Rashtrasant Tukadoji Maharaj Nagpur University,
NagpurFaculty of Engineering & Technology
Course and Examination Scheme of M. Tech. in Computer Aided Structural Engineering (Proposed)
Choice Based Credit System (CBCS)

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	PGCS101T	Finite Element Analysis	4	--	4	30	70	100	50
Core Subject -II	PGCS102T	Advanced Concrete Structures	4	--	4	30	70	100	50
Core Subject -III	PGCS103T	Structural Dynamics	4	--	4	30	70	100	50
Elective –I (Discipline Specific)	PGCS104T	Elective-I	4	--	4	30	70	100	50
Elective –II (Open)	PGOPEN105T	Elective –II (Open)	4	--	4	30	70	100	50
Laboratory -I	PGCS101P	Finite Element Analysis Studio	--	2	1	50	50	100	50
Laboratory -II	PGCS106P	CAD & Computer Application in Structural Engineering Lab	--	2	1	50	50	100	50
		Total	20	4					
Semester Total			24		22	250	450	700	

Elective-I	PGCS104T	Computer Aided Numerical Methods
Elective-I	PGCS104T/ PGST104	Earthquake Resistant Design of Steel Buildings
Elective-I	PGCS104T/ PGST102T	Theory of Elasticity & Elastics Stability
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	PGCS201T	Advanced Steel Design	4	--	4	30	70	100	50
Core Subject -V	PGCS202T	Foundation Design	4	--	4	30	70	100	50
Core Subject -IV	PGCS203T	Design of Composite Structures	4	--	4	30	70	100	50
Elective –III (Discipline Specific)	PGCS204T	Elective-III	4	--	4	30	70	100	50
Foundation Course-I	PGFD205T	Research Methodology	4	--	4	30	70	100	50
Laboratory -III	PGST207P	Advanced Steel Design Studio	--	2	1	50	50	100	50
Laboratory -IV		Foundation Design Studio	--	2	1	50	50	100	50
		Total	20	4					
Semester Total			24		22	250	450	700	
Elective-III	PGCS204T/ PGST204T	High Rise Structures							
Elective-III	PGCS204T/ PGST202T	Analysis of shells and folded plates							
Elective-III	PGCS204T	Structural Instrumentation							

Semester 3									
Subject Category	Subject Code	Subject	Teaching Scheme Hours per week L	P	No. of Credits	Marks Internal	Univ Exam	Total	Passing
Elective –IV (Open)	PGOPEN301T	Elective –IV (Open)	4	--	4	50	50	100	50
Foundation Course-III	PGFD302T	Project Planning & Management	4	--	4	50	50	100	50
Project Seminar	PGST303P	Project Seminar	--	3*	6	50	150	200	100
		Total	8	3					
	Semester Total			11	14	150	250	400	

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

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

NOTE:

1.In every course which having Internal Assessment, 50% weightage is given to student activity and 50% weightage on Class Test (Average of two Class test)

2. Student will learn computer application in structural engineering through various software's and complete the technical activity with respect to concern courses of the programs.

Master of Technology in Computer Aided Structural Engineering

Choice Base Credit System (CBCS)
Semester: 1

FINITE ELEMENT ANALYSIS

Course Outcomes:

1. Understand solution methodologies for solving complex stress analysis problems.
2. understand the general steps of finite element methods and be able to derive equations in finite element methods for 1D, 2D and 3D problems
3. Study of Two Dimensional FEM-Different types of elements for plane stress and plane strain analysis
4. Study of Isoparametric formulation-Concept, Different isoparametric elements for 2d analysis Formulation of 4-noded and 8-noded isoparametric quadrilateral elements
5. Study of Three Dimensional FEM-Different 3-D elements, 3D strain –displacement relationshipformulation of hexahedral and isoparametric solid element

CO-PO Mapping

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Understand solution methodologies for solving complex stress analysis problems.	3	1		1	2				1	2		1
2	understand the general steps of finite element methods and be able to derive equations in finite element methods for 1D, 2D and 3D problems	3	2		1	2				1	1		1
3	Study of Two Dimensional FEM-Different types of elements for plane stress and plane strain analysis	3	3		2	2				1	1		1
4	Study of Isoparametric formulation-Concept, Different isoparametric elements for 2d analysisFormulation of 4-noded and 8-noded isoparametric quadrilateral elements	2	2		2	2					1		1
5	Study of Three Dimensional FEM-Different 3-D elements, 3D strain –displacement relationshipformulation of hexahedral and isoparametric solid element	2	2		2	2				1	1		1
Average		**2.6**	**2**		**1.6**	**2**				**0.8**	**1.2**		**1**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit 1: Introduction-Concepts of FEM –steps involved –merits &demerits –energy principles – Discretization –Rayleigh –Ritz method of functional approximation. Elastic formulations: Stress equations-strain displacement relationships in matrix form-plane

stress, plane strain and Axi-symmetric bodies of revolution with axi symmetric loading using Appropriate Software.

