GONDWANA UNIVERSITY, GADCHIROLI

TEACHING AND EXAMINATION SCHEME (SEMESTER PATTERN CHOICE BASED CREDIT SYSTEM)

PROGRAM : MASTER OF TECHNOLOGY IN Structural Engineering and Construction PROGRAM CODE: PSE
BoS: Civil Engineering FACULTY: ENGINEERING & TECHNOLOGY DURATION: TWO YEARS

I – SEMESTER

Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme									
			Hours per week			No. of Credits	Theory						Practical			
			L	Field Work/ Assignment/ Tutorial	P		Duration of Paper (Hrs.)	Max. Marks	Max. Marks (Sessional)		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
								ESE	MSE	IE			TW	PEE		
PSES11	**C**	Matrix analysis of structures	3	1	-	3+1	4	70	10	20	**100**	50	-	-	-	-
PSES12	**C**	Advanced concrete structures	3	1	-	3+1	4	70	10	20	**100**	50	-	-	-	-
PSES13	**C**	New construction materials	2	1	-	2+1	3	70	10	20	**100**	50	-	-	-	-
PSES14	**C**	Building services	2	1	-	2	3	70	10	20	**100**	50	-	-	-	-
PSES15x	**P**	Elective – I	3	1	-	3+1		70	10	20	**100**	50				
Laboratories/ Practical																
PSES16	**C**	Matrix analysis of structures	-	-	2	1	-	-	-	-	-	-	50	50	**100**	50
TOTAL			13	05	2	18	-	**500**					**100**			
SEMESTER TOTAL			**20**			**18**	**600**									

Elective-I(x)—a. Structural instrumentation and material science b. Computational Techniques c. Optimization Techniques in Structural Engineering

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Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme									
			Hours per week			No. of Credits	Theory						Practical			
			L	Field Work/ Assignment/ Tutorial	P		Duration of Paper (Hrs.)	Max. Marks	Max. Marks (Sessional)		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
								ESE	MSE	IE			TW	PEE		
PSES21	**C**	Finite Element Method	3	1	-	3+1	4	70	10	20	**100**	50	-	-	-	-
PSES22	**C**	Structural dynamics	3	1	-	3+1	3	70	10	20	**100**	50	-	-	-	-
PSES23	**C**	Design of substructures	2	1	-	2	3	70	10	20	**100**	50	-	-	-	-
PSES24	**C**	Advanced construction management & Technology	2	1	-	2	3	70	10	20	**100**	50	-	-	-	-
PSES25x	**P**	Elective – II	3	1	-	3+1	3	70	10	20	**100**	50				
Laboratories/ Practical																
PSES26	**C**	Structural dynamics and instrumentation lab	-	-	2	1	-	-	-	-	-	-	25	25	**50**	25
PSES27	**E**	Seminar*	-	-	2	1							50	-	**50**	25
		TOTAL	13	05	4	18	-	**500**					**100**			
		SEMESTER TOTAL	**22**			**18**	**600**									

II – SEMESTER

Elective II(x) a. Computer Aided Design in Structural Engineering (CAD) b. advanced design of steel structures c. Plastic Analysis and Design.

***Spiral binded copy of seminar delivered on advanced topic related to this course, must be submitted to the department**

GONDWANA UNIVERSITY, GADCHIROLI

TEACHING AND EXAMINATION SCHEME (SEMESTER PATTERN CHOICE BASED CREDIT SYSTEM)

PROGRAM : MASTER OF TECHNOLOGY IN Structural Engineering and Construction **PROGRAM CODE : PSE**
FACULTY : ENGINEERING & TECHNOLOGY **DURATION : TWO YEARS**

III – SEMESTER

Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme									
			Hours per week			No. of Credits	Theory						Practical			
			L	Field Work/ Assignment/ Tutorial	P		Duration of Paper (Hrs.)	Max. Marks	Max. Marks (Sessional)		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
								ESE	MSE	IE			TW	PEE		
PSES31	**C**	Design of Earthquake resisting RCC Structures	4	2	-	4+1	4	70	10	20	**100**	50	-	-	-	-
PSES32(x)	**P**	IDCS	4	2	-	4+1	3	70	10	20	**100**	50	-	-	-	-
Laboratories/ Practical																
PSES33	**C**	Computer aided analysis- lab	-	-	4	2	-	-	-	-	-	-	50	50	**100**	50
PSES34	**E**	Project Phase I and Seminar	-	-	12	6							50	50	**100**	50
TOTAL			8	4	12	18	-	**200**					**200**			
SEMESTER TOTAL			**24**			**18**	**400**									

