simple designs. 12 Hrs

Module -IV

Sample design - Steps in sample design - Characteristics of a good sample design - Types of sample design- Measurement and scaling techniques. Methods of data collection-collection of primary data - Data collection instruments. 10 Hrs

Module- V

Testing hypotheses - Basic concepts - Procedure for hypothesis testing

flow diagram for hypotheses testing-Data analysis with statistical packages- correlation and regression- Important parametric test-Chi-square test- Analysis of variance and covariance. 10 Hrs

ADVANCED DESIGN OF RCC STRUCTURES

Subject Code : 19PSE151	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Yield Line Method: Introduction, basic ideas of yield line theory, location of yield lines for standard cases, internal forces in yield lines, methods of yield line analysis (equilibrium approach & by virtual work principle), yield analysis of one way & two way rectangular slab, circular slab & rectangular slab supported on three edges & design of one way & two way rectangular slabs. 10 Hours

MODULE-II

Design of Grid Floor and Flat Slabs: Introduction, analysis & design of grid floors by approximate & plate theory, design of flat slabs.

Design of Beams Curved in Plan: Design of circular, semicircular & segmental (circular type) type of curved beams for point load & udl. 10 Hours

MODULE-III

Design of Continuous Beams and Portal Frames: Introduction, effective span, and calculation of BM & SF, redistribution of moments, design of continuous beams by limit state method, design of single bay, single story portal frame (hinged & fixed)for given analyzed data, reinforcement detailing. 10 Hours

MODULE-IV

Design of silos, bunkers and chimney. 10 Hours

MODULE-V

Art of dealing earthquake resistant construction**:** General ductile detailing requirements, ductile detailing of beam column joints, expansion &

construction joints. 12 Hours

Extent of teaching: It is clearly defined in the syllabus.
Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. N. Krishnaraju, -**"Design of Advanced Reinforced concrete structures"** CBS publishers, New Delhi.
2. A.K. Jain — **"Limit State method of design"** Nemichand and Bros., Roorkee
3. Park & Paulay — **"Reinforced Concrete"**, John Wiley & Bros.
4. B.C. Punmia, Ashok kumar Jain & Arun kumar Jain — **"Limit State design of Reinforced concrete"**, Laxmi Publication, New Delhi.
5. V.Ramakrishnan & P.D.Arthur, **"Ultimate strength design of structural concrete"**, Wheeler Books, Allahabad
6. IS 456-2000, SP 16

RELIABILITY ANALYSIS ENGINEERING

Subject Code : 19PSE152	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Probability Concepts: Random events-Sample space and events, Venn diagram and event space, Measures of probability-interpretation, probability axioms, total probability theorem and Baye's theorem, Probability distributions - Discrete distributions- Binomial and poison distributions, Continuous distributions- Normal, Log normal distributions probability mass function, probability density function, mathematical expectation, Chebyshev's theorem. 12 Hours

MODULE-II

Probabilistic Analysis of loads: Gravity load, Introduction, load as a stochastic process Wind load- Introduction, wind speed, return period, estimation of life time design wind speed, probability model of wind load. 11 Hours

MODULE-III

Reliability Analysis: Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second Moment Method (Hasofer-Lind's method). 11 Hours

MODULE-IV

System Reliability: Influence of correlation coefficient, redundant and non-redundant systems series, parallel and combined systems, Uncertainty in reliability assessments- confidence limits, Bayesian revision of reliability. 11 Hours

MODULE-V

Simulation Techniques: Monte Carlo simulation- Statistical experiments, sample size and accuracy, Generation of random numbers-random numbers with standard uniform distribution, continuous random variables, discrete random variables. 11 Hours 14

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

REFERENCE BOOKS:

1. Ranganathan, R. (1999). "**Structural Reliability Analysis and design"-** Jaico publishing house, Mumbai, India.
2. Ang, A. H. S., and Tang, W. H. (1984). "**Probability concepts in engineering planning and design"**- Volume – I, John Wiley and sons, Inc, New York.
3. Ang, A. H. S., and Tang, W. H. (1984). "**Probability concepts in engineering planning and design"**-Volume – II, John Wiley and sons, Inc, New York.
4. Milton, E. Harr (1987). "**Reliability based design in civil engineering"-** Mc Graw Hill book Co.
5. Nathabdndu, T., Kottegoda, and Renzo Rosso (1998). Statistics, "**Probability and reliability for Civil and Environmental Engineers"**- Mc Graw Hill international edition, Singapore.
6. Achintya Haldar, and Sankaran Mahadevan (2000). "**Probability, Reliability and Statistical methods in Engineering design"-** John Wiley and Sons. Inc.
7. Thoft-christensen, P., and Baker, M., J., (1982), "**Structural reliability theory and its Applications**"- Springer-Verlag, Berlin, NewYork.
8. Thoft-christensen, P., and Murotsu, Y. (1986). "**Application of structural systems reliability theory"**- Springer-Verlag, Berlin, New York.

