

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Faculty of Engineering & Technology
Course and Examination Scheme of Master of Technology
in Structural Engineering
Choice Base Credit System (CBCS)
Scheme of M. Tech. Structural Engineering

Semester 1									
Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Core Subject -I	PGST101T	Matrix Analysis of Structures	4	--	4	30	70	100	50
Core Subject -II	PGST102T	Theory of Elasticity & Elastics Stability	4	--	4	30	70	100	50
Core Subject -III	PGST103T	Structural Dynamics	4	--	4	30	70	100	50
Elective –I (Discipline Specific)	PGST104T	Elective-I	4	--	4	30	70	100	50
Elective –II (Open)	PGOPEN105T	Elective –II (Open)	4	--	4	30	70	100	50
Laboratory -I	PGST101P	Matrix Analysis of Structure Lab	--	2	1	50	50	100	50
Laboratory -II	PGST103P	Structural Dynamics Lab	--	2	1	50	50	100	50
		Total	20	4					
Semester Total			24		22	250	450	700	
Elective-I	PGST104T	Advanced Steel Design							
Elective-I	PGST104T	Design of Earthquake Resistant Structures							
Elective-I	PGST104T	Design of Environmental Structures							
Elective-II (Open)	PGOPEN105T	Global Warming and Climate Change							
Elective-II (Open)	PGOPEN105T	Road Safety Engineering							

Semester 2									
Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Core Subject -IV	PGST201T	Finite Element Method	4	--	4	30	70	100	50
Core Subject -V	PGST202T	Theory of Plates & Shell	4	--	4	30	70	100	50
Core Subject -IV	PGST203T	Foundation Design	4	--	4	30	70	100	50
Elective -III (Discipline Specific)	PGST204T	Elective-III	4	--	4	30	70	100	50
Foundation Course-I	PGFD205T	Research Methodology	4	--	4	30	70	100	50
Laboratory -III	PGST206P	RCC Design Lab	--	2	1	50	50	100	50
Laboratory -IV	PGST207P	Steel Design Lab	--	2	1	50	50	100	50
		Total	20	4					
Semester Total			24		22	250	450	700	
Elective-III	PGST204T	High Rise Structures							
Elective-III	PGST204T	Design of Composite Construction							
Elective-III	PGST204T	New Engineering Materials and Technology							

Semester 3									
Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Elective –IV (Open)	PGOPEN301T	Elective –IV (Open)	4	--	4	50	50	100	50
Foundation Course-II	PGFD302T	Project Planning & Management	4	--	4	50	50	100	50
Project Seminar	PGST303P	Project Seminar	--	3*	8	50	150	200	100
		Total	8	3					
Semester Total			11		16	150	250	400	

*Contact Hours per week per project

Elective-IV (Open)	PGOPEN301T	Disaster Management and Mitigation
Elective-IV (Open)	PGOPEN301T	Water Resources Management

Semester 4									
Subject Category	Subject Code	Subject	Teaching Scheme			Marks			
			Hours per week		No. of Credits	Internal	Univ Exam	Total	Passing
			L	P					
Project	PGST401P	Project	--	6*	16	--	400	400	200
		Total	--	6					
Semester Total			6		16	--	400	400	

*Contact Hours per week per project

Grand Total of Marks

2200

Master of Technology in Structural Engineering

Choice Base Credit System (CBCS)

Syllabus

PGST101T Matrix Analysis of Structures

Unit 1: Stiffness method for plane truss, beams and plane frames

Unit 2: Stiffness method for plane grid and space frames

Unit 3: Analysis for member loading (self, temperature & Imposed), inclined supports, lack of fit, initial joints displacements.

Unit 4: Effect of shear deformation. Internal member end releases.

Unit 5: Solution technique with banded & skyline technique, band minimization, frontal techniques

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

Unit 1: Analysis of Stress and strain in 2 dimensions: Introduction, Types of forces, Components of Stresses and strains, Stress-strain relation, Plane stress and plane strain strain at a point, Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress function.

Unit 2: Analysis of stress and strain in 3 dimensions: Components of stress, principal stresses, stress invariants, Maximum shearing stress, Differential equation of equilibrium, Boundary conditions and compatibility equations.

Unit 3: Bending of cantilever of narrow rectangular section loaded at end, Bending of simply supported beam with uniform load, torsion of non-circular sections, Elliptical cross section.

Unit 4: Differential equation for beam, columns with concentrated loads, continuous lateral loads and couples for simply supported ends, Application of trigonometric series, Lateral buckling of beams. Buckling of simply supported rectangular plates uniformly compresses in middle plane.

Unit 5: Energy method for elastic buckling of columns, Approximate method, Buckling of columns on elastic foundation, Columns with intermediate compressive forces and distributed axial load, Columns with changes in cross section. Effect of shearing force on critical load, Buckling of built up columns,

Books:

1. Timoshenko, S.P. and Goodier, J.N., Theory of Elasticity, 3rd Edition, Mc-Graw Hill Book Company, New Delhi, 1963
2. Timoshenko, S.P. and Gere J. M., Theory of Elastic Stability , 2nd Edition, Mc-Graw Hill Book Company, New Delhi, 1963
3. Ameen, M., Computational Elasticity—Theory of Elasticity, Finite and Boundary Element Methods, 1st Edition, Narosa publication, 2007

PGST103T Structural Dynamics

Unit 1: Fundamentals of Rigid/Deformable body dynamics, Analysis of undamped and viscously damped, single degree freedom systems.

