Hyderabad Karnataka Education Society's
P. D. A COLLEGE OF ENGINEERING, KALABURAGI
Scheme of Teaching and Examinations – 2022 M.Tech., STRUCTURAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/Seminar	Skill Development Activities (Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	BSC	22MAT11A	Computational Methods	03	00	00	03	50	50	100	3
2	IPCC	22PSE12	Special Concrete	03	02	00	03	50	50	100	4
3	PCC	22PSE13	Structural Dynamics	03	00	02	03	50	50	100	4
4	PCC	22PSE14	Theory of Elasticity and Plasticity	02	00	02	03	50	50	100	3
5	PCC	22PSE15	Advanced Design of RCC Structures	02	00	02	03	50	50	100	3
6	MCC	22RMI16	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCCL	22PSE17	Advanced structural Engineering Laboratory	01	02	00	03	50	50	100	2
8	AUD/AEC	22APSE18/22PSE27	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers							PP
TOTAL				**17**	**04**	**06**	**21**	**350**	**350**	**700**	**22**

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, MCC- Mandatory Credit Course,

AUD/AEC –Audit Course / Ability Enhancement Course (A pass in AUD/AEC is mandatory for the award of the degree)

Integrated Professional Core Course (IPCC): Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Audit Courses /Ability Enhancement Courses Suggested by BOS (ONLINE courses): Audit Courses: These are prerequisite courses suggested by the concerned Board of Studies. Ability Enhancement Courses will be suggested by the BoS if prerequisite courses are not required for the programs. Ability Enhancement Courses:

- These courses are prescribed to help students to enhance their skills in in fields connected to the field of specialization as well allied fields that leads to employable skills. Involving in learning such courses are impetus to lifelong learning.
- The courses under this category are online courses published in advance and approved by the concerned Board of Studies.
- Registration to Audit /Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.
- In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appear for the same course if offered during the next session or register for a new course offered during that session, in consultation with the mentor.
- The Audit Ability Enhancement Course carries no credit and is not counted for vertical progression. However, a pass in such a course is mandatory for the award of the degree.

Skill development activities: Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc. Students and the course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

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II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activities (Hours are for Interaction between faculty and students)	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22PSE21	Design of Earthquake Resistant Structures	02	00	02	03	50	50	100	3
2	IPCC	22PSE22	Matrix Methods Of Structural Analysis	03	02	00	03	50	50	100	4
3	PEC	22PSE23x	Professional elective-1	02	00	02	03	50	50	100	3
4	PEC	22PSE24x	Professional elective-2	02	00	02	03	50	50	100	3
5	MPS	22PSE25	Mini Project with Seminar	00	04	02	--	100	--	100	3
6	PCCL	22PSEL26	CAD. Laboratory	01	02	00	03	50	50	100	02
7	AUD/ AEC	22PSEUD27	Suggested ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers							PP
TOTAL				**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

Note: PCC: Professional core courses,PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project With Seminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory)			
Professional Elective 1		**Professional Elective 2**	
Course Code under 22XXX23X	**Course title**	**Course Code under 22XXX24X**	**Course title**
22PSE231	Advanced Prestressed Concrete	22PSE241	Advanced Foundation Engineering
22PSE232	Advanced Structural Analysis	22PSE242	Advanced Design of steel structures
22PSE233	Theory of Plates and Shells	22PSE243	Stability of Structures

1 Mini Project with Seminar: This may be hands-on practice**,** survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modelling of system, simulation, analysing and authenticating, case studies, etc.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Students can present the seminar based on the completed mini-project. Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Mini-Project work and Seminar, shall be based on the evaluation of Mini Project work and Report, Presentation skill and performance in Question-and-Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. There is no SEE for this course.

2. Internship: All the students shall have to undergo a mandatory internship of **06 weeks** during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in the internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

COMPUTATIONAL METHODS

Course Code:21---11	CIE Marks:50
Contact Hours/week:03	SEE Marks:50
Total Hours:40	Exam Hours:03
Semester: I	Credits:03(3:0:0)

Course Learning Objectives: This course will enable the students:

- To enhance the problem-solving skills of engineering students using an extremely powerful problem-solving tool namely numerical method.
- To understand the system of equations, non-linearities and complicated geometries that are not uncommon in engineering practice and that are often impossible to solve analytically.