Unit 2: One Dimensional FEM-Stiffness Matrix for Beam and bar elements shape functions for ID elements –static condensation of global stiffness matrix-solution –Initial strain and temperature effects using Appropriate Software.

Unit 3: Two Dimensional FEM-Different types of elements for plane stress and plane strain analysis –Displacement models –generalized coordinates-shape functions-convergent and compatibility requirements –Geometric Invariance –Natural coordinate system-area and volume coordinates-Generation of element stiffness and nodal load matrices –static condensation using Appropriate Software.

Unit 4: Isoparametric formulation-Concept, Different isoparametric elements for 2d analysisFormulation of 4-noded and 8-noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.Axi symmetric analysis –bodies of revolution-axi symmetric modelling –strain displacement relationship-formulation of axi symmetric elements.

Unit 5: Three Dimensional FEM-Different 3-D elements, 3D strain –displacement relationship formulation of hexahedral and iso parametric solid element.

Books:

- Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla and Ashok D. Belegundu – Pearson Education Publications.
- Finite Element analysis – Theory & Programming by C.S.Krishna Murthy- Tata Mc.Graw Hill Publishers
- Finite Elements Methods in Engineering by Tirupati. R. Chandrnpatla, Universities Press India Ltd. Hyderabad.
- Finite element method and its application by Desai, 2012, Pearson Pubilications.
- Finite element methods by Darrel W.Pepper, Vikas Pubilishers
- Finite element analysis and procedures in engineering by H.V.Lakshminaryana, 3rd edition, universities press, Hyderabad.
- Finite element analysis in Engineering Design by S.Rajasekharan, S.Chand Publications, New Delhi.
- Finite element analysis by S.S. Bhavakatti-New age international publishers

Advanced Concrete Structures

Course Outcomes:

Student Should get the Knowledge of design of slab and T-beam bridges.
A person with broad vision and complete knowledge of analysis and design of elevated service reservoirs.
The student will be able to analysis and design of multistoried buildings using STAAD-Pro Software.
The student will be able to analysis and design of special structures i.e. pipes, silos & bunkers.
Student Should get the Knowledge of design of silos.

Sr. No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Student Should get the Knowledge of design of slab and T-beam bridges.	2	1	3		1	1	1		1	1		3
2	A person with broad vision and complete knowledge of analysis and design of elevated service reservoirs.	1	1	3		1	1	1		1	1		3
3	The student will be able to analysis and design of multistoried buildings using STAAD-Pro Software.	2	2	3		2	1	1		1	1		3
4	The student will be able to analysis and design of special structures i.e. pipes, silos & bunkers.	2	2	3		2	1	1		1	1		3
5	Student Should get the Knowledge of design of silos.	2	1	3		2	1	1		1	1		3
Average		**1.8**	**1.4**	**3**		**1.6**	**1**	**1**		**1**	**1**		**3**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit-1: Analysis and design of slab, type and T-beam bridges using SAP / STAAD-Pro Software, IRC recommendations.

Unit-2: Analysis and design of elevated service reservoirs, IS recommendations for wind and earthquake and ductiledetailing.

Unit-3: Analysis and design of multistoried buildings using STAAD-Pro Software, calculation of loads, approximate analysis, primary sizing, IS:875, 1893 recommendations, ductile detailing.

Unit-4: Analysis and design of special structures i.e. pipes (underground, on ground and elevated), silos, bunkers,IS recommendations.

Unit-5: Design of silos

Reference books:

1. Plain and reinforced concrete structures Vol. II: *Jain and Jaikrishna.*
2. IS 456-2000
Design & Construction of Silos & Bunkers: *Sargis S. Safarian, Earnest C Harris*
Advance RCC Design by S.S. Bhavikatti

Structural Dynamics

Course Outcomes:

1. Determine the response of single and multi degree freedom systems.
2. Apply appropriate techniques to analyze and interpret data for solving problems related to single and multi-degree freedom systems and shear buildings
3. Demonstrate the knowledge and understanding of principles of dynamics under varying loading conditions.
4. Develop mathematical solutions to predict system response subjected to dynamic loads.
5. Dynamic analysis of systems with distributed properties.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Determine the response of single and multi degree freedom systems.	1	1	1		1	1	3		3	3		3
2	Apply appropriate techniques to analyze and interpret data for solving problems related to single and multi-degree freedom systems and shear buildings	1	1	1		2	2	2		2	2		3
3	Demonstrate the knowledge and understanding of principles of dynamics under varying loading conditions.	1	1	1		1	1	2		2	1		3
4	Develop mathematical solutions to predict system response subjected to dynamic loads.	1	1	1		2	1	1		3	1		3
5	Dynamic analysis of systems with distributed properties.	1	1	1		1	1	1		2	1		3
Average		**1**	**1**	**1**		**1.4**	**1.2**	**1.8**		**2.4**	**1.6**		**3**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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 1893-2002 and 2016 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

Elective-I: Computer Aided Numerical Methods

Course Outcomes:

1. Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.
2. Illustrate the concept of various numerical integration, Newton-Cotes integration formulas, Trapezoidal rule-Romberg Integration, Simpson's rule, Gaussian quadrature, Errors in integration formulas
3. Solve the given system of equation by Gauss elimination method, gauss-Jordan method, L-U decomposition, Errors in the solution, iterative methods, solution of sets of non linear equations
4. Analyse the problem boundary Value.
5. Evaluate numerical Solution of Elliptical partial differential Equations.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Apply numerical methods to find our solution of algebraic equations using different methods under different conditions, and numerical solution of system of algebraic equations.	1	1	2		2	1	1		1	2		3
2	Illustrate the concept of various numerical integration, Newton-Cotes integration formulas, Trapezoidal rule-Romberg Integration, Simpson's rule, Gaussian quadrature, Errors in integration formulas	1	1	2		2	1	1		1	2		3
3	Solve the given system of equation by Gauss elimination method, gauss-Jordan method, L-U decomposition, Errors in the solution, iterative methods, solution of sets of non linear equations	1	1	2		2	1	1		1	2		3
4	Analyse the problem boundary Value.	1	1	2		3	1	1		3	2		3
5	Evaluate numerical Solution of Elliptical partial differential Equations.	1	1	2		3	1	1		2	2		3
Average		**1**	**1**	**2**		**2.4**	**1**	**1**		**1.6**	**2**		**3**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit-1: Solution of Non-linear Equations: Newton-Raphson method, Von-mises formula, Chord‟s method, bisection method- Comparative study-solution of cubic equation and quartic equation.

Unit-2: Numerical integration: Newton-Cotes integration formulas- Trapezoidal rule-Romberg Integration – Simpson‟s rule – Gaussian quadrature – Errors in integration formulas – Multiple integration with variable limits.

Unit-3: Solution of system of equations: Gauss elimination method- gauss-Jordan method- L-U decomposition – Errors in the solution- iterative methods – solution of sets of non linear equations.

Unit-4: Boundary Value Problems and Characteristics – Value problems: Shooting methodsolution through a set of equations – Derivative boundary conditions – characteristic value problems – Eigen values of matrix by iteration.

Unit-5: Numerical Solution of Elliptical partial differential Equations: Equilibrium temperatures in a heated slab-Equation of steady state heat flow.

Text Books:

1. Numerical methods, Principles, Analyses and Algorithms: Srimanth Pal, Oxford University Press, NewDelhi.
2. Numerical Methods in Finite Element Analysis: Bathe K. J., Wilson E. L., Prentice-Hall of India PrivateLimited, New Delhi, (1987).
3. Numerical Methods: Kandasamy P., Thilagavathy K. and Gunavathi K., S. Chand & Company Ltd, NewDelhi, (1997)
4. Numerical Methods for Engineers with Programming and Software Applications: Chapra. S. C. andCanale R. P.,3rd ed., Tata McGraw Hill, New Delhi, (2009).

Numerical Mehtods: Salvadori M., PHI learning Pvt, ltd., New Delhi, (1987)

Elective-I: Earthquake Resistant Design of Steel Buildings

Course Outcomes:

1. Student Should get the Knowledge of plastic analysis and design of members
2. The student will be able to design of earthquake loads.
3. The student will be able to get knowledge about OCBF (Ordinary Concentrically braced frames), SCBF (specially concentrically braced frames), EBF(Eccentrically braced frames)
4. The student will be able to understand OMF(Ordinary moment frames), SMF(Special moment frames), Column bases, STMF (Special Truss moment frames)
5. The student will be able to analysis, design and detailing of multistorey steel building.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Student Should get the Knowledge of plastic analysis and design of members	2	1	3		1	1	1		1	1		3
2	The student will be able to design of earthquake loads.	2	1	3		1	1	1		1	1		3