ADVANCED STRUCTURAL ANALYSIS

Subject Code : 19PSE153	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE - I

Beams Curved in Plan: Derivation for Bending and Torsional Moment at different sections including Shear Force of curved beams in plan, Analysis of curved beams in plan. 8 Hours

MODULE - II

Beams Curved in Elevation: Introduction to curved beam & assumptions, WINKLER BACH equation, Limitation, Radius of Neutral surface of rectangular, triangular sections, Trapezoidal and circular sections, Stress distribution in open curved members, Hooks etc, Problems on Hooks, Stress distribution in closed rings. Problems on closed rings.

10 Hours

MODULE - III

Beams on Elastic Foundation: Differential equation of Elastic line, Infinite beam with concentrated load, moment & UDL and problems related to infinite beams. Semi-infinite beams with concentrated load, moment and UDL, Semi infinite beam with fixed and hinged conditions, Problems on semi infinite beams. 12 Hours

MODULE - IV

Beam Column: Governing differential equation for axial and lateral loads, Analysis of Beam columns subjected to axial and concentrated loads, axial and UDL, Beam column with different end conditions.

Unsymmetrical Bending of Beams: Introduction, Stresses in Beams, Deflections of Beams Subjected to unsymmetrical Bending problems related to unsymmetrical bending. 14 Hours

MODULE - V

Buckling of Columns: Assumptions, Euler's theory of buckling Governing differential equation, Prismatic columns with different end conditions, obtaining the Characteristic equation for the critical load for

Non Prismatic Columns buckling of frames, Introduction to energy method applied to buckling of columns and problems. Numerical method applied to buckling of columns. 12 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each unit.

ii) Total five questions are to be answered by selecting minimum one question from each part.

REFERENCE BOOKS:

1. VAZIRANI V N and RATWANI M " **Advanced theory of structures and matrix method"**. 5th Edition, Khanna publishers, Delhi 1995.
2. M.HETENYI "**Beams on elastic foundation"** 3rd printing, Univercity of Michigan,
3. ALEXANDER CHATJES "**Principles of Structural stability theory"**, PHI, New Delhi
4. JUNNARKAR S.B. **"Mechanics of Structure**." Vol – III, VIVEK publications, 1962.
5. STERLING KINNEY "**Indeterminate Structural Analysis"**, Oxford & IBH publishers.
6. TIMOSHENKO S "**Strength of Materials"** Vol – II, Third Edition, D.VAN, NOSTRAD COMPANY – 1958.
7. SARWAR ALAM RAZ "**Analytical methods in Structural Engineering",** Wiley, Eastern Pvt. Ltd, New – Delhi, 1974.
8. STEPHEN P TIMOSHENKO & JAMES M GERE **Theory of Elastic Stability**, McGraw Hill Book Company 1961.
9. SRINATH L.S. **Advanced Mechanics of Solids**, Tenth Print, Tata McGraw Hill publishing company. New Delhi, 1994.
10. KRISHNA RAJU N & GURURAJ D R **Advanced mechanics of solids and structures**, NAROSA Publishers Company Delhi.

ADVANCED PRESTRESSED CONCRETE

Subject Code : 19PSE161	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE -I

Analysis for Flexure: General Concepts of stresses, Prestressing force transferred by i) Pre-Tensioning system, ii) Post tensioning system. Resultant Compression line, Load Balancing Concept. Prestressing Losses: Introduction, Immediate Losses, Time Dependent losses. 12Hours

MODULE-II

Analysis of Members under Axial load: Introduction, Analysis at transfer, Analysis at services loads, Analysis at ultimate strength. Design Philosophy: Limit state of Collapse and Serviceability. Design for flexure: Stress range approach, Lins approach, Magnels Approach. Deflection of beams. 11 Hours

MODULE-III

Design for Shear and Torsional mechanism of Shear Resistance in Concrete beams, Design for Shear in PSC beams, Shear in flanged beams, Failure of Concrete Elements under Torsion. Anchorage zone Stresses: Pre-tensioned and Post-tensioned pre-stressed Concrete Elements, Detailing of Reinforcement in General. 11 Hours

MODULE-IV

Statically Indeterminate Structures: Analysis of pre-stressed indeterminate structures, continuous beams, linear transformation and concordance of cable profiles, frames, partial pre-stressing and codes of practice, analysis, design, crack control. Design of slabs One way and two way. 11 Hours

MODULE-V

Composite Construction: Need for composite construction, types of Composite Construction, Flexural Stresses, Longitudinal and Transverse Shear Transfer, creep and Shrinkage Effects in Composite Construction.