Course content:

Module-I

Linear Algebra:Solution of System of Linear Algebraic equations by triangularization method: Crout's method,Cholesky method, Partitions method, Gauss Jacobi, Gauss- Sidel's method and Power method for eigen values and eigen vectors.(RBT Levels:L1&L2) [8 hours]

Module-II

Roots of equations: Muller method, Graeffe's root squaring method. Numerical solution of ordinary differential equation by Picards method of successive approximation, first order simultaneous equation by Picard and Runge-Kutta method. Second order equation by Picard's method.
.(RBT Levels:L2&L3) [8 hours]

Module-III

Partial Differential Equations: Numerical solution of one-dimensional wave equation, Heat equation, (Schmidt's explicit formula) & Laplace equation (Gauss-Seidel process) by finite difference schemes. Illustrative examples on each method.
.(RBT Levels:L2&L3) [8 hours]

Module-IV

Probability distribution: Random variables, probability mass and probability distribution function, Probability distributions: Binomial, Normal and Gaussian distributions & examples.
.(RBT Levels:L2&L3) [8 hours]

Module-V

Sampling Theory: Testing of hypothesis: t-distribution test, Chi square test and F-test. Analysis of Variance (ANOVA):one way classification, Design of experiments, RBD.
.(RBT Levels:L2&L3) [8 hours]

Course Outcomes:

At the end of this course, students will be able to:

CO1. Acquire the idea of significant figures, types of errors during numerical computation.
CO2. Learn various numerical methods to solve system of linear deferential equations
CO3. Analyze and solve PDE's related to wave equation arising in vibration analysis
CO4. Describe the basic notions of discrete and continuous probability distributions
CO5. Understand statistical and probabilistic concepts required to test the hypothesis and designing the experiments using RBD.

.Reference Books:

1.S.S .Shastry, Introductory Methods of Numerical Analysis , PHI, 2005.
2.David C. Lay, "Linear Algebra and its applications", 3rd Edition , Pearson Education, 2002.
3.T.Veerarajan "Probability, Statistics and Random Process", 3rd Edition, Tata Mc-Graw Hill Co.,2016
4.Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2nd Edition,PHI, 2011
5.B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers,44Th Ed,2017
6.E.Kreyszig, "Advanced Engineering Mathematics", 10th edition, Wiley,2015.

SPECIAL CONCRETES

Subject Code: 22PSE12	Credits: 04	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. + 2 Hrs. Practical		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.

STRUCTURAL DYNAMICS

Subject Code: 22PSE13	Credits: 04	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. (Theory) + 2 Hrs. SDA		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, Directintegration 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 selectingminimum 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"**, McgrawHill

THEORY OF ELASTICITY AND PLASTICITY

Subject Code : 22PSE14	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 2 Hrs. + 2 Hrs. SDA		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 ofcircular 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 McGrawHill Publications Co.Ltd., New Delhi.
3. Venkataraman and Patel- **"Structural Mechanics with Introduction to Elastity and Plasticity"**, McGraw Hill Book Inc., New York.

ADVANCED DESIGN OF RCC STRUCTURES

Subject Code: 22PSE15	Credits: 03	
CIE: 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week: 2 Hrs. + 2 Hrs SDA		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 ofyield 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 & designof 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 detailingrequirements, 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 byselecting minimum one question from each module.

Reference Books:

1. N. Krishnaraju, -**"Design of Advanced Reinforced concretestructures"** CBS publishers, New Delhi.
2. A.K. Jain — **"Limit State method of design"** Nemichand andBros., 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 ofstructural concrete"**, Wheeler Books, Allahabad

RESEARCH METHODOLOGY AND IPR		
Subject code	22RMI16	Credit: 03
Hours/Week	3 hours. (Theory)	SEE: 50 Marks
Total hours: 42	CIE: 50 Marks	SEE: 3 hours
Prerequisite:		
Course objectives:		

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. **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	10 Hrs.
Module-II **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. **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.	10 Hrs.
Module-III Research Design: Diagnosis and Experimentation Determining Experimental and simple designs. **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.	12 Hrs

Module-IV 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. **Interpretation and Report Writing:** Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports	10 Hrs.
Module-V **Intellectual Property:** The Concept**,** Intellectual Property System in India, Development of TRIPS complied Regime in India, Patents Act,1970,,Trade Mark Act ,1999,The designs Act 2000,The Geographical Indications of Goods(Registration and Protection)Act 1999,Copyright Act 1957,The protection of plant varieties and farmers' Right Act 2001,Layout Design Act 2000,Trade Secrets, World Intellectual Property Organization(WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, common Rules Patent Marks, Industrial Designs, Trade Names, Indications of Source Unfair competition, Patent Cooperation Treaty(PCT),advantages of PCT Filling Copyright and related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable subject matter, Rights conferred, Exceptions, Term of protection, Conditions on Patent Applicants.	10Hrs

Course outcomes:

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

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs and their characteristics.
- Explain the art of interpretation and the art of writing research reports

Question paper pattern:

Examination will be conducted for 100 marks with question paper containing 10 full questions, each of 20 marks.