Unit 2: Response of single degree freedom systems to harmonic loading support motion and transmissibility Duhamels integral.

Unit 3: Introduction to vibrations due to earthquake, Study of IS 1893-1984 and 2000 applicable to buildings and water tanks.

Unit 4: Free vibrations of lumped mass multi degree freedom systems, shear buildings orthogonality criteria Rayleigh's method.

Unit 5: Dynamic analysis of systems with distributed properties, Approximate design method Transformation factors.

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. Clough / Penzien, "Dynamics of Structures", McGraw Hill, 1993

PGST104T-1 Elective-I: Advanced Steel Design

Unit 1: Design of eccentric connections.

Unit 2: Design of steel chimneys,

Unit 3: Design of industrial sheds, bridges of crane / gantry Girders.

Unit 4: Design of bridges – highway and railways. Foot Bridge.

Unit 5: Design of storage vessels

Books:

1. RamChandra Design of Steel structures Vol-I & Vol-II Std. book house / Rajsons Publication Pvt. Ltd., Delhi, 2006
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

Unit 1: Engineering geology of earthquakes, faults, Propagation of earthquake waves, quantification of earthquake, magnitude, energy intensity of earthquake, accelerograph, accelogram, recording and analysis of earthquake records, seismicity of the world, Analysis and interpretation of earthquake data, determination of magnitude, epicenter, epicenter distances focal depth, focal mechanism, seismic zoning

Unit 2: Causes or sources of earthquake damage, damage due to ground failure, History of a past earthquakes, generation of response spectrum from available earthquake records, Evolution of seismic risk, Concept of response spectra, generation of site-specific spectrum, characteristics of earthquake ground motion.

Unit 3: Strength, ductility and energy absorption, ductility of reinforced members subjected to flexure. Axial loads & shear detailing of RCC members beam column, Beam-column joints for ductile behaviors, IS code provisions.

Unit 4: Guideline for achieving efficient seismic resistant design, Special aspects in Multi-storey buildings, effect of torsion, flexible first story, P-delta effect, soil-structure, interaction on building response. Drift limitation.

Unit 5: Study of IS: 1893, IS:13920 for analysis and ductile design of RCC structures and other related codes.

Books:

1. Murthy, C.V.R, "Earthquake tips", IIT Kanpur documents.
2. Chopra A. K., Dynamics of Structures, Theory & Application to Earthquake Engineering, 2nd Edition., Pearson Education (Singapore) Pvt. Ltd, New Delhi, 1995
3. Dowrick, D.J, "Earthquake Resistant Design for Engineers and Architects", 2nd Edition; 1987

PGST104T-3 Elective-I: Design of Environmental Structures

Unit 1: Design of Over Head Water Tanks.

Unit 2: Design of under Ground Tanks.

Unit 3: Design of jack well/Pump house / approach bridges.

Unit 4: Design of pretreatment units i.e. clarifloculators aerators, flash Mixture, sand filters etc

Unit 5: Design considerations including loads such as traffic load, backfill load, live load etc. for Appurtenances like man-holes, concrete bedding and thrust blocks for sewers, rising mains etc.

Books:

1. Ghali, A., Circular Storage Tanks and Silos, E & F N Spon, London, (1979)
2. Jain, S.K. & Jaiswal, O.R., Guidelines for seismic design of liquid storage tanks, NICEE, IITK, 2004
3. Anchor, R.D., Design of liquid retaining concrete structure, Edward Arnold, London, (1992)

PGOPEN105T-1 Elective-II: Global Warming and Climate Change

Unit 1: Earth's Climate System: Role of ozone in environment-ozone layer-ozone depleting gases-Green House Effect, Radiative Effects of Greenhouse Gases-The Hydrological Cycle-Green House Gases and Global Warming- Carbon Cycle.

Unit 2: Atmosphere And Its Components: Importance of Atmosphere, Physical Chemical Characteristics of Atmosphere, Vertical structure of the atmosphere, Composition of the atmosphere, Atmospheric stability, Temperature profile of the atmosphere, Lapse rates, Temperature inversion, effects of inversion on pollution dispersion.

Unit 3: Impacts Of Climate Change: Causes of Climate change- Change of Temperature in the environment-Melting of ice Pole, sea level rise, Impacts of Climate Change on various sectors-Agriculture, Forestry and Ecosystem, Water Resources, Human Health, Industry, Settlement and Society. Methods and Scenarios, Projected Impacts for Different Regions, Uncertainties in the Projected Impacts of Climate Change, Risk of Irreversible Changes.

Unit 4: Observed Changes and Its Causes: Climate change and Carbon credits, CDM, Initiatives in India, Kyoto Protocol, Intergovernmental Panel on Climate change, Climate Sensitivity and Feedbacks, The Montreal Protocol, UNFCCC, IPCC, Evidences of Changes in Climate and Environment- on a Global Scale and in India.

Unit 5: Climate Change: Clean Development Mechanism, Carbon Trading, examples of future Clean Technology - Biodiesel, Natural Compost, Eco- Friendly Plastic, Alternate Energy, Hydrogen, Bio-fuels -Solar Energy -Wind -Hydroelectric Power.

Mitigation Measures: Mitigation Efforts in India and Adaptation funding. Key Mitigation Technologies and Practices -Energy Supply, Transport, Buildings, Industry, Agriculture, Forestry. Carbon sequestration- Carbon capture and storage (CCS)- Waste MSW & Bio waste, Biomedical, Industrial waste. International and Regional cooperation.