IDCS-I(x) : a. Quality and safety in construction b. Data structure and algorithm c. Neuro network and fuzzy logic
d. Research Methodology

Note: for PSES34- Student should carry out following work for Phase-I of Project

1. Extensive literature survey and finalization of topic
2. Submission of Synopsis in the form of spiral binding
3. Data collection and analysis (partial)
4. Final submission seminar on PPT for Internal and External both. Total work carried in Phase-I must be submitted in Hard copy.
   Student has to submit the report and deliver the seminar based on Dissertation topic. It is to be evaluated by three member's panel of examiners headed by HOD; wherein guide should be one of the members of the panel. Last date of submission of report shall be one week before the end of semester.

GONDWANA UNIVERSITY, GADCHIROLI

TEACHING AND EXAMINATION SCHEME (SEMESTER PATTERN CHOICE BASED CREDIT SYSTEM)

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FACULTY : ENGINEERING & TECHNOLOGY **DURATION : TWO YEARS**

IV – SEMESTER

Unique Subject Code (USC)	Course type	Subject	Teaching Scheme				Examination Scheme									
			Hours per week			No. of Credits	Theory						Practical			
			L	Field Work/ Assignment/ Tutorial	P		Duration of Paper (Hrs.)	Max. Marks	Max. Marks (Sessional)		Total	Min. Passing Marks	Max. Marks	Max. Marks	Total	Min. Passing Marks
								ESE	MSE	IE			TW	PEE		
Laboratories/ Practical																
PSES41	**E**	Project Phase-II and Dissertation	-	-	24	18	-	-	-	-	-	-	200	200	**400**	400
TOTAL				-	24	18	-						**400**			
SEMESTER TOTAL			**24**			**18**	**400**									

Note:

1) Dissertation work should be carried out on any recent topic decided in project phase-I, which has not been carried out earlier by any alumni. If it is found at any stage then it will be rejected without any clarification.

2) At least one research paper should be published in research journal having ISSN number and impact factor more than 0.75.

3) Those candidates completing the dissertation without publishing research paper, will be evaluated from total marks out of 160 (160 TW + 160 PEE) only.

PSES11: MATRIX ANALYSIS OF STRUCTURES

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 4 Hrs.

COURSE OBJECTIVES

After completion of syllabus students will able to,
1) Understand basic concepts of stiffness method of matrix analysis.
2) Analyse the structures using stiffness method.
3) Apply softwares of structural analysis based on this method.

UNIT - I

Introduction to stiffness and flexibility approach, Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Global stiffness matrix and load vectors, Assembly of structure stiffness matrix with structural load vector, application to spring and bar problems.

UNIT - II

Analysis of Plane Truss, Space Truss by Stiffness Method

UNIT - III

Analysis of Beam, Plane Frame, Space Frame by Stiffness Method.

UNIT - IV

Analysis of Plane Grid by Stiffness Method

UNIT - V

Analysis for member loading (self, Temperature & Imposed), Inclined supports, Lack of Fit, Initial joint displacements. Effect of shear deformation, internal member end releases.

UNIT - VI

Analysis of building systems for horizontal loads, Buildings with and without rigid diaphragm, various mathematical models and introduction to Solution techniques.

Text Books:-

1] Gere, W. and Weaver; J. M., Matrix Method of Structural Analysis 3rd Edition, Van Nostrand Reinhold; New York; 1990
2] Meghre A.S. & Deshmukh S.K. ; Matrix Method of Structural Analysis, 1st edition, Charotar publishing house, Anand, 2003.
3] Kasmali Aslam, Matrix Analysis of Structures, Brooks /Cole Publishing Co. 1999.

4] Kanchi, M. B., Matrix Method of Structural Analysis, 2nd Edition; John Willey & Sons, 1999.

REFERENCE BOOKS:-

1] Cheng, F.Y., M. Dekke; Matrix Analysis of Structural Dynamics, NY 2000
2] Bathe, K.J., Finite Element Procedures, 2nd Edition Springer, 2002
3] Cook, R. D Concepts and Applications of Finite Element Analysis,*et.al*, John Willey & Sons; NY 1995
4] Martin; H.C., Introduction to Matrix Method of Structural Analysis, McGraw Hill Book Co.1966
5] Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991

PSES12: ADVANCED CONCRETE STRUCTURES

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 4 Hrs.