3	The student will be able to get knowledge about OCBF (Ordinary Concentrically braced frames), SCBF (specially concentrically braced frames), EBF(Eccentrically braced frames)	2	1	3		2	1	1		1	1		3
4	The student will be able to understand OMF(Ordinary moment frames), SMF(Special moment frames), Column bases, STMF (Special Truss moment frames)	2	1	2		2	1	1		2	1		3
5	The student will be able to analysis, design and detailing of multistorey steel building.	2	2	3		2	1	1		1	1		3
Average		**2**	**1.2**	**2.8**		**1.6**	**1**	**1**		**1.2**	**1**		**3**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit- 1: Introduction to plastic analysis and design philosophy foe steel structures review of design tension members, Compression members, flexural members, beam- Column members

Unit- 2: Design and detailing for earthquake loads, load combinations, Response reduction factor, Panel Zones and connections, Joints and fastners, columns, story drift and modelling in using STAAD-Pro/ETABS Software.

Unit- 3: Ordinary Concentrically braced frames (OCBF), specially concentrically braced frames (SCBF), Eccentrically braced frames (EBF)

Unit- 4: Ordinary moment frames (OMF), Special moment frames (SMF), Column bases, Special Truss moment frames (STMF)

Unit- 5: Analysis, design and detailing of multistorey steel building (max 2 bay and 4 storeys) using STAAD-Pro/ ETABS Software.

Reference Books

1. Subramanian S., Steel Structures design and practice , Oxford
2. Owens G.W., Khowles, P.R.(1992), steel designer's manual
3. faella C., Piluso V., Rizzano G.(1999), Structural Steel Semirigid Connections – design and software (Vol.21), CRC Press
4.Trahair N.S., Bradferd M.A., Nethercot D. and Gardner L.(2007)
The behaviour and design of steel structures to EC3, CRC Press.

Elective-I: Theory of Elasticity & Elastics Stability

Course Outcome:

1. The student will be able to design & analysis of stress and strain in 2 dimensions
2. The student will be able to Design & analysis of stress and strain in 3 dimensions.
3. The student will be able to analysis bending of cantilever beam and simply supported beam.
4. The student will be able to understand buckling of simply supported rectangular plates.
5. The student will be able to understand buckling of columns

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Analysis of stress strain in 2D and their relationship.	2	2	2		1	1	1		1	1		3
2	Analysis of stress strain in 3D and their relationship.	2	2	2		1	1	1		1	1		3
3	Analysis of Cantilever and Simply supported rectangular beam, non circular section and elliptical section for bending and torsion.	2	1	3		1	1	1		1	1		3
4	Analysis of buckling of beam, column and simply supported rectangular plate for different type of loading condition.	2	1	2		1	1	1		1	1		3
5	Analysis of buckling of column by energy and approximate method.	2	1	2		1	1	1		1	1		3
Average		**2**	**1.4**	**2.2**		**1**	**1**	**1**		**1**	**1**		**3**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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 bucking 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

Elective-II: Global Warming and Climate Change

Course Outcomes:

1. Study of ozone layer, Greenhouse Gases and Global Warming
2. Study of atmosphere And Its various Components and the effects of inversion on pollution dispersion.
3. Understand the impacts Of Climate Change, Impacts of Climate Change on various sectors- Impacts of Climate Change, Risk of Irreversible Changes.
4. Study of Climate change and Carbon credits, Evidences of Changes in Climate and Environment- on a Global Scale and in India.
5. Study about Climate Change, Mitigation Measures, Carbon sequestration- Bio waste, Biomedical, Industrial waste. International and Regional cooperation.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Study of ozone layer, Greenhouse Gases and Global Warming			1		1	2	3		1	1		2
2	Study of atmosphere And Its various Components and the effects of inversion on pollution dispersion.			1		1	2	3		1	1		2
3	Understand the impacts Of Climate Change, Impacts of Climate Change on various sectors- Impacts of Climate Change, Risk of Irreversible Changes.			1		1	1	2		1	1		2
4	Study of Climate change and Carbon credits, Evidences of Changes in Climate and Environment- on a Global Scale and in India.			1		1	1	3		1	1		2
5	Study about Climate Change, Mitigation Measures, Carbon sequestration- Bio waste, Biomedical, Industrial waste. International and Regional cooperation.			1		1	2	3		1	1		2
Average				**1**		**1**	**1.6**	**2.8**		**1**	**1**		**2**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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.