Books

1. Dash Sushil Kumar, "Climate Change -An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.
2. Adaptation and mitigation of climate change-Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006.
3. Atmospheric Science, J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
4. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

PGOPEN105T-2 Elective-II: Road Safety Engineering

Unit 1: Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

Unit 2: Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction

Unit 3: Road Safety in Planning And Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care

Unit 4: Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections ,Road Safety in Urban Transport, Sustainable Modes and their Safety.

Unit 5: Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

Books:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
3. Transportation Engineering – An Introduction, C.Jotin khisty, B. Kent Lall
4. Fundamentals of Traffic Engineering, Richardo G Sigua
5. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
6. Road Safety by NCHRP

PGST101P Matrix Analysis of Structure

Minimum Six practicals based on syllabus of **PGST101T Matrix Analysis of Structure**

PGST103P Structural Dynamics Lab

Minimum Six practicals based on syllabus of **PGST103T Structural Dynamics**

Unit 1: Principles and discretization, Elements stiffness/mass formulation based on direct, variational and weighted residual techniques.

Unit 2: Shape function, convergence, displacement formulation for rectangular, triangular elements in Cartesian coordinates, Application to 2D stress analysis.

Unit 3: Natural coordinates. Isoparametric elements, Numerical integration, Convergence of Isoparametric elements, Application to 1D problems.

Unit 4: Isoparametric elements for two-dimensional and axisymmetric stress analysis for plane stress/strain problems.

Unit 5: Isoparametric formulation for thin and thick plates and shells. Modeling techniques.

Books:

1. Chandrupatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Rajasekaran S, Finite Element Analysis in Engineering Design, S. Chand & Co.Ltd.New Delhi, 1999.
3. Zienkiewicz O.C. and Taylor R.L., The Finite Element Method (Volume -I), 1st Edition, Tata McGraw Hill Publishing Company Limited, New Delhi, 1989
4. Cook R. D. , Concepts and Applications of Finite Element Analysis, 3rd Edition, Wiley India Text books, Wiley India Pvt Limited, New Delhi, 1989.

Unit 1: Introduction, Moment curvature relation in pure bending, Symmetrical bending of laterally loaded circular plates, Uniformly loaded circular plates with clamped and simply supported edges, Governing differential equations of thin rectangular plates with various boundary conditions & loading.

Unit 2: Laterally loaded rectangular plates, Differential equation of the deflection surface (Lagrange's equation). Boundary conditions, Simply supported plates under sinusoidal loading. Navier's solution. Finite difference method,

Unit 3: General shell geometry. Classification, Membrane theory of cylindrical shells, equation of equilibrium, stress resultants under dead load and snow load for circular, cycloidal, catenary, and parabolic **cylindrical** shells.

Unit 4: Bending theory of cylindrical shells. Finster walder theory, schorer's theory.

Unit 5: Approximate analysis of cylindrical shells by beam arch method.

Books

1. Timoshenko S.P and Krieger S.W, Theory of Plates and Shells, 2nd Edition, McGraw-Hill Book Company, New Delhi, 1970.
2. Chadrashekhara K, Theory of Plates, 1st Edition, Universities Press (India) Ltd, Hyderabad, 2001.
3. Ramaswamy, G.S, Design of Concrete Shells, Krieger Publ. Co., 1984

Unit 1: Design of isolated and combined footings, proportioning of footing for equal settlements.

Unit 2: Theory of Sub grade reaction beam on elastic foundation, Foundation subjected to eccentric loads

Unit 3: Design of rafts – I. S. code method, introduction to various methods.

Unit 4: Floating foundations, analysis and design of pile foundations, negative skin friction, group action in piles, design of pile cap.

Unit 5: Analysis and design of simple machine foundation using I.S. code.

Books:

1. Sawmi Saran, “ Analysis and Design of Substructures”, , Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
2. Kurain N. P,” Design of foundation systems- Principles and Practice”, Narosa Publishing house, New Delhi, 2005.
3. Karuna Moy Ghosh , “Foundation Design in practice”, PHI Learning Pvt. Ltd, New Delhi 2012
4. P. C. Varghese, “Design of Reinforced Concrete Foundations”, PHI Learning Pvt. Ltd., New Delhi, 2009

Unit 1: Performance of buildings, behaviors of various type of buildings in past earthquakes.

modes of failures, influence of unsymmetry, infill walls, foundations, soft story & detailing of reinforcements in buildings.

Unit 2: Frames shear walled buildings, mathematical modeling of building with different

structural systems Analysis of frames shear walled buildings, Analysis of coupled shear walled building.

Unit 3: Special aspects in Multi-story buildings, Effect of torsion, flexible first story, P-delta

effect, soil-structure interaction on building response, drift limitation.

Unit 4: Strength, ductility and energy absorption, ductility of reinforced members subjected to

flexure, axial loads & shear. Detailing of RCC members, beam, column, Beam-column joints for ductile behaviors, IS code provisions.

Unit 5: Design of multi-story buildings with bracings & infills.