- Each full question can have a maximum of 4 sub questions.
- There will be 2 full questions from each module covering all the topics of the module
- Students will have to answer 5 full questions, selecting one full question from each module

Textbooks

1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age International 4th Edition,2018.
2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition,2011.
3. Study Material (For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Books

1. Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005.
2. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications 2009

DESIGN OF EARTH QUAKE RESISTANT STRUCTURES

Subject Code: 22PSE21	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		Total Hours: 56

MODULEs	Teaching Hours
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. sponse spectrum – elastic and elasto - plastic spectra, tripartite plot, use of response spectrum in earthquake resistant design.	14 Hours
MODULE - II namics of multistoried buildings – natural frequencies and mode shapes, analysis of multistoried buildings, obtaining seismic forces using IS 1893.	14 Hours
MODULE - III uctural 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 ctility and energy absorption in buildings, confinement of concrete for ductility, ductility of columns and beams – code provisions.	10 Hours
MODULE - V avior 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). Polyakov “Design of Earth Quake Resistant Structures” (MIR Publishers Moscow). 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.	

MATRIX METHODS OF STRUCTURAL ANALYSIS

Subject Code: 22PSE22	Credits: 04	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. (Theory) + 2 Hrs. SDA		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.

ADVANCED PRESTRESSED CONCRETE

Subject Code: 22PSE231	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		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 STRUCTURAL ANALYSIS

Subject Code: 22PSE232	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		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.

THEORY OF PLATES AND SHELLS

Subject Code: 22PSE233	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		Total Hours: 56

	Teaching Hours
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. 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.	04 Hours 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). Introduction: Definition of shell, Types of shell, classification of shells, Advantages and disadvantages of shell roofs. Structural action of shells.	06 Hours

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. Bending theory of Cylindrical shells: Stress - strain relation, Moment curvature relation. Finsterwalder theory: Assumptions, Equation of equilibrium, Finsterwalder differential equation.	10 Hours 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. Membrane theory of shells of Revolution: Introduction, equilibrium equations. Membrane analysis of spherical shells and rotation hyperboloid of one sheet. Membrane theory of shells of translation: Introduction. Membrane analysis of Synclastic shells (Elliptic paraboliod shell only).	03 Hours 03Hours 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

ADVANCED FOUNDATION ENGINEERING

Subject Code: 22PSE241	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		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

ADVANCED DESIGN OF STEEL STRUCTURES

Subject Code: 22PSE242	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		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: Introduction, 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)

STABILITY OF STRUCTURES

Subject Code: 22PSE243	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		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 Theor

CAD LAB

Subject Code: 22PSEL26	Credits: 02	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		Total Hours: 56

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
6. Create a Spread sheet for design of Uniaxially loaded Column
7. Create a Spread sheet for design of Bi-axially loaded column.
8. Create a Spread sheet for design of footing
9. Create a spread Sheet for design of staircase
10. Create a Spread Sheet for analysis of continuous beams by moment distribution method.
11. Analysis and design of Continuous Beam by commercial software
12. Analysis and design of 3D Frame by commercial software
13. Modelling, Analysis and design of portal frames for varying load conditions and comparison with manual calculation (One Storey & One Bay) by commercial software.
14. Analysis and design of Truss for Industrial Warehouse by commercial software.

Question Paper Pattern: Student has to write algorithm and create spreadsheet to get the output for any of the One question from Sl. No 1 To Sl.No.10 and obtain design results with manual calculation as applicable for One question from Sl. No 11 to 14 in the above listed experiments.