Elective-II: Road Safety Engineering

Course Outcomes:

1. Understand the concept of fundamentals of Traffic Engineering, Traffic Design of Parking Facilities, Traffic Engineering Studies

2. Understand and learn the accident Investigations and Risk Management, Methods to Identify and Prioritize Hazardous Locations and Elements.

3. Study about Road Safety in Planning And Geometric Design and Design of road and Road Equipments.

4. Design of Roads; Design of Horizontal and Vertical Elements at Grade and Grade Separated Intersections.

5. Study of Traffic Management Systems for Road Safety Audits and Tools for Safety Management Systems.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Understand the concept of fundamentals of Traffic Engineering, Traffic Design of Parking Facilities, Traffic Engineering Studies	1	1	2	1	1	1	1		2	1	1	2
2	Understand and learn the accident Investigations and Risk Management, Methods to Identify and Prioritize Hazardous Locations and Elements.	1	1	3	1	1	1	1		2	1	1	2
3	Study about Road Safety in Planning And Geometric Design and Design of road and Road Equipments.	1	1	3	1	1	1			3	1	1	2
4	Design of Roads; Design of Horizontal and Vertical Elements at Grade and Grade Separated Intersections.	1	1	2	1	1	1			3	1	1	2
5	Study of Traffic Management Systems for Road Safety Audits and Tools for Safety Management Systems.	1	1	2	1	1	1			2	1	1	2
Average		**1**	**1**	**2.4**	**1**	**1**	**1**	**0.4**		**2.4**	**1**	**1**	**2**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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

Semester: 2

Advanced Steel Design

Course Outcomes:

1. Student Should get the Knowledge about the design of eccentric connections.
2. The student will be able to design of steel chimneys.
3. The student will be able to design of industrial sheds, bridges of crane / gantry Girders.
4. The student will be able to design of bridges, highway and railways.
5. The student will be able to design of storage vessels

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Student Should get the Knowledge about the design of eccentric connections.	1	1	3		1	1	1		1	1		3
2	The student will be able to design of steel chimneys.	2	2	2		1	1	1		1	1		3
3	The student will be able to design of industrial sheds, bridges of crane / gantry Girders.	2	3	3		1	1	1		1	1		3
4	The student will be able to design of bridges, highway and railways.	2	2	2		1	1	1		3	1		3
5	The student will be able to design of storage vessels	2	2	3		2	1	1		1	1		3
Average		**1.8**	**2**	**2.6**		**1.2**	**1**	**1**		**1.4**	**1**		**3**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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. Ram Chandra 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

Foundation Design

Course Outcomes:

1. Identify a suitable foundation system for a structure.
2. Examine and discuss foundation subjected to eccentric loads
3. Analyse and design of rafts.
4. Evaluate the importance of floating foundation Analyse and design of Pile foundation.
5. Examine and discuss various machine foundations.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Identify a suitable foundation system for a structure.	1	1	1		1	1	1		1	1		2
2	Examine and discuss foundation subjected to eccentric loads	1	1	1		1	1	1		2	1		2
3	Analyse and design of rafts.	1	1	1		1	1	1		1	1		2
4	Evaluate the importance of floating foundation Analyse and design of Pile foundation.	1	1	1		2	1	1		1	1		2
5	Examine and discuss various machine foundations.	1	1	1		2	1	1		3	1		2
Average		**1**	**1**	**1**		**1.4**	**1**	**1**		**1.6**	**1**		**2**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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

Design of Composite Structure

Course Outcomes:

1. Understand and analyze the composite beams, Steel concrete composite.
2. Study the composite floors, shear connectors: factions & types.
3. Understand and design the Steel concrete composite columns subjected to axial loads and moment.
4. Understand the concept and design of encased composite construction of beams and columns.
5. Study of IS 11384, IRC-22 and their applications.

Sr. No.	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Understand and analyze the composite beams, Steel concrete composite.	2	2	2	1	1	1	1		1	1	1	1
2	Study the composite floors, shear connectors: factions & types.	2	1	2	1	1	1	1		1	1	1	2
3	Understand and design the Steel concrete composite columns subjected to axial loads and moment.	2	2	2	1	1	1	1		1	1	1	2
4	derstand the concept and design of encased composite construction of beams and columns.	2	1	2	1	1	1	1		1	1	1	2
5	Study of IS 11384, IRC-22 and their applications.	2	1	2	1	1	1	1		1	1	1	2
Average		**2**	**1.4**	**2**	**1**	**1**	**1**	**1**		**1**	**1**	**1**	**1.8**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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

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

Elective-III: High Rise Structures

Course Outcomes:

1. Study of behaviors of various type of buildings in past earthquakes, modes of failures, influence of un-symmetry, infill walls and foundations
2. Analysis of frames shear walled buildings, mathematical modeling of building and of coupled shear walled building by using STAAD-Pro Software.
3. Study of effect of torsion, flexible first story, P-delta effect, soil-structure interaction on building response, and Calculation of drift limitation.
4. Design and detailing of RCC members, beam, column, Beam-column joints for ductile behaviors
5. Design of multi-story buildings with bracings & infills using STAAD-Pro Software.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Study of behaviors of various type of buildings in past earthquakes, modes of failures, influence of un-symmetry, infill walls and foundations	3	1	1	1	1	1			1	2		2
2	Analysis of frames shear walled buildings, mathematical modeling of building and of coupled shear walled building.	3	2	1	1	2	1			1	2		2
3	Study of effect of torsion, flexible first story, P-delta effect, soil-structure interaction on building response, and Calculation of drift limitation.	3	1	1	1	1	1			1	2		2
4	Design and detailing of RCC members, beam, column, Beam-column joints for ductile behaviors	3	2	1	1	1	1			1	2		2
5	Design of multi-story buildings with bracings & infills.	3	2	1	1	1	1			1	2		2
Average		**3**	**1.6**	**1**	**1**	**1.2**	**1**			**1**	**2**		**1**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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

Elective-III: Analysis of shells & folded plates

Course Outcomes:

1. Study of forces and their resultant acting on the member
2. Design of short and Long Cylindrical shell.
3. Analysis of geometry of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes shell and their analysis.
4. Analysis of different types of folded plate.
5. Analysis and design of Shells of double Curvature-Surfaces of revolution.

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Study of forces and their resultant acting on the member	3	1	1	1	1	1	1		1	1	1	2
2	Design of short and Long Cylindrical shell.	3	2	3	1	1	1	1		1	2	1	2
3	Analysis of geometry of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes shell and their analysis.	3	2	3	1	2	1	1		1	2	1	1
4	Analysis of different types of folded plate.	3	2	2	1	2	1	1		1	1	1	1
5	Analysis and design of Shells of double Curvature-Surfaces of revolution.	3	2	3	1	2	1	1		1	2	1	2
Average		**3**	**1.8**	**2.4**	**1**	**1.6**	**1**	**1**		**1**	**1.6**	**1**	**1.6**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit 1: Equations of equilibrium : Introduction, classification, derivation of stress Resultants, Principles of membrane theory and bending theory

Unit 2: Cylindrical shells: Derivation of governing DKJ equation for bending theory, details of Schorer's theory, Applications to the analysis and design of short shells and long shells. Introduction of ASCE manual co-efficients for design.

Unit 3: Introduction to shells of double curvature: (other than shells of revolution:) Geometry and analysis of elliptic paraboloid, rotational paraboloid and hyperbolic paraboloid shapes by membrane theory.

Unit 4: Folded Plates: Folded plate theory, plate and slab action, Whitney's theory, Simpson's theory for the analysis of different types of folded plates (Design is not included)

Unit 5: Shells of double Curvature-Surfaces of revolution .Derivation of equilibrium equations by membrane theory, Applications to spherical shell and rotational Hyperboloid

Books

Design and construction of concrete shell roofs by G.S. Rama Swamy – CBS Publishers & Distributors, 485, Jain Bhawan Bldg. Nehru Nagar, Delhi

1. Chadrashekhara K, Theory of Plates, 1st Edition, Universities Press (India) Ltd, Hyderabad, 2001.
2. Fundamentals of the analysis and design of shell structures by Vasant S.kelkar Robert T.Swell – Prentice hall, Inc., Englewood cliffs, new Jersy -02632.
3. N.k.Bairagi, Shell analysis, Khanna Publishers, Delhi, 1990.
4. Billington, Ithin shell concrete structures, Mc Graw Hill Book company, New york, St. Louis, Sand Francisco, Toronto, London
5. ASCE Manual of Engineering practice No.31, design of cylindrical concrete shell roofs ASC, Newyork

Elective-III: Structural Instrumentation

Course Outcomes:

1. Explain principles of Measurement and its methods.
2. Illustrate Transducers, its classification, working principle and construction.
3. Describe Strain Gauges, its classification, working principle and its construction.
4. Understand the dynamic strain measurement
5. Demonstrate the knowledge and understanding of NDT

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Explain principles of Measurement and its methods.	1	1	3		2	2	1		1	1		3
2	Illustrate Transducers, its classification, working principle and construction.	1	1	2		2	2	1		1	1		3
3	Describe Strain Gauges, its classification, working principle and its construction.	1	1	3		2	2	1		1	1		3
4	Understand the dynamic strain measurement	1	1	2		3	2	1		3	1		3
5	Demonstrate the knowledge and understanding of NDT	1	1	2		2	1	1		2	1		3
Average		**1**	**1**	**2.4**		**2.2**	**1.8**	**1**		**1.6**	**1**		**3**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit- 1: Measurement, methods, basic principles, errors in measurement, error analysis. Measurement of displacement, pressure, force, torque etc.