Books:

1. Paulay, T. & Prestiley, M.J.N., Seismic design of R C & Masonry Buildings, John Willey & Sons; 2nd Edition, 1999
2. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, Kluwer Academic Publisher, 2001
3. Booth, E., Concrete Structures in Earthquake Regions, Longman Higher Education, 1994

PGST204T-2 Elective-III: Design of Composite Construction

Unit 1: Introduction Steel concrete composite Analysis and of composite beams

Unit 2: Composite floors, shear connectors: factions & types

Unit 3: Steel concrete composite columns, columns subjected to axial loads and moments

Unit 4: Encased composite construction of beams and columns, concepts and design.

Unit 5: Study of IS 11384, IRC-22 and their applications

Books:

1. M. Daniel and O. Ishai, Engineering mechanics of Composite materials, Oxford university press, 1999
2. P.K. Mallick, Fiber-reinforced Composites, Marcel Dekker Inc, 1988.
3. D. Hull and T. W. Clyne, An introduction to composite materials, Cambridge university press, Second Edition, 1996.
4. J.N. Reddy, Mechanics of laminated composite plates and shells-Theory and Analysis, CRC Press, Boca Raton, Second Edition, 2003.
5. INSDAG course Material

PGST204T-3 Elective-III: New Engineering Materials and Technology

Unit 1: Steel fibers reinforced concrete Properties, Aspect ratio, strength, durability of fibre reinforced plastics other types of fibers any their applications.

Unit 2: Light weight concrete. Ferro cement concrete, their types, foam concrete, workability durability, and composition, application.

Unit 3: Fly ash blended concrete, replacement procedures, effect of admixtures, adhesives, bond strength, durability applications.

Unit 4: High-grade concrete, high strength performance concrete, tremie concrete.

Unit 5: Concrete admixture. Accelerators, retarders, ND Testing of materials.

Books:

1. Neville A. M., Properties of Concrete, Pearson Education Limited.
2. Rafat siddhequi , Special Concretes, Galgotia Publications.
3. M Gambhir, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
4. Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
5. Shetty M. S, Concrete Technology, S. Chand Publisher.

PGST206P**RCC Design Lab**

1. Review of IS 456, IS 962 Basics of Limit State Design (Beams, Columns, Slabs) Design of Multistoried buildings
2. Design for axial force, flexural, shear and combined effects
3. Slabs (one way & two way) and slabs on grades. Preliminary sizing and modeling of RC structures

PGST207P**Steel Design Lab**

1. Review of IS 800
2. Elementary Design of Beam including open web sections
3. Elementary Design of various types of truss.
4. Design of Plate Girders
5. Structural Fasteners and Connections (Bolted/ Welded Connections all types)

PGOPEN301T-1 Elective-IV: Water Resources Management

Unit 1: Introduction: World water resources, water resources in India, water as finite resource, variability of water in time & space, history of water resources development, water infrastructure-problems and perspectives, present institutional framework for water management.

Water laws: Constitutional provisions, National Water Policy, riparian rights / ground water ownership, prior appropriation, permit systems, acquisition and use of rights, scope for privatization. (3Hrs)

Economics of water: Water as economic good, intrinsic value, principles of water pricing & water allocation, capital cost, opportunity cost, internal rate of return, benefit cost analysis, principles of planning and financing of water resources project.

Unit 2: Probabilistic and statistical methods: statistical parameters, mean, mode, median, standard deviation, curtosis, probability, random events, random variable, functions of random variables, moments and expectations, common probabilistic distributions (normal, lognormal, poisson, extreme value, log-pearson etc.) estimation of parameters, goodness of fit tests, regression and correlation analysis.

Systems engineering: Systems Engg. concepts, optimizing techniques, conventional (LP, NLP, DP...) and evolutionary (ANN, fuzzy logic, genetic algorithm), simulation, applications of soft computing techniques for water resources planning and management

Unit 3: Flood management: causes of floods, structural and non-structural measures, mitigation plan, flood damage assessment, use of geoinformatics, Drought management: types of droughts, severity index, drought forecasting, damage assessment, mitigation plan, use of geoinformatics.

Unit 4: Basin scale hydrology: Estimation of surface water, estimation of ground water draft/recharge import/ export of water (interbasin water transfer), recycling and reuse, storages.

Demand and supply based management: Consumptive & non consumptive demands, irrigation demand estimation, water utilization, irrigation efficiency, water management in irrigation sector, demand estimation in hydro/thermal/nuclear power sector, estimation & forecasting of water demands of domestic & industrial sector, navigation and recreational water demands

Unit 5: Environmental management: protection of vital ecosystem, water requirements for environmental management, aquaculture, minimum flows, water quality management for various uses.

Social impact of water resources development: direct/ indirect benefits, employment generation, industrial growth, agro-industry, enhanced living standards, education & health, co-operative movement, management of rehabilitation & resettlement, control of water logging, salinity, & siltation of storages.

Books

1. Water Resources Systems Engg, D. P. Loucks, Prentice Hall
2. A. K. Biswas; Systems Approach to Water Management, McGraw Hill Book Co, New York.
3. Chaturvedi, M.C. "Water Resources Systems Planning and Management" Tata McGraw Hill
4. Water resources hand book; Larry W. Mays, McGraw International Edition
5. ANN in Hydrology; Govinda Raju & Ramachandra Rao; PHI
6. "Handbook of Applied Hydrology" by Van Tee Chow- McGraw Hill

PGOPEN301T-2 Elective-IV: Disaster Management and Mitigation

Unit 1: Introduction to Disaster :Meaning, Nature, Importance of Hazard, Risk, Vulnerability and Disaster-Dimensions & Scope of Disaster Management- India's Key Hazards - Vulnerabilities - National disaster management framework - Disaster Management Cycle.

