

CURRICULUM & SYLLABUS (R2015)
CHOICE BASED CREDIT SYSTEM
M.Tech-STRUCTURAL ENGINEERING
FULL TIME
I – IV SEMESTERS

SEMESTER-I							
S.No	Category	Code	Subject Name	L	T	P	C
Theory							
1	PM	MMA110	Advanced Mathematical Methods	3	2	0	4
2	PC	MST101	Theory of Elasticity and Plasticity	3	0	0	3
3	PC	MST102	Computer Aided Structural Analysis	3	0	2	4
4	PC	MST103	Structural Dynamics	3	0	0	3
5	PE	MST1E1	Professional Elective- I	3	0	0	3
6	PE	MST1E2	Professional Elective- II	3	0	0	3
			Total	18	2	2	20

SEMESTER-II							
S.No	Category	Code	Subject Name	L	T	P	C
Theory							
1	PC	MST201	Concrete Structures	3	0	0	3
2	PC	MST202	Experimental Techniques and Instrumentation	3	1	0	3
3	PC	MST203	Finite Element Analysis	3	0	0	3
4	PC	MST204	Steel Structures	3	0	0	3
5	PC	MST205	Earthquake Resistant Design of Structures	3	0	0	3
6	PE	MST2E3	Professional Elective- III	3	0	0	3
Practical							
7	P L	MST2L1	Advanced Structural Engineering Laboratory	0	0	4	2
			Total	18	1	4	20

SEMESTER-III							
S.No	Category	Code	Subject Name	L	T	P	C
1	PE	MST3E4	Professional Elective- IV	3	0	0	3
2	PE	MST3E5	Professional Elective- V	3	0	0	3
3	OE	MST3E6	Open Elective	3	0	0	3
4	PW	MST3P1	Project Work Phase I	0	0	12	6
			Total	9	0	12	15

SEMESTER- IV

S.No	Category	Code	Subject Name	L	T	P	C
1	PW	MST4P1	Project Work Phase II	0	0	24	12
			Total	0	0	24	12

Overall Credits for the Programme – 67

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

	Sub Area	Credit as per Semester				No. of Credit	% of credit
		I	II	III	IV		
1	Professional Mathematics(PM)	4	-	-	-	4	4.5
2	Professional Core (PC)	10	17	-	-	27	40.9
3	Professional Electives (PE)	6	3	6	-	15	23
5	Open Electives (OE)	-	-	3	-	3	4.5
6	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	6	12	18	27
	Total Credits	20	20	15	12	67	100
	Total Contact Hours	22	23	21	24	89 Hrs	

LIST OF ELECTIVES

Professional Electives (PE-I)

S.No	Code	Subject Name	L	T	P	C
1	MST051	Computer Aided Structural Design	3	0	0	3
2	MST055	Design of Structures For Dynamic Loads	3	0	0	3
3	MST058	Industrial Structures	3	0	0	3
4	MST062	Optimization in Structural Design	3	0	0	3

Professional Electives (PE-II)

Sl.No.	Code	Subject Name	L	T	P	C
5	MST053	Design of Bridges	3	0	0	3
6	MST056	Design of Tall Buildings	3	0	0	3
7	MST061	Offshore Structures	3	0	0	3

Professional Electives (PE-III)

8	MST054	Design of Foundation Structures	3	0	0	3
9	MST065	Stability of Structures	3	0	0	3

Professional Electives (PE-IV)

10	MST064	Pre-stressed Concrete	3	0	0	3
11	MST052	Advanced Concrete Technology	3	0	0	3
12	MST060	Maintenance and Rehabilitation of Structures	3	0	0	3
13	MST063	Prefabricated Structures	3	0	0	3

Professional Electives (PE-V)

14	MST066	Theory of Plates	3	0	0	3
15	MST067	Wind and Cyclone Effects On Structures	3	0	0	3
16	MST068	Design of Shell and Spatial Structures	3	0	0	3
17	MST069	Disaster Resistant Structures	3	0	0	3

List of Open Elective (OE)

	Code No.	Course Title	L	T	P	C
18	MST070	Research Methodology	3	0	0	3
19	MST057	Environmental Engineering Structures	3	0	0	3