11 Hours

Extent of teaching: It is clearly defined in the syllabus

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. Krishnaraju Pre-stressed Concrete, Tata Mcgraw Hill, 2007
2. N Rajagopalan – Prestressed Concrete narosa, 2nd Ed. 2006 Zeevaert, **"Foundation Engineering for Difficult subsoil conditions"** -L - Van Nostrand Reinhold Company, 1972

ADVANCED FOUNDATION ENGINEERING

Subject Code : 19PSE162	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Subsurface exploration program for industrial structures, Interpretation of soil parameters on tests on undisturbed soil samples.

Theories of failure for soils, Use of different foundation models, Different methods of design of shallow foundation for axial and eccentric loads.

14 Hours

MODULE-II

Design of raft foundation for industrial structures - Conventional methods. Winider's hypothesis - finite difference. Yield line analysis for footings and rafts. 12 Hours

MODULE-III

Design of axially and laterally loaded piles. Design of pile groups. Batter piles and pile groups. 10 Hours

MODULE-IV

Design of machine foundations subjected to different type of loads, framed and massive foundations. Methods of isolating foundation vibrations.

10 Hours

MODULE-V

Design of foundation for tall structures - Water tanks, chimney, antenna towers and Radar units. Special types of Foundations - Hyperbolic - Paraboloid shells. 10 Hours

Extent of teaching: It is clearly defined in the syllabus

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. **"Subsurface Exploration and sampling of soils for Civil Engineering"** Hyorslev M J J S Army Corps of Engineers, 1949
2. Winterkorn H F and Fang H Y **"Foundation Engineering Hand Book"**- Van Nostand Reinhold Company, 1975
3. Zeevaert, **"Foundation Engineering for Difficult subsoil conditions"** -L - Van Nostrand Reinhold Company, 1972
4. Bowles J E **"Foundation Analysis and Design"** - McGraw Hill Book Company 1968
5. **"Vibration Analysis and Design of Foundations for Machines and Turbines"** - Maicir A Collets Holding Ltd. 1962
6. Szechy K **"Foundation Engineering"**, Springer Verlag, 1965
7. Kany, M **"Design of Raft Foundations"** Eliheim Earnest and Schn 1974
8. Goodman, L J and Karol, R H., **"Theory and Practice of Foundation Engineering"**, MeMillan, 1968

SPECIAL CONCRETES

Subject Code : 19PSE163	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Behavior of concrete under uniaxial compression, Uniaxial tension, Biaxial, triaxial stress state and Fracture mechanics approach for failure criteria, testing of existing structure. Core testing, NDT tests other than rebound hammer and UPSV. 08 Hours

MODULE-II

Ferro cement: Materials and mechanical properties, strength and behavior in tension, Compression, flexure and cracking. Durability of Ferro cement, prestressed Ferro cement, lightweight Ferro cement, design of Ferro cement in flexure. 10 Hours

MODULE-III

Fiber reinforced concrete: materials, mix properties, fiber content-distribution, orientation and interfacial bond, fiber concrete properties in fresh state, strength and behavior in tension, compression and bending.

10 Hours

MODULE-IV

High density concrete: Materials, placement method, properties in wet and hardened state, use of high density concrete as radiation shields. Lightweight concrete: Classification, properties of light- weight concrete, strength and durability, design of lightweight concrete mixes. Polymer concrete composting admixtures in concrete, polymer impregnated concrete. Geo-polymer concrete, materials, design fresh and hardened state properties. SCC materials, design fresh and hardened state properties. 14 Hours

MODULE-V

Design of concrete by packing Density method, Design of High strength concrete, reactive powder concrete, modern concrete chemicals. Bacterial concrete. 10 Hours

Extent of teaching: It is clearly defined in the syllabus

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. Paul and Rama, **"Ferrocement LFIC"**, AIT, Bangkok
2. Short A and V Kinniburg N **"Lightweight concrete"**.
3. Nevile A.M **"Properties of concrete"** ELBS Edition London.
4. Shah S P **"Special Concrete"** Proceedings of seminar University of Illinois, 1973.

VALUATION ENGINEERING

Subject Code : 19PSE164	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 52

MODULE-I

Terms used in valuation, cost price and value purpose of valuation Different forms of values - Accommodation value, Annual Value, Book value, Market value, Potential value, replacement value, salvage value, speculative and sentimental value.

Outgoings: Municipal and Government taxes - Annual repairs and maintenance, Insurance - sinking fund. Capitalized value, Deferred land value, Depreciation, life of structure, Class of Structure, Rating, Years purchase - Lease-hold property. 12 Hours

MODULE-II

Methods of valuation**:** Open land valuation - Comparative methods, Abstractive method, Belting method. Valuation of land with building. Cost of structure, I S I rules measurement of plinth area and cubical contents. 12 Hours

MODULE-III

Definition of rent, determination of rental value, standard rent – Rental method of valuation Valuation based on reconstruction cost, land and building method - - Valuation on profit basis - Residual or development method. 12 Hours

MODULE-IV

Valuation by break up method - average profit basis. Fair market value and open market valve - parameters which affect the fair market value.Valuation of different types of properties - Leasehold properties Agricultural land - farm house - case studies. 08 Hours

MODULE-V

Investments - Bonds, gilt- edged securities. Debentures, preferences and equity shares, Capital gains, wealth tax and income tax - Easements -self imposed - legally created -effect on valuation due to easement

08 Hours

Extent of Teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. Mitra **"Theory and Practice of valuation"** Eastern Law House, Calcutta. 1986.
2. Gopinatha Rao, **"Valuation practices of immovable properties"** 1985.
3. N A Shah **"Quantity surveying and Valuation"**, Khanna Publishers, First Edition, 1976.