Unit 2: Natural Disasters: Natural Disasters- Meaning and nature of natural disaster; their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion.

Unit 3: Anthropogenic Disasters: Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation and industrial waste water pollution.

Unit 4: Approaches in Disaster Management : Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/ forecasting & warning - Preparing disaster preparedness plan - Land use zoning - Preparedness through Information, education. Emergency Stage - Rescue training for search & operation - Immediate relief - Assessment surveys. Post Disaster stage - Rehabilitation - Social Aspect - Economic Aspect and Environmental Aspect.

Unit 5: Disaster Mitigation: Meteorological observatory - Seismological observatory - Hydrology Laboratory and Industrial Safety inspectorate. Technology in Disaster Management- Emergency Management Systems (EMS) in the Disaster Management Cycle -Remote Sensing and Geographic Information Systems(GIS) in Disaster Management.

BOOKS:

1. Sharma.S.R, "Disaster management", A P H Publishers, 2011.
2. VenuGopalRao.K, "Geoinformatics for Disaster Management", Manglam Publishers and Distributors, 2010.
3. Singh.R.B, "Natural Hazards and Disaster Management: Vulnerability and Mitigation", Rawat Publications, 2006.
4. Gupta.H.K, "Disaster Management", University Press, India, 2003.
5. Gupta.M.C, "Manuals on Natural Disaster management in India", National Centre for Disaster Management,IIPA, New Delhi, 2001

PGST303P

Project Seminar

Seminar based on topic for research for project

PGST401P

Project

Seminar research work based on some topic related to structural Engineering

Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur
Scheme for absorption of students from old scheme to M Tech (Structural Engineering) CBS 2016

New Scheme CBS 2016		Equivalent Subject of Old Scheme	
Subject Code	Subject Name	Subject Code	Subject Name
Semester 1			
PGST101T	Matrix Analysis of Structures	IFST03	Matrix Analysis of Structure
PGST102T	Theory of Elasticity & Elastics Stability	IFST01	Theory of Elasticity & Elastics Stability
PGST103T	Structural Dynamics	IIFST04	Structural Dynamics
PGST104T	Elective-I	IFST02	Numerical Methods for Structural Analysis
PGOPEN105T	Elective -II (Open)	IFST05	Plastics Analysis and Design of Steel Structure
PGST101P	Matrix Analysis of Structure Lab	IFST03	Matrix Analysis of Structure (Practical)
PGST103P	Structural Dynamics Lab	IIFST04	Structural Dynamics (Practical)
	----	IFST04	Structural Instrumentation & Material Science
Semester 2			
PGST201T	Finite Element Method	IIFST02	Finite Element Method
PGST202T	Theory of Plates & Shells	IIFST01	Theory of Plates & Shell
PGST203T	Foundation Design	IIFST03	Foundation Design
PGST204T	Elective-III	IIFST05	Elective-I
PGFD205T	Research Methodology	----	-----
PGST206P	RCC Design Lab	IIIFST01	Advanced Concrete Structures (Practical)
PGST207P	Steel Design Lab	IIFST05	Elective-I (Practical)
Semester 3			
PGOPEN301T	Elective -IV (Open)	IIIFST02	Elective-II
PGFD302T	Project Planning & Management	----	-----
PGST303P	Project Seminar	IIIFST03	Seminar on Dissertation
		IIIFST01	Advanced Concrete Structures
Semester 4			
PGST401P	Project	IVFST01	Dissertation/Thesis (Viva Voce)

Scheme for absorption of students from Very Old Scheme to New Scheme (CBS-2016)

M Tech in Structural Engineering

New Scheme (CBS-2016)		Very Old Scheme
Subject Code	Subject Name	Subject Name
PGST101T	Matrix Analysis of Structures	Structural Analysis
PGST102T	Theory of Elasticity & Elastics Stability	Theory Of Elasticity
PGST103T	Structural Dynamics	Structural Dynamics
PGST104T	Elective-I	Elective-I
PGOPEN105T	Elective –II (Open)	Plastic Theory & Ultimate Load Analysis
PGST101P	Matrix Analysis of Structure Lab	Structures Lab
PGST103P	Structural Dynamics Lab	Structural Dynamics (Practical)

PGST201T	Finite Element Method	Finite Element Method
PGST202T	Theory of Plates & Shell	Theory & Design Of Plates
PGST203T	Foundation Design	Foundation Design
PGST204T	Elective-III	Elective-II
PGFD205T	Research Methodology	-----
PGST206P	RCC Design Lab	Elective-I (Practical)
PGST207P	Steel Design Lab	Elective-II (Practical)

PGOPEN301T	Elective –IV (Open)	Structural Optimization
PGFD302T	Project Planning & Management	-----
PGST303P	Project Seminar	Seminar/ Project

PGST401P	Project	Project
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Rashtrasant Tukadoji Maharaj Nagpur University
Scheme of Examination of M. Tech. in Structural Engineering (Non CBS)
 Note: This scheme is replaced by Choice Based Credit Scheme from 2016-17