SYLLABUS

MMA110	ADVANCED MATHEMATICAL METHODS			L	T	P	C
	Total Contact Hours:75			3	2	0	4
	Prerequisite: Numerical Methods						
	Course Designed by :Department of civil						
OBJECTIVES To familiarize the students in the field of differential equations to solve bound value problems associated with engineering applications.							
COURSE OUTCOMES (COs)							
CO1	To make them master the techniques of Partial Differential Equations						
CO2	To know about Fourier Transform Techniques						
CO3	To understand about Concept of variation and its properties						
CO4	To know about the Conformal Mapping and Applications						
CO5	To know about Tensor Analysis						
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low							
1	COs/Pos	a	b	c	d	e	
2	CO1	H					W
	CO2	H	L	M			
	CO3	H					
	CO4	H		M			W
	CO5	H					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
		√					
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016					

UNIT I LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+6

Laplace transform, Definitions, properties – Transform error function, Bessel's function, Dirac Delta function, Unit Step functions – Convolution theorem – Inverse Laplace Transform: Complex inversion formula – Solutions to partial differential equations: Heat equation, Wave equation.

UNIT II FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+6

Fourier transform: Definitions, properties – Transform of elementary functions, Dirac Delta function – Convolution theorem – Parseval’s identity – Solutions to partial differential equations: Heat equation, Wave equation, Laplace and Poisson’s equations.

UNIT III CALCULUS OF VARIATIONS 9+6

Concept of variation and its properties – Euler’s equation – Functional dependant on first and higher order derivatives – Functional dependant on functions of several independent variables – Variation problems with moving boundaries – Problems with constraints – Direct methods – Ritz and Kantorovich methods.

UNIT IV CONFORMAL MAPPING AND APPLICATIONS 9+6

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation – Transformation of boundaries in parametric form – Physical applications : Fluid flow and heat flow problems.

UNIT V TENSOR ANALYSIS 9+6

Summation convention – Contravariant and co-variant vectors – Contraction of tensors – Inner product – Quotient law – Metric tensor – Christoffel symbols – Covariant differentiation – Gradient, divergence and curl.

REFERENCES:

1. Gupta, A.S., “Calculus of Variations with Applications”, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
2. James,G., “Advanced Modern Engineering Mathematics, 3rd Edition, Pearson Education, 2004.
3. Ramaniah.G. “Tensor Analysis”, S.Viswanathan Pvt. Ltd., 1990.
4. Sankara Rao, K., “Introduction to Partial Differential Equations”, Prentice Hall of India Pvt. Ltd., New Delhi, 1997.
5. Spiegel, M.R., “Theory and Problems of Complex Variables and its Application (Schaum’s Outline Series)”, McGraw Hill Book Co., 1981.

MST 101	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
	Total Contact Hours:45	3	0	0	3
	Prerequisite: strength of materials				
	Course Designed by : Department of civil Engineering				
OBJECTIVES To understand the concept of 3D stress, strain analysis and its application simple problems					
COURSE OUTCOMES (COs)					
CO1	To know about the Basic Concepts of deformation of elastic bodies.				
CO2	To understand the concepts of Equations of equilibrium and Compatibility.				
CO3	To know about the Torsion methods of analysis.				
CO4	To study the concepts of theorem of minimum potential energy				

CO5		To get knowledge about introduction to plasticity.				
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H				
	CO2	H			L	
	CO3	H	L			
	CO4	H				L
	CO5	H				
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
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UNIT-I INTRODUCTION 9

Basic Concepts of deformation of elastic bodies – Notation for stress and strain transformation of strain components Theory of small displacement – Generalized Hook’s Law – Significance of elastic constant for isotropic materials –Plane stress and Plane strain problems.

UNIT-II STRESS STRAIN ANALYSIS 9

Two dimensional problems in rectangular coordinates, Equations of equilibrium and Compatibility –analysis of stress and strain in three dimensions –Simple problems

UNIT-III TORSION 9

Torsion of non – circular section, methods of analysis –membrane analogy –torsion of thin rectangular section and hollow thin walled section

UNIT-IV ENERGY METHODS 9

Energy methods – theorem of minimum potential energy – energy theorem- Rayleigh Ritz methods.

UNIT-V PLASTICITY 9

Introduction to plasticity – Physical assumptions, yield criteria of metal flow, Laws of Plastic mass – Plastic stress strain relationship –Lower and Upper Bound theorem. Applications to simple problems in tension and compression.