REPAIR AND REHABILITATION OF STRUCTURES

Subject Code : 19PSE165	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs. + 2 Hrs. (Tutorial)		Total Hours : 56

MODULE-I

General: Introduction, Cause of deterioration of concrete structures, Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods. 13 Hours

MODULE-II

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. **Maintenance, Durability and Repair Strategies:** Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Corrosion mechanism, method of carrion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection, corrosion mapping. 13 Hours

MODULE-III

Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques. Materials for Repair**:** Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. 10 Hours

MODULE-IV

Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning. 10 Hours

MODULE-V

Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies. 10 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

REFERENCE BOOKS:

1. Sidney, M. Johnson "**Deterioration, Maintenance and Repair of Structures**".
2. Denison Campbell, Allen & Harold Roper, "**Concrete Structures – Materials, Maintenance and Repair"-** Longman Scientific and Technical
3. R.T.Allen and S.C. Edwards, "**Repair of Concrete Structures**"-Blakie and Sons
4. Raiker R.N., "**Learning for failure from Deficiencies in Design, Construction And Service "** -R&D Center(SDCPL)

THEORY OF PLATES AND SHELLS

Subject Code : 19PSE21	Credits : 05	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs. + 2 Hrs. (Tutorial)		Total Hours : 56

MODULE-I

Introduction: Thin and Thick plates, Behavior of plates, Thin plate theories (Small deflection and large deflection theory), isotropic, anisotropic and orthotropic material, boundary conditions. 04 Hours

Small deflection theory of Thin Plates in Bending: Assumptions for Small deflection of thin plates, isotropic plate in Cartesian co-ordinate system. Strain -displacement relation Stress -strain relation, Moment-curvature relation, Equilibrium equations. Plate equation. 06 Hours

MODULE-II

Bending analysis of thin rectangular plates: Analysis of rectangular plates with all edges simply supported using Navier's solution for various loading conditions (Uniform loading, patch loading and concentrated load).

Analysis of rectangular plates using Levy's solution for various boundary conditions and loading cases (Two opposite edges simply supported under Uniform loading, Two opposite edges clamped under uniform intensity of loading and action of distributed moment along the two opposite edges). 10 Hours

MODULE-III

Analysis of circular plates in bending: Equilibrium equation. Plate equation. Analysis of simply supported circular plate subjected to uniform loading (Axisymmetric case). Analysis of Clamped circular plate subjected to uniform loading (Axisymmetric case). Analysis of Clamped annular plate subjected to uniform loading (Axisymmetric case). 06 Hours

Introduction: Definition of shell, Types of shell, classification of shells, Advantages and disadvantages of shell roofs. Structural action of shells.

Beam theory of cylindrical shells: Advantages and disadvantages of beam theory. Assumptions, range of validity. Beam analysis and arch analysis. 05 Hours

MODULE-IV

Membrane theory of Cylindrical shells: Membrane theory. Equation of equilibrium. Expression for stresses under dead load and snow loads for Circular, Parabola, Catenary and Cycloid directrices. 10 Hours

Bending theory of Cylindrical shells: Stress - strain relation, Moment curvature relation. Finsterwalder theory: Assumptions, Equation of equilibrium, Finsterwalder differential equation. 04 Hours

MODULE-V

Bending theory continued:-D.K.J theory: Comments on D.K.J theory, Equation of equilibrium, Flugge's simultaneous equations, D.K.J equation. Expression for stress resultants and displacements. 03 Hours

Membrane theory of shells of Revolution: Introduction, equilibrium equations. Membrane analysis of spherical shells and rotation hyperboloid of one sheet. 03 Hours

Membrane theory of shells of translation: Introduction. Membrane analysis of Synclastic shells (Elliptic paraboliod shell only). 05 Hours

Extent of teaching: It is clearly explained in the syllabus

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. Timoshenko and S. Gere, **"Theory of plates and shells"**, Tata Mcgraw-Hill Co.Ltd New Delhi
2. N.K.Bairagi' **"Plate Analysis"** Khanna Publishers New Delhi
3. Szilard.R., **"Theory and Analysis of Plates"**,PHI Publications
4. Ugural, "**Stresses in Plates and Shells"** Mcgraw-Hill Book Co.
5. N.K.Bairagi **"Shell Analysis"** Khanna Publishers New Delhi
6. G.Ramaswamy **"Design and Construction of concrete shell roofs"**, CBS Publishers New Delhi
7. K. Chandrashekhara, **"Analysis of thin concrete shells"**, Iota Mcgraw-Hill Co. Ltd New Delhi