First Semester														
Subject Code	Subject	Teaching Scheme Clock Hours per week				Assessment of Marks for Theory				Assessment of Marks for Theory				Duration of paper in hrs
		L	T	P/D	Total	Paper	CA	Total	Min for Passing	Univ Exam	CA	Total	Min for Passing	
IFST01	Theory of Elasticity & Elastics Stability	3	1	-	4	70	30	100	50	-	-	-	-	3
IFST02	Numerical Methods for Structural Analysis	3	1	-	4	70	30	100	50	-	-	-	-	3
IFST03	Matrix Analysis of Structure	3	1	2	6	70	30	100	50	25	25	50	25	3
IFST04	Structural Instrumentation & Material Science	3	1	2	6	70	30	100	50	25	25	50	25	3
IFST05	Plastics Analysis and Design of Steel Structure	3	1	-	4	70	30	100	50	-	-	-	-	3
	Total	15	5	4	24	350	150	500	250	50	50	100	50	Total (T+P)=600

Second Semester														
Subject Code	Subject	Teaching Scheme Clock Hours per week				Assessment of Marks for Theory				Assessment of Marks for Theory				Duration of paper in hrs
		L	T	P/D	Total	Paper	CA	Total	Min for Passing	Univ Exam	CA	Total	Min for Passing	
IIFST01	Theory of Plates & Shell	3	1	-	4	70	30	100	50	-	-	-	-	3
IIFST02	Finite Element Method	3	1	-	4	70	30	100	50	-	-	-	-	3
IIFST03	Foundation Design	3	1	-	4	70	30	100	50	-	-	-	-	3
IIFST04	Structural Dynamics	3	1	2	6	70	30	100	50	25	25	50	25	3
IIFST05	Elective-I	3	1	2	6	70	30	100	50	25	25	50	25	3
	Total	15	5	4	24	350	150	500	250	50	50	100	50	Total (T+P)=600

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Third Semester														
Subject Code	Subject	Teaching Scheme				Assessment of Marks for Theory				Assessment of Marks for Theory				Duration of paper in hrs
		Clock Hours per week				Paper	CA	Total	Min for Passing	Univ Exam	CA	Total	Min for Passing	
		L	T	P/D	Total									
IIIFST01	Advanced Concrete Structure	3	1	2	6	70	30	100	50	25	25	50	25	3
IIIFST01	Elective-II	3	1	-	4	70	30	100	50	--	--	--	--	3
IIIFST01	Seminar on Dissertation	--	--	--	--	--	--	--	--	--	150	150	--	--
	Total	6	2	2	10	140	60	200	100	25	175	200	25	Total (T+P)=400

Fourth Semester														
Subject Code	Subject	Teaching Scheme				Assessment of Marks for Theory				Assessment of Marks for Theory				Duration of paper in hrs
		Clock Hours per week				Paper	CA	Total	Min for Passing	Univ Exam	CA	Total	Min for Passing	
		L	T	P/D	Total									
IVFST01	Dissertation/ Thesis (Viva-Voce)	--	--	12	12	--	--	--	--	400	--	400	200	--

Syllabus of for First Semester M.Tech. (Structural Engineering) Full Time

I FST01 THEORY OF ELASTICITY AND ELASTIC STABILITY

SECTION A

1. Analysis of Stress and strain in 2 dimensions: Introduction, Types of forces, Components of Stresses and strains, Stress-strain relation, Plane stress and plane strain strain at a point, Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Airy's stress function.
2. Analysis of stress and strain in 3 dimensions: Components of stress, principal stresses, stress invariants, Maximum shearing stress, Differential equation of equilibrium, Boundary conditions and compatibility equations.
3. Bending of cantilever of narrow rectangular section loaded at end, Bending of simply supported beam with uniform load torsion of non-circular sections, Elliptical cross section.

SECTION B

4. Differential equation for beams columns with concentrated loads continuous lateral loads and couples for simply supported ends, Application of trigonometric series, Lateral buckling of beams.
5. Energy method for elastic buckling of columns, Approximate method, Buckling of columns on elastic foundation, Columns with intermediate compressive forces and distributed axial load, Columns with changes in cross section.
6. Effect of shearing force on critical load, Buckling of built up columns, Buckling of simply supported rectangular plates uniformly compresses in middle plane.

I FST02 NUMERICAL METHODS FOR STRUCTURAL ANALYSIS

SECTION A

1. Programming fundamentals, introduction to algorithm development, interpolation & extrapolation.
2. Integration (central difference method, the Houbolt method, Newmark's method, Wilson -6 method), Newton-Gauss Quadrature method.
3. Solution of linear algebraic equations, Gauss elimination, Cholesky, Gauss Cholesky methods Given's Householder methods, solution errors.

SECTION B

1. Solution of non linear Equation (Newton Raphson scheme, BFGS (Broyden et al) methods introduction to line search algorithms
2. Eigen values problems (Jacob, QR Method, Introduction to Determinant search method, Subspace iteration. Householder & Given's algorithms)
3. Initial & two point boundary value problem Euler's, Runge-Kutta, Milne's Methods Computer oriented algorithms

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I FST03 MATRIX ANALYSIS OF STRUCTURES

SECTION A

1. Stiffness method for plane truss and plane frames
2. Stiffness method for plane grid and space frames
3. Analysis of building systems for horizontal loads

SECTION B

4. Analysis for member loading (self, temperature & Imposed), inclined supports, lack of fit, initial joints displacements.
5. Effect of shear deformation. Internal member end releases.
6. Solution technique with banded & skyline technique, band minimization, frontal techniques

PRACTICAL:

Minimum Six practicals based on above syllabus

I FST04 STRUCTURAL INSTRUMENTATION AND MATERIAL SCIENCE

SECTION A

1. Study of various transducers & Principle of their working, displacement velocity acceleration.
2. Stress-strain measurement strain gauges static and dynamics strain measurement Calculation of stresses from measurement of strain deflections etc
3. Special materials for building constructions i.e. steel fibre reinforced concrete, fibre reinforced plastics

SECTION B

4. Non-destructive testing of concrete/steel/ultrasonic techniques etc, model Analysis related to structures
5. Admixture for concrete theories of corrosion and its preventions.
6. Special concrete like lightweight concrete. No fines concrete. Ferro cement. Fly ash concrete etc. high performance concrete.