60% Weightage for question no 1 (Sl.no 1 to Sl.no 10)

40% Weightage for question no 1 (Sl.no 11 to Sl.no 14)

Hyderabad Karnataka Education Society's
P. D. A COLLEGE OF ENGINEERING, KALABURAGI
Scheme of Teaching and Examinations – 2022 M.Tech., STRUCTURAL ENGINEERING
Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				
				Theory	Practical/ Mini-Project	Skill Development Activities(Hours are for	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22PSE31	Finite Element Method of Structural Analysis	03	00	02	03	50	50	100	4
2	PEC	22PSE32X	Professional elective -3	03	00	00	03	50	50	100	3
3	OEC	22PSE33X	Open Elective course-1	03	00	00	03	50	50	100	3
4	PROJ	22PSE34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22PSE35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22PSE36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
TOTAL				**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

Note: PCC: Professional core Courses, PEC: Professional Elective Courses. PROJ-Project Work, INT-Internship, OEC Open Elective Courses, SP-Societal Project

Professional Elective 3		Open Elective 1	
Course Code under 22XXX32X	**Course title**	**Course Code under 22XXX33X**	**Course title**
22PSE321	Design of Bridges	22PSE331	Remote Sensing
22PSE322	Design of Masonry Structures	22PSE332	Building Science
22PSE323	Repair and Rehabilitation of Structures	22PSE333	Soft Computing Tools

Note:

1. **Project Work Phase-1:** The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

2. **Societal Project:** Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology toworkout/proposing viable solutions for societal problems.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the

department. The CIE marks awarded, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. Internship: Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

Hyderabad Karnataka Education Society's
P. D. A COLLEGE OF ENGINEERING, KALABURAGI
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IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	22PSE41	Project work phase -2	--	08	03	100	100	200	18
			TOTAL	**--**	**08**	**03**	**100**	**100**	**200**	**18**

Note:

1. Project Work Phase-2:

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

Total Credits 22+18+22+18 =**80**

FINITE ELEMENT METHOD OF STRUCTURAL ANALYSIS

Subject Code: 22PSE31	Credits: 04	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 2 Hrs. (Theory) + 2 Hrs. SDA		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.

DESIGN OF BRIDGES

Subject Code: 22PSE321	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. (Theory)		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: 22PSE322	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. (Theory)		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

REPAIR AND REHABILITATION OF STRUCTURES

Subject Code: 22PSE323	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. (Theory)		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)

REMOTE SENSING

Subject Code: 22PSE331	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. (Theory)		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: 22PSE332	Credits: 03	
CIE: 50 Marks	SEE: 50 Marks	SEE: 03 Hrs.
Hours/Week: 3 Hrs. (Theory)		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”.

SOFT COMPUTING TOOLS

Subject Code : 22PSE333	Credits : 03	
CIE : 50 Marks	SEE : 50 Marks	SEE : 03 Hrs.
Hours/Week : 4 Hrs.		Total Hours : 56

MODULE-I

Object Oriented Programming: Comparison between procedure – oriented programming and object oriented programming, Advantages of OOP objects, Classes, Data encapsulation, Inheritance, Polymorphismetc. Application of OOP in Analysis and design of RC, PSC and steel structural elements. 12 Hours

MODULE-II

Artificial Intelligence: Artificial Intelligence, Introduction, AI – Application fields, defining the problems – state space representation –problem characteristics – production system – production system characteristics. Knowledge representation – Formal logic – predicate logic – logic programming – forward v/s backward reasoning – matching controlknowledge. 10 Hours

MODULE-III

Search and control: Concepts – uniformed blind search: depth first search: depth first search – breadth first search – bi – directional search informed search – heuristic graph search – generate and test – hill climbing –best first search AND OR graph search. Non formal knowledge representation – semantic networks – frames – scripts – productions systems. Programming in LISP. 10 Hours

MODULE-IV

Expert Systems: Expert systems, Their superiority over conventional software – components of an expert system – expert system life cycle – expert system developments process – nature of expert knowledge – techniques of soliciting and encoding expert knowledge. Inference: Forward chaining- backward chaining – rule value approach.

12 Hours

MODULE-V

Uncertainty – symbolic reasoning under uncertainty: logic for non monotonic reasoning. Statistical reasoning: Probability and Bayes theorem – certainty factor and rule based system – Bayesian network –Dempster –Shafer theory. Fuzzy reasoning. Features of rule based, networks based and frame based expert system – examples of expert systems in Construction Management and Structural Engg., Expert system shells. Neural Networks, An introduction – their possible applications inCivil Engg. **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 byselecting minimum one question from each module.

REFERENCE BOOKS:

1. Timothy Budd, "**An Introduction to Object OrientedProgramming in Turbo C++**"- Addison – Wesley Publications.
2. Rober Lafore, "**Object Oriented Programming in Turbo C++**"-Gelgotia Publishers.
3. Patterson D W, "**Artificial Intelligence and Expert Systems"-** Prentice Hall, New Jersy.

4. Rich, E and Knight K. "**Artificial Intelligence**"- TMH, New Delhi.
5. Rolston, D.W **"Artificial Intelligence and Expert Systems"-** McGraw Hill, New York.