STABILITY OF STRUCTURES

Subject Code : 19PSE22	Credits : 05	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs. + 1 Hrs. (SS)		Total Hours : 56

MODULE-I

Concepts of stability Effect of initial imperfection - South well plot - empirical formulae for designs. methods of successive approximations. Large deflection theory. Numerical examples. 11 Hours

MODULE-II

Beam Column-Concentrated load, number of point loads and UDL case Numerical Examples. 11 Hours

MODULE-III

Euler's buckling load - Classical approaches -imperfect method. Equilibrium method, energy methods, buckling of laced, battened and tapered columns, Numerical Examples. 11 Hours

MODULE-IV

Inelastic buckling of straight columns, double modules theory, tangent modules theory, effect of shear on buckling, Secant modulus theory, buckling of frames Eigen value problem. 12 Hours

MODULE-V

Buckling flexure, torsional buckling of thin walled open section columns, lateral buckling of simply supported beams of rectangular and I – section. Buckling of slightly curved beams.

Buckling of plates and shells (simple Cases). 11 Hours

Extent of Teaching: It is clearly defined in the syllabus

Scheme of SEE : i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. Timoshenko S P & Gere J M **"Theory of Elastic Stability"** McGraw Hill Book Co. 1963
2. Blowich **"Buckling Strength of Metal Structures"**
3. Gerard **"Structural Stability Theory"**.

FINITE ELEMENT METHOD OF STRUCTURAL ANALYSIS

Subject Code : 19PSE23	**Credits : 05**	
CIE : 50 Marks	**SEE : 50 Marks**	**SEE : 03 Hrs.**
Hours/Week : 4 Hrs. + 2 Hrs. (Tutorial)		**Total Hours : 56**

MODULE-I

Introduction: Basic concepts of elasticity – Kinematics and Static variables for various types of structural problems – approximate method of structural analysis – Rayleigh – Ritz method Finite difference method – Finite element method. Principles of finite element method – advantages & disadvantages – Finite element procedure. Basic principle of variational mechanics. Discretization of Structures**:** Finite elements used for one, two & three dimensional problems – Element aspect ratio – mesh refinement vs. higher order elements – minimization of band width.

14 Hours

MODULE-II

Displacement Model and Element stiffness formulation: Nodal displacement parameters – Convergence criterion – Compatibility requirements – Geometric invariance – Shape function – Polynomial form of displacement function – Generalized and Natural coordinates – Lagrangian interpolation function – shape functions for one, two & three dimensional elements. 14 Hours

MODULE-III

Hermitian polynomials, Internal nodes, Condensation of internal nodes and higher order elements – Serendipity elements, Development of strain – displacement matrix and stiffness matrix, direct method and variational approach of formulation of element stiffness, Consistent load vector, Isoparametric Elements, Concept of Isoparametric Elements, sub

parametric and super parametric elements –Jacobian transformation Matrix –numerical integration. 10 Hours

MODULE-IV

Application of Finite Element Method for the analysis of one & two dimensional problems: Analysis of simple beams and plane trusses – Application to plane stress / strain / axisymmetric problems using CST & Quadrilateral Elements. 10 Hours

MODULE-V

Application to Plates bending problems: Choice of displacement function (C0, C1 and C2 type), rectangular and triangular elements, Mindlin elements.

Techniques for Non -linear Analysis: Introduction to techniques for problems involving material non linearity and geometric non linearity.

08 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

REFERENCE BOOKS:

1. Krishnamoorthy C S, "**Finite Element Analysis"-** Tata McGraw Hill
2. Bathe K J, "**Finite Element Procedures in Engineering Analysis**"- Prentice Hall
3. Rajasekaran. S, "**Finite Element Analysis in Engineering Design"-**Wheeler Publishing
4. Cook R D, Malkan D S & Plesta M.E, "**Concepts and Application of Finite Element Analysis" -** 3rd Edition, John Wiley and Sons Inc., 1989
5. Shames I H and Dym C J, "**Energy and Finite Element Methods in Structural Mechanics**"-McGraw Hill, New York, 1985
6. Desai C and Abel J F, "**Introduction to the Finite Element Method"** – East West Press Pvt. Ltd, 1972

6. Nilson, N.J., "**Principals of Artificial Intelligence"-** Narosa, New Delhi.
7. Adeli, H., **"Expert Systems in Constructions and Structural Engg"-** Chapman & Hall, New York.
8. Elaine Rick and Keuin Knight, "**Artificial intelligence**"- Tata McGraw Hill Edition.
9. H.Adeli**, "Expert system in structural design and construction**"- Chapman and Hall, 1988.
10. Kostem, "**Expert systems in Civil Engineering**"- ASCE, 1987.
11. C.S.Krishnamoorthy and S Rajeev **"Computer Aided Design"** Narosa Publishing house.