COURSE OBJECTIVES

After completion of syllabus students will able to get the knowledge about the design of
1. Bridges.
2. Water tanks.
3. Multistoried buildings.
4. Silos & Bunkers.

UNIT – I

Analysis and design of Multistoried buildings, calculation of loads, Approximate analysis, Preliminary sizing, IS:875, IS:1893 recommendations, Ductile detailing, Calculation of earthquake forces.

UNIT – II

Analysis and Design of Elevated service Reservoirs, IS Recommendations for wind & earthquake, Ductile detailing, Design of Concrete Chimney.

UNIT – III

Analysis and Design of bridges and Culverts. IRC Recommendations,Prostressed concrete bridges-Analysis & Design, Arch Bridges.

UNIT – IV

Analysis and design of Silos and Bunkers. IS recommendations.

Text Books:

1. Bhavikatti S. S., Advanced R. C. C. Design Volume-II, New age international publisher, New Delhi, Ist edition – 2006.
2. Krishna Raju N, Advanced R. C. C. Design, CSB Publisher and Distributor, New Delhi, 2nd edition-2005
3. Ramaswamy, G.S, Design of Concrete Shells, Krieger Publ. Co., 1984

REFERENCE BOOKS:

1. Johnson and Victor, ―Essentials of Bridge Engineering‖ Oxford and IBH publisher, 1980
2. Jain O. P. and Jai Krishna, Plain and Reinforced concrete structures – Volume –II, Nemchand and brothers, 1987
3. Chatterjee, B K, ―Theory and design of Concrete Shells‖ Oxford and IBH publisher, 1978.

PSES13: NEW CONSTRUCTION MATERIALS

Teaching scheme: 03 L+01 T=04 **Credit: 03**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

OBJECTIVE:

- To study and understand the properties of recent materials used in construction.

UNIT I: SPECIAL CONCRETES

Concretes, Behaviour of concretes - High Strength and High Performance Concrete-Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete.

UNI T II :METALS

Steels - Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel, Corrosion of concrete in various environments. Corrosion of reinforcing steel. Electro-chemical process, measures of protection. New Alloy Steels, Aluminum and its Products –Coatings to reinforcement Applications.

UNIT III: COMPOSITES

Plastics –Reinforced Polymer,Ferro-cement, material and properties. Polymers in Civil Engineering Polymers, fibres and composites, Fibre reinforced plastic in sandwich panels, Brick Ferro-cement Composite.

UNIT IV: OTHER MATERIALS

Water Proofing Compounds – Non-weathering Materials – Flooring and Façade Materials.

UNIT V: SMART AND INTELLIGENT MATERIALS

Smart and Intelligent Materials for intelligent buildings - Special features. green building materials, waste products, reuse and recycling.

UNIT: VI

Ceramic Materials: Classification, Refractories, glass, glass wool, mechanical, thermal and electrical properties, fire resistance materials, Uses and application.

TEXT BOOKS:

1. Rangawala S.C. Engineering Materials Chortor Publications 1991.
2. S.K. Duggal Building Materials, New Age International Publications 2006.
3. Bruntley L.R Building Materials Technology Structural Performance & Environmental Impact McGraw Hill Inc 1995.
5. R Chudley Construction Technology, Vol I - IV Longman Group Construction Ltd. 1973.

REFERENCES:

1. Santhakumar A.R., Concrete Technology, Oxford University press, New Delhi. 2007.
2. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.

3. Ashby, M.F. and Jones.D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2005.
4. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
5. Aitkens , High Performance Concrete, McGraw Hill, 1999
6. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
7. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2005.
8. ACI Report 440.2R-02, “Guide for the design and construction of externally bonded RP Systems for strengthening concrete structures”, American Concrete Institute, 2002

PSES14: BUILDING SERVICES

Teaching scheme: 02L+01 T=04 **Credit: 02**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

OBJECTIVE:

After studying this subject students will be able to understand the importance of various building services.

UNIT I: Water Supply

Water quality, Purification and treatment- water supply systems-distribution systems in small towns -types of pipes used- laying jointing ,testing-testing for water tightness plumbing system for building-internal supply in buildings- municipal bye laws and regulations - Rain Water Harvesting.

UNIT II: Sanitation

Sanitation in buildings-arrangement of sewerage systems in housing –pipe systems- storm water drainage from buildings -septic and sewage treatment plant - collection, conveyance and disposal of town refuse systems.