Unit- 2: Transducers, classification, working principle and construction of load cell, sensitive dial gauge and LVDT.

Unit- 3: Strain gauge, classification, electrical resistance strain gauges, working Principle, types and construction, materials, strain gauge circuits, rosette analysis

Unit- 4: Indicating and recording devices, static & dynamic strain measurement, data acquisition and processing systems, load strain behaviour.

Unit- 5: Non destructive testing techniques, methods of NDT, working principle of rebound hammer, ultrasonic pulse velocity,
Model analysis.

REFERENCES:

1. Dally J. W. and Riley W.F., Experimental stress Analysis, McGraw-Hill, Inc. New York.
2. Srinath L.S, Experimental Stress Analysis, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi.
4. Renganathan S, Transducer Engineering, Allied Publishers Limited, Chennai.

Research Methodology

Course Outcomes:

1. Understand some concepts of research its methodologies
2. Identify appropriate research topics and define appropriate research problem and parameters
3. Identify, explain, compare, and prepare the key elements of a research proposal/report
4. Describe sampling methods, measurement scales and instruments, and appropriate uses of each.
5. Demonstrate how educational research contributes to the objectives of your master program and to your specific career aspirations

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Understand some concepts of research its methodologies	1	1			1	1	1		1	1		1
2	Identify appropriate research topics and define appropriate research problem and parameters	2	1	2	1	1	1	1		1	1		1
3	Identify, explain, compare, and prepare the key elements of a research proposal/report	2	1	2	1	2	1	1	1	1	1	1	2
4	Describe sampling methods, measurement scales and instruments, and appropriate uses of each	2	1	1	1	3	1		1	3		1	3
5	Demonstrate how educational research contributes to the objectives of your master program and to your specific career aspirations	1	1			2	2	1		1	3		3
Average		**1.6**	**1**	**1**	**0.6**	**1.67**	**1.2**	**0.8**	**0.4**	**1.33**	**1.2**	**0.4**	**2**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit- 1: What is Research?, How to do Research, The Objective of Research, Motivation in Research, Types of Research, Various Research Approaches, Significance of Research.

Unit- 2: Research Methods, What is Research Methodology, Research Process, What is Research Problem, Various Components of Research Problem, How to Identify the Research Problem, Steps involved in formulation of Research Problem, Necessity and Techniques involved in Defining Research Problem, Feasibility Check.

Unit- 3: What is Hypothesis?, its Characteristics, Examples and Types, Hypothesis Testing, Concepts and Procedure of Hypothesis Testing. Data Collection, Methods of data collection, Primary Data, Secondary Data, Analysis of data, Simple regression, Multiple regression, linear and non linear correlation and regression .

Unit- 4: Optimization, Principle, linear programming technique, simplex method, evolutionary programming techniques. Model analysis of structures, direct and indirect method, dimensionless terms and their significance, structural similitude's, optimization of model.

Unit- 5: Research Paper and its contents, Choice on topic, Method of writing research paper, Plagiarism including rules of plagiarism

Reference Books

1. Research Methodology- Methods and Techniques: *Kothari C.K. (2004), 2/e, New Age International, New Delhi*
2. Simulation Modeling and Analysis, 2nd ed.: *Law, A. M., and W. D. Kelton, 1991, McGraw Hill*
3. Applied Statistics & Probability for Engineers: *Montgomery, Douglas C. & Runger, George C. (2007), 3/e*,
(Wiley India)
4. Research Methods: A Modular Approach: 2nd edition, Sherri L. Jackson, Wadsworth Cengage Learngin,
Belmont, USA
5. Schaum's Quick Guide to Writing Great Research Papers: *Laurie Rozakis*, 2nd edition, McGraw Hill, New York, USA.

Advance Steel Design Studio

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)

Foundation Design Studio

1. Design of Pile Foundation
2. Design of Raft Foundation
3. Design of Combined Footing
4. Design of Footing for equal settlement

Semester: 3

Project Planning & Management

Course Outcomes:

1.Understand basic concept of project management.
2.Learn about project plan..
3.Build knowledge about costing and scheduling of projects.
4.Understand resource requirement concepts.
5.Learn concepts of risk management in project..