OPTIMIZATION METHODS IN ENGINEERING DESIGN

Subject Code : 19PSE241	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Introduction to optimization, engineering applications of optimization, Foundation of some structural optimization problems as programming problems. Classical Optimization Techniques, single variable optimization, Multivariable optimization with no constraints unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, LaGrange multipliers techniques and feasible direction techniques. 12 Hours

MODULE-II

Linear Programming, standard form of a linear, Programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pinotal production of general systems of equations simplex algorithm, Revised simpler method, Duality in linear programming. 12 Hours

MODULE-III

Non-Linear programming, one dimensional minimization methods, such as elimination methods, Fibonacci method, golden section method,

Interpolation methods, Quadratic and cubic. Unconstrained optimization techniques, direct search methods, Random search methods, Descent methods. 11 Hours

MODULE-IV

Constrained optimization techniques such as direct methods, the complex method, cutting plane method and exterio penalty function methods for structural Engineering problems. 11 Hours

MODULE-V

Geometric programming, Conversion of NLP as a sequence of LP Geometric programming. Dynamic Programming, Conversion of NLP as a sequence of LP Dynamic programming.

Formulation and solution of structural optimization problems by different techniques. 10 Hours

Extent of teaching: It is clearly defined in the syllabus

Scheme of SEE : i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. S.S.Rao, **"Engg optimization theory & practice"** Wiley Eastern Publisher
2. K.Deb, **"Optimization for engineering design"** , PHI Publication
3. A.D.Belgundu & T.R.Chandrapatla, **"Optimization concepts & applications in engineering design"**, PHI Publication
4. R.L.Fox, **"Optimization methods for engineering design"**, R.T.Haftka & Z.Gurdal, "**Elements of structural optimization"**, Springer Publication.

DESIGN OF BRIDGES

Subject Code : 19PSE242	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE - I

Introduction: choice of bridge types, IRC Loading and other bridge loads. 08 Hours

MODULE - II

Design of RCC Bridge: Slab bridge, T-beam Slab Bridge. 18 Hours

MODULE - III

Balanced Slab bridge Rigid frame, bridge, Box girder bridge. 10 Hours.

MODULE - IV

Design of Prestressed concrete bridges. (Simply supported case only) 12 Hours

MODULE - V

Design of Piers & Abutments, Bearings: Types of bearings & design of bearings. 08 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each unit.

ii) Total five questions are to be answered by selecting minimum one question from each part.

Reference Books:

1. Victor, D.J., **"Essentials of Bridge Engineering"**. Oxford and IBH Publications, New Delhi.
2. Krishna Raju, N., **"Design of Bridges"**, Oxford and IBH Publications New Delhi.
3. Jagadish T.R., and Jayaram, M.A., **"Design of Bridge structures"**, Prentice Hall of India, New Delhi.
4. Relevant IRC and BIS codes.

DESIGN OF MASONRY STRUCTURES

Subject Code : 19PSE243	Credits : 04	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE - I

Introduction, Masonry units, materials and types: History of masonry Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars. 10 Hours

MODULE-II

Strength of Masonry in Compression: Behavior of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength. 10 Hours

MODULE-III

Flexural and shear bond, flexural strength and shear strength: Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. 10 Hours

MODULE-IV

Permissible Stresses: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

Design of load bearing masonry buildings: Permissible compressive stress, stress reduction and shape reduction factors, increase in

permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall. 14 Hours

MODULE-V

Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS code provisions. Earthquake resistant masonry buildings: Behavior of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS code provisions

Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure. 12 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each part.

REFERENCE BOOKS:

1. Hendry A.W., **"Structural masonry"**- Macmillan Education Ltd., 2nd edition
2. Sinha B.P & Davis S.R., "**Design of Masonry structures**"- E & FN Spon
3. Dayaratnam P, "**Brick and Reinforced Brick Structures**"- Oxford & IBH
4. Curtin, "**Design of Reinforced and Prestressed Masonry**"- Thomas Telford
5. Sven Sahlin, "**Structural Masonry**"-Prentice Hall
6. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, "**Alternative Building Materials and Technologies**"-New Age International, New Delhi & Bangalore
7. IS 1905, BIS, New Delhi and SP20(S&T),New Delhi

COMPOSITE AND SMART MATERIALS

Subject Code : 19PSE251	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE - I

Composite Materials: Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic laminae, thermo – mechanical properties, manufacturing of composites. 10 Hours

MODULE-II

Composite Materials: micro – mechanical analysis, characterization tests. Failure theories: Maximum stress, maximum strain theory, Tsai-Hill, Tsai-Wu theories, Micromechanics for stiffness and strength.