UNIT III : Electrical Systems

Types of wires , wiring systems and their choice -planning electrical wiring for building - main and distribution boards -transformers and switch gears -modern theory of light and colour -synthesis of light -luminous flux -candela- lans of illumination-lighting design-design for modern lighting.

UNIT:IV HVAC

Ventilation and its importance-natural and artificial systems-Window type and packaged Air conditioners- chilled water plant -fan coil systems-water piping -cooling load -air conditioning systems for different types of buildings -protection against fire to be caused by A.C.Systems.

UNIT V: Fire Systems

Causes of fire in buildings-safety regulations-NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and A.C. systems, special features required for physically handicapped and elderly in building types-heat and smoke detectorsdry and wet risers-Automatic sprinklers - Capacity determination of OHT and UGT for firefighting needs.

UNIT VI: Intelligent buildings
Building automation-Smart buildings- Building services in high rise buildings.

REFERENCE BOOKS:

1. G.M.Fair, J.C.Geyer and D.Okun, Water and waste Engineering, Vol.II, John Wiley&sons, Inc., New York. 1968.
2. R. G. Hopkinson and J.D.Kay, The Lighting of buildings, Faber and Faber, London, 1969.
3. Hand book for Building Engineers in Metric systems, NBC, New Delhi, 1968.
4. Philips Lighting in Architecture Designs, McGraw Hill, New York, 1964.
5. Time saver Standards for Architecture Design Data, Callendar JH, McGraw Hill, 1974.
6. William H. Severns and Julian R.Fellows, Air conditioning and refrigeration, John Wily and sons, London, 1988.
7. National Building Code 2005, Part 0-10, Bureau of Indian Standards.
8. F. Hall (Author), Roger Greeno (Author), Building Services Handbook: Incorporating Current Building and Construction Regulations.
9. Building Services Research and Development Association Staff Building Services Materials Handbook - Heating, Sanitation and Fire Rout ledge
10. Willan T. Mayer, Energy economics and building design.
11. E.C. Butcher and A.C. Parnell., Designing for Fire safety
12. Peter R. Smith and Warden G. Julian, Building Services

PSES15x: A) STRUCTURAL INSTRUMENTATION & MATERIAL SCIENCE

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

Objective:
After studying this subject the student will be able to understand instrumentation and its application in structural engineering

UNIT: I

Study of various transducers & Principle of their working, displacement velocity acceleration.

UNIT: II

Stress-strain measurement, strain gauges static and dynamics strain measurement, calculation of stresses from measurement of strain, deflections etc.

UNIT: III

Special materials for building constructions i. e. steel fibre reinforced concrete, fibre reinforced plastics.

UNIT: IV

Non-destructive testing of concrete / steel / ultrasonic techniques etc, model Analysis related to structures.

UNIT: V

Admixture for concrete, theories of corrosion and its preventions.

UNIT: VI

Special concrete like lightweight concrete, no fines concrete, Ferro cement, fly ash concrete etc., high performance concrete.

Text Books:

1. Experimental Stress Analysis: Singh, Sadhu Khanna Publishers.
2. Instrumentation in Industry: Soisson, H. E. John Willey & Sons, NY, 1975
3. Corrosion of Steel in Concrete: Boon Field, J. P. E & FN SPON, 1997.

References Books:

1. Modal Analysis of Structures: Ganesan, T. P., University Press,2000
2. "IS: 13925 Repair and Seismic Strengthening of Buildings- Guidelines", Bureau of Indian Standard, New Delhi, 1993.
3. "SP: 25 Causes and Prevention of Cracks in Buildings", Bureau of Indian Standard, New Delhi

PSES15x: B COMPUTATIONAL TECHNIQUES

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

OBJECTIVES:

At the end of the course the student will be able to
1. Get the knowledge of various numerical methods which are required in static and dynamic analysis of structures.
2. Develop computer programs for numerical methods for easier computations.

UNIT – I

Solution of algebraic and transcendental equation:
Regula Falsi Method, Newton-Raphson method, Development of Computer Program.

UNIT – II

Solution of linear algebraic equations:
Gauss elimination, Cholesky method, Given's method, Householder's method.

UNIT – III

Eigen values problems: Direct , Jacobi, Rutishauser's LR method, QR method.

UNIT – IV

Initial & two point boundary value problem:
Euler's, Runge-Kutta, Milne's Methods, Development of Computer Program.