PRACTICAL:-

Minimum Six practicals based on above syllabus

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I FST05 PLASTIC ANALYSIS & DESIGN OF STEEL STRUCTURES

SECTION A

1. Plastic behavior, review curves of structural steel, plastic moments, shape factors, load factors, plastic hinge, types of collapse, collapse mechanism, collapse load factor.
2. Upper and lower bound uniqueness theorems principle of virtual work. Statical method, minimum and maximum theorems step by step method.
3. Methods of release of restrains, load interaction diagrams method of inequalities.

SECTION B

4. Plastic Moment distribution applied to continuous beams & portal frames (Max two bays single storey)
5. Effect of Axial force & shear force on (Plastic moment of resistance)
6. Design of beams continuous beams and portal frames up to two storey – two bays.
7. Minimum weight analysis, introduction to stability.

Syllabus of Examination for Second Semester M. Tech. (Structural Engineering) Full Time

II FST01 THEORY OF PLATES AND SHELLS

SECTION A

1. Introduction, Moment curvature relation in pure bending, Symmetrical bending of laterally loaded circular plates, Uniformly loaded circular plates with clamped and Governing differential equations of thin rectangular plates with various boundary conditions & loading.
2. Laterally loaded rectangular plates, Differential equation of the deflection surface (Lagrange's equation). Boundary conditions, Simply supported plates under sinusoidal loading. Navier's solution.
3. Finite difference method, Differential equation to bent surface of anisotropic plate, Application to grid.

SECTION B

4. General shell geometry. Classification, Membrane theory of cylindrical shells, equation of equilibrium, stress resultants under dead load and snow load for circular, cycloidal, catenary, and parabolic cylindrical shells.
5. Bending theory of cylindrical shells. Finster walder theory, scorer's theory.
6. Approximate analysis of cylindrical shells by beam arch method.

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IIFST02 FINITE ELEMENT METHOD

SECTION A

1. Principles and discretization, Elements stiffness/mass formulation based on direct, variational and weighted residual techniques.
2. Shape function, convergence, displacement formulation for rectangular, triangular elements in Cartesian coordinates, Application to 2D stress analysis.
3. Natural coordinates. Isoparametric elements, Numerical integration, Convergence of Isoparametric elements, Application to 1D problems.

SECTION B

4. Isoperimetric elements for two-dimensional and axisymmetric stress analysis for plane stress/strain problems.
5. Isoperimetric formulation for thin and thick plates and shells.
6. Modeling techniques, application of FEM packages to general engineering structures.

IIFST03 FOUNDATION DESIGN

SECTION A

1. Design of isolated and combined footings, proportioning of footing for equal settlements.
2. Theory of Sub grade reaction beam on elastic foundation
3. Design of rafts – I. S. code method, introduction to various methods.

SECTION B

4. Floating foundations, analysis and design of pile foundations, negative skin friction, group action in piles, design of pile cap.
5. Foundation subjected to eccentric loads, pull out resistance of foundation structures.
6. Analysis and design of simple machine foundation using I.S. code.

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IIFST04 STRUCTURAL DYNAMICS

SECTION A

1. Fundamentals of Rigid/Deformable body dynamics, Analysis of undamped and viscously damped, single degree freedom systems.
2. Response of single degree freedom systems to harmonic loading support motion and transmissibility Duhamels integral.
3. Study of IS 1893-1984 and 2000 applicable to buildings and water tanks.

SECTION B

4. Free vibrations of lumped mass multi degree freedom systems, shear buildings orthogonality criteria Rayleigh's method.
5. Dynamic analysis of systems with distributed properties, Approximate design method Transformation factors.
6. Response spectra, Introduction to vibrations due to earthquake.

PRACTICAL:

Minimum Six experiments based on above syllabus

II FST04 Elective – I ADVANCED STEEL DESIGN

SECTION A

1. Design of connections.
2. Design of round tubular structures, Design of steel chimneys, Design of storage vessels

SECTION B

3. Design of industrial sheds, bridges of crane / gantry Girders.
4. Design of bridges – highway and railways. Foot Bridge.

PRACTICAL:

Minimum Four practical designs based on above syllabus.

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Note: This scheme is replaced by Choice Based Credit Scheme from 2016-17

II FST04

Elective – I DESIGN OF EARTHQUAKE RESISTANT STRUCTURES

SECTION A

1. Engineering geology of earthquakes, faults, Propagation of earthquake waves, quantification of earthquake, magnitude, energy intensity of earthquake, accelerograph, accelogram, recording and analysis of earthquake records, seismicity of the world, Analysis and interpretation of earthquake data, determination of magnitude, epicenter, epicenter distances focal depth, focal mechanism, seismic zoning
2. Causes or sources of earthquake damage, damage due to ground failure, History of past earthquakes, generation of response spectrum from available earthquake records, Evolution of seismic risk, Concept of response spectra, generation of site-specific spectrum, characteristics of earthquake ground motion.
3. Guideline for achieving efficient seismic resistant design, geotechnical design consideration, determination of average shear wave velocity, average SPT etc.