12 Hours

MODULE-III

Smart Materials: smart materials and structures – piezoelectric materials – coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysterics – creep – strain rate effects – manufacturing. 10 Hours

MODULE-IV

Composite lamination theory, creoss and angle – ply laminates, symmetric, antisymmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories –first ply failure, vibration and buckling analysis.

12 Hours

MODULE-V

Actuators and Sensors: single and dual actuators – pure extension, pure bending – bending extension relations – uniform strain beam model – symmetric induced strain actuators – bond shearing force – Bernoulli Euler (BE) beam model – embedded actuators – Axissymetric induced strain actuators in uniform strain and Euler – Bernoulli models. Uniform strain model – energy principle formulation – BE model – single and dual surface bonded actuators – Extension – bending model. 12 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

REFERENCE BOOKS:

1. Robart M.Jones, "**Mechanical of Composite Materials**"- McGraw Hill Publishing Co.
2. Bhagwan D Agarvalm, and Lawrence J Brutman, "**Analysis and Performance of Fiber Composites**"- John Willy and Sons.
3. Crawley, E and de Luis, J., "**Use of Piezoelectric actuators as elements of intelligent structures**"- AIAA Journal, Vol.25, No.10, Oct 1987, PP 1373-1385.
4. Crawley, E and Anderson, E., "**Detailed models of Piezoceramic actuation of beams**" - Proc. of the 30th AIAA/ASME/ASME/ASCE/ AHS/ASC – Structural dynamics and Material conference, AIAA, Washington DC,April 1989.

DESIGN OF TALL STRUCTURES

Subject Code : 19PSE252	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE - I

Design Criteria: Design philosophy, loading, sequential loading, and materials - high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. 12 Hours

MODULE-II

Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design. 12 Hours

MODULE-III

Behavior of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Futigger – braced and hybrid mega system. 08 Hours

MODULE-IV

Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analyses. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire. 12 Hours

MODULE-V

Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, 40

Transnational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation. 12 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

REFERENCE BOOKS:

1. Taranath B.S, "**Structural Analysis and Design of Tall Buildings**"- McGraw Hill
2. Wilf gang Schuller, "**High rise building structures**"- John Wiley
3. Bryan Stafford Smith & Alexcoull, "**Tall building structures Analysis and Design**"-John Wiley
4. T.Y Lin & D.Stotes Burry, "**Structural concepts and system for Architects and Engineers" -** John Wiley
5. Lynn S.Beedle, "**Advances in Tall Buildings**"- CBS Publishers and Distributors.
6. Dr. Y.P. Gupta – Editor, "**Proceedings National Seminar on High Rise Structures-Design and Construction practices for middle level cities"-** New Age International Limited.

REMOTE SENSING

Subject Code : 19PSE253	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE - I

Introduction : Introduction to Remote sensing, Historical development of remote sensing, Remote sensing components.

Basic Principles : Energy sources & its characteristics Electromagnetic energy and spectrum, wave bands, Interaction of electromagnetic energy with atmosphere and earth's surface, Radiometric quantities. Photogrammetry**:** Introduction to Photogrammetry and aerial photography. 10 Hours

MODULE-II

Vertical and tilted photographs, Photographic materials, Stereoscopic viewing, Fly view, Aerial mosaics, Remote Sensing Platform & Sensors **:** Satellite system parameters. 10 Hours

MODULE-III

Sensor parameters, types of sensors, image sensor system, satellite & satellite imageries.

Data Products & Visual Image Interpretation **:** Data collection and transmission, Data products, Data formats. 10 Hours

MODULE-IV

Data acquisition for various purposes like Data acquisition for natural resources management and weather forecast, process of image interpretation, interpretation of Arial photo. Digital Image Processing **:** Photo process. 12 Hours

MODULE-V

Image processing, Image enhancement techniques, Image transformation, Image classification, Random errors and least square adjustments, Coordinate transformation, Photographic interpretation.

14 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each part.

REFERENCE BOOKS:

1. M. Anji Reddy **"Remote Sensing & Geographical Information System" -** BS Publications, 3RD edition.

BUILDING SCIENCE

Subject Code : 19PSE261	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Introduction, Climate : Climatic factors, Classification of tropical climates, Site climate, Microclimate of human settlements. Comfort **:** Thermal comfort factors, Comfort indices. 09 Hours

MODULE-II

Principles of Thermal Design : Thermal quantities, Heat exchange in buildings, Periodic heat flow. Mechanical means of thermal control. 11 Hours

MODULE-III

Means of Thermal Control : Mechanical and structural means of thermal control, Moisture control in buildings, Ventilation requirements for health. 09 Hours

Means of Thermal Control: Mechanism and estimation of natural ventilation, Airflow patterns in buildings. 05 Hours

MODULE-IV

Noise & Noise Control : Propagation of sound, Sound insulation, absorption & transmission, reverberation, Design of floor, Roofing & walling system for sound absorption and insulation, Design of auditorium, Noise control in buildings. 12 Hours