UNIT – V
Numerical Integration:
Trapezoidal Method, Simpson's Method, Gauss Quadrature, Development of Computer Program, Double and triple integration.

UNIT – VI
Direct Integration Methods:
Central difference method, Houbolt method, Newmark's method, Wilson - θ method.

Text Books

1. Balachandra Rao S., Santha C. K. ;Numerical Methods with programs in BASIC, FORTRAN and Pascal, University Press (India) Limited, Hyderabad 1992.
2. Bathe K. J., Wilson E. L., Numerical Methods in Finite Element Analysis, Prentice-Hall of India Private Limited, New Delhi, 1987

Referrence Books

1. Kandasamy P. ,Thilagavathy K, Gunavathi K.;Numerical Methods, S. Chand & Company Ltd, New Delhi, Edition-I,1997.
2. Chapra.S.C. and Canale,R.P., ― Numerical Methods for Engineers with Programming and Software Applications‖ - 3 Ed., Tata McGraw Hill, New Delhi, 2009
3. Salvadori M., ―Numerical Mehtods‖ - PHI learning Pvt, ltd., New Delhi, 1987
4. Jain, Iyanger & Jain ―Numerical Methods for Scientific Engineering computation- Wiley Eastern Ltd., 1985
5. Gupta S. K.; Numerical Methods for Engineers, New Age International Limited Publishers, New Delhi, 1997

PSES15x Elective-I c: OPTIMIZATION TECHNIQUES IN STRUCTURAL ENGINEERING

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

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

UNIT II: Linear Programming: Introduction - Applications of linear programming - standard form of a linear programming problem - Geometry of linear programming problems - Definitions and theorems - Solution of a system of Linear simultaneous equations - Pivotal reduction of a general system of equations - Motivation of the Simplex Method - Simplex Algorithm - Two phases of the simplex method. non-Linear Programming: Introduction - Unimodal Function - Unrestricted search - Exhaustive search - Dichotomous search - Interval Halving method - Fibonacci method - Golden section method - Comparison of elimination methods - Unconstrained optimization techniques - Direct search methods - Random search methos - grid search method - Univariate method - Powell's method - Simplex method - Indirect search methods - Gradient of a function - Steepest descent method - Conjugate gradient - Newton's method.

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

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

UNIT V: Application of Optimization techniques to trusses, Beams and Frames.

REFERENCES

1. Optimization: Theory and Applications by S.S.Rao.
2. Numerical Optimization Techniques for Engineering Design with applications by G.N.Vanderplaats.
3. Elements of Structural Optimization by R.T.Haftka and Z.Gurdal.
4. Optimum Structural Design by U.Kirsch.
5. Optimum Design of Structures by K.I.Majid.
6. Introduction to Optimum Design by J.S.Arora.

PSES16 MATRIX ANALYSIS OF STRUCTURES

Teaching scheme: 02P = 02 **Credit: 01**
Evaluation scheme: 25 TW + 25 P/OE **Total marks: 50**

PRACTICALS:

Analysis of following structural elements by using commercial software (Any Eight)

1. Continuous beam without sinking of support.
2. Continuous beam with sinking of support.
3. Plane truss.
4. Plane truss with inclined roller.
5. Plane truss with temperature effect and lack of fit.
6. Space truss.
7. Plane frame without axial deformation.
8. Plane frame with axial deformation.
9. Plane grid.
10. Rigid jointed space frame.

PSES21: FINITE ELEMENT METHOD

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 4 Hrs.

COURSE OBJECTIVES

After completion of syllabus students will able to
1. Understand basic concepts of Finite Element Method.
2. Apply the Finite Element Method to solve the problems of Structural Analysis
3. Understand modeling techniques for analysis of structures

UNIT – I

Principles and discretization, Elements stiffness formulation based on direct and variational techniques, Raleigh Ritz Method for Bar and Beam analysis .

UNIT – II

Shape functions, Finite Element Formulation using Cartesian Coordinates, Application to 1D problems, Convergence criteria.

UNIT – III

Triangular and Rectangular element formulation using Cartesian Coordinates, Application to 2D stress analysis.

UNIT – IV

Natural coordinates, Numerical integration, Isoparametric elements, Application to 1D Problems, Isoparametric elements for two-dimensional stress analysis.

UNIT – V

Plate bending element based on classical and Mindlin plate theory, Formulation of stiffness matrix for Mindlin thin and thick plates.