SECTION A

4. Strength, ductility and energy absorption, ductility of reinforced members subjected to flexure. Axial loads & shear detailing of RCC members beam column, Beam-column joints for ductile behaviors, IS code provisions.
5. Special aspects in Multi-storey buildings, effect of torsion, flexible first story, P-delta effect, soil-structure, interaction on building response. Drift limitation.
6. Study of IS: 1893, IS:13920 for analysis and ductile design of RCC structures and other related codes.

Reference Books:

1. IS:1893 – 2002
2. IS: 19920 – 1993
3. Handbook on seismic analysis and design of structures, Farzad neaim

II FST04

Elective –I DESIGN OF ENVIRONMENTAL STRUCTURES

SECTION A

1. Design of Over Head Water Tanks.
2. Design of under Ground Tanks.

SECTION B

3. Design of jack well/Pump house / approach bridges.
4. Design of pretreatment units i.e. clarifloculators aerators, flash Mixture, sand filters etc

PRACTICAL:

Four practical designs based on above syllabus

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Syllabus of Examination for Third Semester M. Tech (Structural Engineering) Full Time

III FST01 ADVANCE CONCRETE STRUCTURES

SECTION A

1. Analysis and Design of Slab type & T – Beam bridges, IRC Recommendations.
2. Analysis and Design of Elevated service Reservoirs. IS Recommendations for wind & earthquake, Ductile detailing.

SECTION B

3. Analysis and design of Multistoried buildings, calculation of loads, Approximate analysis, Preliminary sizing, IS: 87S, IS: 1893 recommendations, Ductile detailing.
4. Analysis and design of special structures i.e. pipes (underground, on ground, Elevated), silos, Bunkers, chimneys, IS recommendations.

PRACTICAL:-

Minimum two Designs / Experiments based on above syllabus

Reference Books:

1. Plan & reinforced concrete Structures Vol-II. Jain & Jaikrishna
2. IS:1893-2002
3. Handbook on seismic analysis and design of structures, Farzad neaim
4. Seismic design of R C & masonry Buildings, paulay & Prestiley
5. Earthquake resistant Design for engineers & Architects, Dowrick DJ
6. Concrete Structures in earthquake regions Booth E.

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III FST02 Elective – II HIGH RISE STRUCTURES

SECTION A

1. Performance of buildings, behaviors of various type of buildings in past earthquakes. modes of failures, influence of unsymmetry, infill walls, foundations, soft story & detailing of reinforcements in buildings.
2. Frames shear walled buildings, mathematical modeling of building with different structural systems Analysis of frames shear walled buildings, Analysis of coupled shear walled building.
3. Special aspects in Multi-story buildings, Effect of torsion, flexible first story, P-delta effect, soil-structure interaction on building response, drift limitation.

SECTION B

4. Strength, ductility and energy absorption, ductility of reinforced members subjected to flexure, axial loads & shear. Detailing of RCC members, beam, column, Beam-column joints for ductile behaviors, IS code provisions.
5. Design of multi-story buildings with bracings & infills.
6. Seismic design of floor diaphragm

Reference Books:

1. IS 1893-2002
2. Handbook on seismic analysis and design of structures, Farzad nealm
3. Seismic design of RC & masonry Buildings, paulay & Prestiley
4. Earthquake resistant Design for engineers & Architects, Dowrick DJ
5. Concrete structures in earthquake regions. Booth E.
6. Reinforced Concrete Structures, Park & Paulay.

III FST02 Elective – II DESIGN OF COMPOSITE CONSTRUCTIONS

SECTION A

1. Introduction to composite construction, basic concepts, types of composite constructions.
2. Steel concrete composite Analysis and of composite beams
3. Composite floors, shear connectors: factions & types

SECTION B

4. Steel concrete composite columns, columns subjected to axial loads and moments
5. Encased composite construction of beams and columns, concepts and design.
6. Study of IS 11384, IRC-22 and their applications

PRACTICALS:

Minimum two Designs/Experiments based on above syllabus.

Reference Books:

1. Steel design manual – Construction steel research and development organization
2. IS:11384
3. IRC-22
4. INSDAG course Material
5. Composite Structures, GM Sabnis

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III FST02 Elective – II NEW ENGINEERING MATERIALS AND TECHNOLOGY

SECTION A

1. Steel fibers reinforced concrete Properties, Aspect ratio, strength, durability of fibre reinforced plastics other types of fibers any their applications.
2. Light weight concrete. Ferro cement concrete, their types, foam concrete, workability durability, and composition, application.
3. Fly ash blended concrete, replacement procedures, effect of admixtures, adhesives, bond strength, durability applications.

SECTION B

4. High-grade concrete, high strength performance concrete, trimix concrete.
5. Concrete admixture. Accelerators, retarders, ND Testing of materials.
6. Introduction to steel concrete composite including infill, encased section, properties of shear connectors use of IS 11384, IRC 220.

Reference Books:

IIIFST03 SEMINAR / PROJECT

Seminar based on topic for research for project

IVFST01 PROJECT

Seminar research work based on some topic related to structural Engineering.