MODULE-V

Light & Lighting : Day lighting, Design of fenestration in buildings for day light of various types, Illumination design, Luminaries and their characteristics, Code requirements. 10 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

REFERENCE BOOKS:

1. Koenigsberger, Ingersoll, Mayhew, Szokolay **"Manual of Tropical Housing & Building".**

ADVANCED DESIGN OF STEEL STRUCTURES

Subject Code : 19PSE262	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Plastic Analysis & Design: Introduction, load factor, shape factor, fully plastic moment-General methods of plastic design trial and error method - method of combining mechanisms, Estimation of deflection, factors affecting the fully plastic moment (secondary design factors) Plastic Analysis of continuous beams, Gable frames, two bay and two storied frames. 10 Hours

MODULE-II

Plastic design of continuous beams & single bay single story portal frame.

Minimum weight design: Assumptions, analysis of continuous beams & single bay single story portal frame by minimum weight design principle.

10 Hours

MODULE-III

Design of light gauge sections: Introducation, post bucking strength, design of light gauge sections for axial load & flexure. 10 Hours

MODULE-IV

Design of Steel Structures as per code provision: Industrial building frames (design of gantry girder not included), bunkers & silos.

14 Hours

MODULE-V

Design of Steel Structures as per code provision : Design of chimney (self supporting), Design of transmission line towers (along with their foundation design), Design of pressed steel tanks with staging.

12 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each module.

ii) Total five questions are to be answered by selecting minimum one question from each module.

Reference Books:

1. J.F.Baker, M.R.Home & J.Heyman, "**The steel skeleton vol. II"** Publishers, ELBS & Cambridge University press
2. B.G.Neal, "**The plastic methods of structural analysis"**
3. Dr.B.C.Punmia, Ashok kumar Jain & Arunkumar Jain, **"Design of steel structures"** Laxmi Publications, New Delhi
4. Ramchandra "**Design of steel structures Vol.1&2"**
5. IS 800-2007, IS 801, IS 3363, Sp 6(6)

DESIGN OF EARTH QUAKE RESISTANT STRUCTURES

Subject Code : 19PSE263	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE - I

Introduction to endogenic processes, Tectonic and volcanic earthquakes, General features of earth quakes with regard to Indian continent, magnitude and intensity scales, and seismic instruments.

Response spectrum – elastic and elasto - plastic spectra, tripartite plot, use of response spectrum in earthquake resistant design. 14 Hours

MODULE - II

Dynamics of multistoried buildings – natural frequencies and mode shapes, analysis of multistoried buildings, obtaining seismic forces using IS 1893. 14 Hours

MODULE - III

Structural configuration for earthquake resistant design, frames, shear walls and dual systems, effect of infill masonry walls on frames, problem of soft storey, capacity design procedures. 10 Hours

MODULE - IV

Ductility and energy absorption in buildings, confinement of concrete for ductility, ductility of columns and beams – code provisions. 10 Hours

MODULE - V

Behavior of masonry buildings during earthquake, failure patterns, strength of masonry in shear and flexure, concepts for earthquake resistant masonry buildings – code provisions. 08 Hours

Extent of teaching: It is clearly defined in the syllabus.

Scheme of SEE: i) Two questions are to be set from each unit.

ii) Total five questions are to be answered by selecting minimum one question from each part.

Reference Books:

1. Clough and Penzien **"Dynamics of Structures"** (McGraw Hill book Co)
2. AY Yakushova **"Geology with the Elements Geomorphology"** (M[R Publisher Moscow).
3. Polyakov **"Design of Earth Quake Resistant Structures"** (MIR Publishers Moscow).
4. S F Borg **"Earth quake Engineering Damage assessment and Structural design"** (John Wiley and sons 1983)
5. Anil Chopra **"Earthquake Resistant Design"**. Ghose.S.K, **"Earthquake resistance design of concrete structures"** , SDCPL — R & D Center New Mumbai.

CAD LAB

Subject Code : 19PSE27	Credits : 01	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 3 Hrs.		Total Hours : 42

1. Create a Spread sheet for design of Singly RCC beams.
2. Create a Spread sheet for design of Doubly RCC beams.
3. Create a Spread sheet for design of one-way Slab.
4. Create a Spread sheet for design of Two-way Slab
5. Create a Spread sheet for design of Axially loaded Column and Bi-axially loaded column.
6. Create a Spread Sheet for analysis of continuous beams by moment distribution method.
7. Analysis and design of frames 2D and 3D by commercial software.
8. Analysis and design of Truss for Industrial Warehouse by commercial software.
9. Program to find the product of two matrices.
10. Program to find the inverse of the given matrix.
11. Gauss elimination method of solving homogeneous equations.
12. Program for finding Eigen values and Eigen vectors.

Note: the said programs shall also be carried out by using MATLAB.