UNIT – VI:

Modelling techniques, storage techniques and solution techniques

Text Books:

1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice HallIndia, 1991
2. Rajasekaran S, Finite Element Analysis in Engineering Design, S. Chand &Co.Ltd.NewDelhi,1999.
3. S.S. Bhavikatti - Finite Element Analysis – New Age International Publishers,Delhi

Reference Books:

1. Zienkiewicz O. C. and Taylor R. L. ,The Finite Element Method (Volume -I), , 1st Edition, TataMcGraw Hill Publishing Company Limited, New Delhi, 1989
2. Cook R. D. , Concepts and Applications of Finite Element Analysis, , 3rd Edition, Wiley India Textbooks, Wiley India Pvt Limited, New Delhi , 1989
3. Krishnamurthi C. S. ,Finite Element Analysis: Theory and Programming , 2nd Edition, Tata McGraw Hill Publishing Company Limited, 1994, Reprint 2005.
4. Bathe K. J., Finite Element Procedure, Prentice-hall of India, New Delhi,1997
5. G.R. Buchanan – Finite Element Analysis Schaum's outlines - Tata McGraw Hill Publishing Co. Ltd.

PSES22 : STRUCTURAL DYNAMICS

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

COURSE OBJECTIVES

After completion of syllabus students will able to,
1) Understand basic concepts of structural dynamics.
2) Calculate the response of building to dynamic loading.
3) Generate the response spectrum for dynamic loading.
4) Understand IS codes related to dynamic loading.

UNIT – I

Fundamentals of Rigid / Deformable body dynamics, Analysis of undamped and viscously dampedsingle degree freedom systems.

UNIT – II

Response of single degree freedom systems to harmonic loading, support motion and transmissibility, Duhamel's integral.

UNIT – III

Multiple degree of Freedom system: Vibration of undamped 2 DOF systems; Response of 2 DOF toharmonic excitation, mode superposition, vibration absorber, Lagrange equation and their applicationto lumped parameter models of MDOF (up to 3 DOF). Free vibration of MDOF (up to 3 DOF) systems,Dynamic response of MDOF (2 DOF) systems-modal superposition method

UNIT – IV

Dynamic analysis of systems with distributed properties, Approximate design method, Transformation factors.

UNIT – V

Response spectra, Introduction to vibrations due to earthquake, Study of IS 1893 applicable to Building and Water Tanks.

UNIT – VI

Vibration of Continuous Systems: Free vibrations of Continuous systems-axial and transverse vibration of bars / beams. Response of continuous systems to dynamic loads. Energy Principle, Rayleigh-Ritz method.

Text Books:

1. Mario Paz, Structural Dynamics Theory & Application, CBS Publ.; N-Delhi, 1995.
2. Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition.Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995
3. R.C. Roy - Structural Dynamics an Introduction to Computer Methods, John Wiley & Sons Publications

Reference Books:

1. Clough / Penzien, ―Dynamics of Structures, McGraw Hill, 1993
2. Humar, J. L., ―Dynamics of Structures, Prentice Hall, 1993
3. Timoshenko, S., ―Advanced Dynamics, McGraw Hill Book Co; NY, 1948
4. Biggs, J.M., ―Introduction to Structural Dynamics, McGraw Hill; NY, 1964
5. Damodarasamy and Kavitha,Basics of structural Dyanamics and Aseismic design, Phi Publisher,NewDelhi.

PSES23: DESIGN OF SUBSTRUCTURES

Teaching scheme: 02 L+01 T=04 **Credit: 02**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

COURSE OBJECTIVES

After completion of syllabus students will able to
1. Understand design of composite foundation systems of shallow foundations.
2. Understand design of deep foundation systems.
3. Analyze and understand various foundation failures.

UNIT – I

Design of different isolated and combined footings including eccentric loading, Design of inverted arch foundation.

UNIT – II

Design of raft foundation.

UNIT – III

Design of deep foundation such as pile and well foundation.

UNIT – IV

Introduction to analysis and design of simple machine foundation.

UNIT – V

Theory of sub grade reaction, beam on elastic foundation, **Concrete pavements.**

UNIT – VI

Analysis and design of Abutments, Pier and Retainin
g walls.