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Understand basic concept of project management.	1	3	1	1	1	2	1	1	1	2	3	2
2	Learn about project plan..	3	3	3	2	3	3	1	1	2	3	3	2
3	Build knowledge about costing and scheduling of projects.	2	3	3	2	2	3	2	1	3	3	3	2
4	Understand resource requirement concepts.	2	2	3	2	2	3	2	1	3	3	3	2
5	Learn concepts of risk management in project..	1	1	3	1	2	3	3	1	3	3	3	2
Average		**1.8**	**2.4**	**2.6**	**1.6**	**2**	**2.8**	**1**	**1**	**2.4**	**2.8**	**3**	**2**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

Unit 1: Project Management Concepts Characteristics of a project, Need for project management, Roles of project managers, Project Life Cycle.

Unit 2: Developing a Project Plan Work breakdown Structure, Developing the project network Activities: Sequencing, Duration and Scheduling, CPM/PERT.

Unit 3: Project Cost & Scheduling Estimating Project Time, Costs-Factors influencing quality of estimates, Top Down& Bottom Up methods of Estimating, Various Costs associated with Projects.

Unit 4: Resource Management Identifying resource requirement, Types of Resource Constraints, Classification of a Scheduling Problem Resource Allocation Methods Scheduling resources.

Unit 5: Project Risk Management Risk Management Process, Risk Identification, Risk Assessment, Risk Response Development & Risk Response Control.

Reference Books:

1. Project Management: Jeffrey Pinto, Pearson
2. Project Management: Rory Burke, Wiley India
3. Project Management, S. Chowdhary, McGraw Hill

4. Project Management: V. C. Sontakki, Himalaya Publishing House
5. Project Management: Arun Kanda, PHI

Elective-IV: Disaster Management and Mitigation

Course Outcomes:

1. Understanding foundations of hazards, disasters and associated natural/social phenomena.
2. Familiarity with disaster management theory (cycle, phases)
3. Understand and study the manmade disaster
4. Humanitarian Assistance before and after disaster
5. Technological innovations in Disaster Risk Reduction: Advantages and problems

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Understanding foundations of hazards, disasters and associated natural/social phenomena.	1	1			1	1	1		1	1		1
2	Familiarity with disaster management theory (cycle, phases)	1	1			1	1	1		1	1		1
3	Understand and study the manmade disaster	1	1			1	1	1		1			1
4	Humanitarian Assistance before and after disaster	1	1			1	2	1		3			2
5	Technological innovations in Disaster Risk Reduction: Advantages and problems	1	1	1	2	2	2	1		1	1		3
Average		**1**	**1**	**02**	**0.5**	**1.2**	**1.4**	**1**		**1.33**	**0.6**		**1.6**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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

Elective-IV: Water Resources Management

Course Outcomes:

1. Learn about economic aspects of water and get awareness about allocation of resources and financial analysis in the water sector\
2. Introduce the basics of soft computing techniques and illustrate its application for solving various problems in water resources engineering
3. The appraisal and design of measures for mitigating and managing such risks (such as structures for flood protection /mitigation, flood and droughts policies/plans/mapping; forecasting and managing flood and drought emergencies**)**
4. Make effort for learning basin level water resources management with technical and social aspects and understand water demand for irrigation, domestic, industrial use.
5. Apply knowledge acquired to the process of environmental impact , social impact

Sr No	Course Outcomes	Program Outcomes											
		1	2	3	4	5	6	7	8	9	10	11	12
1	.Learn about economic aspects of water and get awareness about allocation of resources and financial analysis in the water sector	2	1	1	1				1	1	1	1	2
2	Introduce the basics of soft computing techniques and illustrate its application for solving various problems in water resources engineering	2	1		1	1				1	1	1	2
3	The appraisal and design of measures for mitigating and managing such risks (such as structures for flood protection /mitigation, flood and droughts policies/plans/mapping; forecasting and managing flood and drought emergencies**)**	2	1	1	1	1				1	1	1	2
4	Make effort for learning basin level water resources management with technical and social aspects and understand water demand for irrigation, domestic, industrial use.	2	1		1	1	1			1	1	1	2
5	Apply knowledge acquired to the process of environmental impact , social impact	2	1	1		1				1	1		2
Average		**2**	**1**	**0.6**	**0.8**	**0.8**	**0.2**		**0.2**	**1**	**1**	**0.8**	**2**

3-HIGH, 2-MEDIUM, 1 -LOW

Syllabus

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 owner ship, 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, poission, 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

Project Seminar

Seminar based on topic for research for project

Semester: 4

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