Text Books:-

1. Swami Saran , Analysis and Design of Substructures Limit State Design, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, (2007)
2. Kurian N.P., Design of Foundation Systems- Principles and Practices, Narosa Publishing House, New Delhi (2006)
3. Verghese P.C., Reinforced Concrete Design, Prentice hall of India, New Delhi, 2001.
4. Pillai S. V. and MenonD.,‖ Reinforced concrete Design‖ , TMH, New Delhi, 2009

Reference Books

1. Bowles, J. E, Foundation Analysis & Design, McGraw Hill Inc, NY (1999)
2. Swami Saran, Soil Dynamics and Machine Foundations, Galgotia Publications (P) Ltd, New Delhi(2006)
3. Srinivasulu P, Vaidyanathan C V, Handbook of Machine Foundation, tataMc-Graw Hill, New Delhi(2002)
4. Kurian N.P., Modern Foundations, Introduction to Advanced Techniques , Tata McGraw-
5. Hill, New Delhi (1982)
6. Ghosh, ―Foundatios design in practice‖ , Phi Publisher, New Delhi
7. Som and Das, ―Theory and Practice of Foundation Design, Phi Publisher, New Delhi

PSES24: ADVANCED CONSTRUCTION MANAGEMENT AND TECHNOLOGY

Teaching scheme: 02 L+01 T=04 **Credit: 02**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

COURSE OBJECTIVES:

By understanding this subject the students will get versed with management techniques and advance technology in construction.

Unit:I

Understanding Project Management, Project manager, organization structures, organizing and staffing the project office and team Management functions – directing, controlling, project authority, interpersonal influences, barriers, team building, communication, time management, conflicts Construction Planning : Project planning, milestone schedules,WBS, Network techniques, CPM , PERT and Prima Vera , Resources leveling and smoothing. Cost Control Understanding control, operating cycles, cost account codes, Job cost report, Projected Cost Estimates, status reporting, variance and earned value

Unit:II

Concrete construction for heavy Engineering projects:-
Selection of equipments for batching , mixing, transporting, placing and compacting for various types of jobs, safety measures during concreting, special concretes and mortars, preplaced aggregate concrete, roller compacted concrete, concreting under water, concreting in different weather condition.

Unit:III

Method statement for large and heavy Engineering projects:-
Method statement for major activities like excavation, concreting, steel fabrication and erection for projects like earthen dams, tunnels, composite structure hydropower projects, nuclear power plant, refineries and other industrial projects like cooling tower, silos, and Chimney

Unit:IV

Road Project Equipment:
Automatic Paving Machine, Road Rollers, Asphalt plant, Batch Plants, Drum Mix Plants, Asphalt storage and heating, Haul truck, asphalt distributor, asphalt paver.
Bridge Construction: - Launching of bridges by incremental launching, using false work, and balanced cantilever construction method.

Unit:V

Ground Improvement Techniques:-
Soil distribution in India, Reclaimed Soils, selection for field compaction procedures,compaction quality control, stone column, sand drain, diaphragm wall, soil reinforcement, thermal methods, improving rock stability and quality.

Unit:VI Formwork:

Requirement of formwork, loads carried by formwork, types of formwork such as timber formwork, Steel formwork, patent formwork, modular shuttering, slip forms,Vertical slip forming, Horizontal slip forming steel scaffolding.

REFERENCES:

1. Thomas Baron, Erection of steel structures.
2. Stubbs, handbook of heavy Construction.
3. Mahesh Verma, Construction Equipment and its planning & applications.
4. R.L. Purify & Ledbetter, Construction Equipment and planning, McGraw Hill.
5. Wadell, Concrete Construction Handbook.
6. Dr. P. Purushothamma Raj, Ground Improvement Techniques, Laxmi Publications
7. Journals of Civil Engineering and Construction Engineering
8. Purifoy, Schexnayder, Construction Planning, Equipment and Methods, Tata Mc Graw Hill
9. Edward Nawy , Concrete Construction and engineering Handbook , CRC Press.

PSES25x Elective-II A: COMPUTER AIDED DESIGN IN STRUCTURAL ENGINEERING

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

UNIT I:

Introduction to computer aided design-An over view-computer as a design medium hardware components of a computer -programming languages. C - Programming language-Introduction-An over view of programming in C-variables and data types, Declaration of variables-Initialization of variables-operators-arithmetic operators- precedence and associability-Input and output-Character I/O-Formatted output. Print f ()-Formatted input scan f ()- Examples.

UNIT II:

C Programming Language-Control structures-If statement-Switch statement-loops-nested loops-while and for ,Do-While-continue statement-Go to statement-Examples. C Programming Language-Arrays-One dimensional Arrays-Two Dimensional Arrays-pointer operators, pointer, arithmetic-pointers and arrays-Matrix manipulations using arrays and pointers-pointers to functions-data files-basic operations-reading and writing and file accessing files-examples.

UNIT III:

Computer Graphics-introduction-applications graphic devices-display devices-output and input devices, two dimensional geometric transformations-homogeneous co-ordinates-world co-ordinates-device coordinates-window to view port-transformations-clipping operations.

UNIT IV :

Data base management system-introduction-data base systems-hardware-software-users-operational data independence-architecture of data base system-distributed databases.

UNIT V :
Knowledge based expert system-introduction-artificial intelligence-compo
nents of an expert system, stages in expert system development-knowledge representation-inference mechanisms-applications.

REFERENCES

1. Computer Aided Design by C.S.Krishnamoorthy and S.Rajeev.
2. Computational Structures by S.Rajasekharan

PSES25: Elective –II B: ADVANCED DESIGN OF STEEL STRUCTURES

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

COURSE OBJECTIVES:

At the end of the course student will be able to
1. Understand different types of loading with respect to structural parameters.
2. Application of IS code & SP code for detailing and drafting of different structural components.
3. Analysis and design of different types of structures.

UNIT – I

Design of steel industrial buildings, Design of Gantry girder analysis &Design of gable frame with haunch, Lattice girder.

UNIT – II

Design of Steel Chimney

UNIT – III

Design of a truss Bridges, Design of plate girder bridges, Suspension bridges, Design of **steel framework.**

UNIT – IV

Design of storage Vessels, overhead pressed steel tanks, Plastic Analysis.

Text Books:

1. Pumia B.C. Comprehensive Design of steel structures, Laxmi publication ltd., 2000,
2. Duggal S.K., Design of Steel Structures, Mc Graw Hill publication, 2007
3. RamChandra Design of Steel structures Vol-I &Vol-II Std. book house / Rajsons Publication Pvt. Ltd.Delhi, 2006

References:

1. Arya A.S and Ajmani J.L. Design of Steel Structures, Nemchand &bros, Roorkee, 2007.
2. Gaylords, E.H. &Gaylords, C. N., Design of Steel Structures, Blackwell, 1994.
3. Dayaratnam P., Design of Steel Structures, Wheeler Publications, Allahabad, 1992
4. Ghosh, ― Analysis and Design practice of Steel Structure, (Forthcoming), Phi Publisher, New Delhi.

PSES25x Elective-II C : PLASTIC ANALYSIS AND DESIGN

Teaching scheme: 03 L+01 T=04 **Credit: 04**
Evaluation scheme: 20 IE+10 MSE+70 ESE **Total marks: 100**
Duration of ESE: 3 Hrs.

UNIT – I

Analysis of Structures for Ultimate Load: Fundamental Principles – statistical method of Analysis – Mechanism method of analysis – Method of analysis, Moment check – Carry over factor – Moment Balancing Method.

UNIT - II

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

UNIT - III

Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force – local buckling of flanges and webs – lateral buckling – column stability.

UNIT - IV

Design of Connections: Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

UNIT - V

Design of Steel Frames: Introduction – Single span frames – simplified procedures for Single span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections: Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Single span frames.

REFERENCES:

1. Plastic Design of Steel Frames, L.S.Beedle.
2. Plastic Analysis, B.G.Neal.
3. Plastic Analysis, Horve.

PSES26: STRUCTURAL DYNAMICS AND INSTRUMENTATION LAB

Teaching scheme: 02P = 02 **Credit: 01**
Evaluation scheme: 25 TW + 25 P/OE **Total marks: 50**
PRACTICALS (Any Eight)

1. To study various instruments
2. Non Destructive Tests- Rebound Hammer and Ultra Sonic techniques, etc.
3. To study various instruments for the response of vibrating structure.
4. To study the response of a single degree of lumped mass system subjected to base excitation.
5. To study the response of a two degree of freedom system building frame subjected to base motion.
6. To study the response of a multi degree of lumped mass system.
7. Verification of natural frequency of SDOF model under free vibration.
8. To study the liquefaction of soil structure.
9. To study the Earthquake induced waves in rectangular water tank.
10. To calculate horizontal seismic force of building using IS-1893.
11. To calculate the lateral forces in water tank due to Earthquake when water tank is empty and watertank is full by IS-1893.