Tutorials 15

L=45, T=15, No. of Periods: 45

References:

1. Timoshenko .S. and Goodier .J.N. “Theory of Elasticity”, McGraw Hill Book Co., New York 1988.

2. Sadusingsh ,” Theory of elasticity ,” Khanna Publisher,1988.
3. SaduSingh, “Theory of Elasticity , “Khanna Publisher,1988
4. N.Krishna,Raju,Guru,Raja ”Advanced Mechanics of wilds and structures, “Narosa Publishing House”
5. V.K. Manickaselvam “ Fundamentals of limit Analysis of structures” Dhanpat Rai& Sons,Delhi.

MST 102	COMPUTER AIDED STRUCTURAL ANALYSIS			L	T	P	C
	Total Contact Hours:30			3	0	2	4
	Prerequisite: computer aided structural design						
	Course Designed by :Department of civil Engineering						
OBJECTIVES To introduce the students about computer applications, structural analysis, design special structures and expert systems with application analysis.							
COURSE OUTCOMES (COs)							
CO1	To make them master the Analysis of pin jointed and rigid jointed plane frames.						
CO2	To know about Displacement Method						
CO3	To understand about Application to Plane – trusses & Plane frames						
CO4	To know about the Computer applications and use of computer packages.						
CO5	To analyse problems based on large structures.						
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low							
1	COs/Pos	a	b	c	d	e	
2	CO1	H		H	M	L	
	CO2	H		H			
	CO3	H		H		L	
	CO4	H		H	M		
	CO5	H		H		L	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√				
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UNIT-I INTRODUCTION

12

Introduction to Matrix methods – Displacements formulation – Co-ordinate transformations, Analysis of pin jointed and rigid jointed plane frames – Continuous beams.

UNIT-II DISPLACEMENT METHOD -3D ANALYSIS 9

Displacement method – three dimensional structures – Coordinate transformation – analysis of space trusses and rigid jointed space frames

UNIT-III FORCE METHOD 9

Matrix Force method – general formulation –Application to Plane – trusses & Plane frames

UNIT-IV COMPUTER APPLICATION 9

Computer applications and use of computer packages – Staad Pro-Strap analysis – sap 2000 Gtscudl – Programming Techniques – Problems.

UNIT-V SPECIAL PROBLEMS 6

Analysis of large structures – substructures – subs structuring – static condensation procedure – Simple problems.

Practicals 30

Total No. of Periods: 45 + 30

Text book:

1. M.Rubeinstein “ Matrix analysis of structures”

References:

1. John I Meek matrix “ Structural analysis “ –M.C Graw Hill Book –Co
2. Coastos R.C.CoutieM.G.and Kong F.K.” Structural Analysis “John Wiley and Sons.
3. McGuire W and Gallagher,R.H. JohnWilly and Sons Matrix structural Analysis.

MST 103	STRUCTURAL DYNAMICS	L	T	P	C
	Total Contact Hours:60	3	0	0	3
	Prerequisite: Basics of dynamics and asesmic design				
	Course Designed by :Department of civil Engineering				
OBJECTIVES To introduce the students about computer applications, structural analysis, desig special structures and expert systems with application analysis.					
COURSE OUTCOMES (COs)					
CO1	To learn about Principles of dynamics and application to seismic instruments				
CO2	To know about two and multiple degree freedom system				
CO3	To understand about natural frequencies and modes shapes.				
CO4	To know about the Computer applications and use of computer packages.				

CO5		To analyze problems based on application to earthquake resistant design.				
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	M	L		
	CO2	H		L		
	CO3	H			M	L
	CO4	H	M			
	CO5	H				
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
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UNIT-I INTRODUCTION

12

Principles of Dynamics - D'Alembert's Principle - formulation of equations of motion. Single Degree Freedom system - Free & Forced vibrations with and without damping Evaluation of Damping - Response of Single Degree Freedom system to Base Excitation - Transmissibility - **Application to seismic instruments** - Vibration isolation principle.

UNIT -II TWO DEGREE OF FREEDOM

9

Two Degree Freedom System - Application to Vibration Absorber - Multiple Degree Freedom System - Eigen value Problem - orthogonally & ortho normality properties of modes - Solution by Matrix Iteration - **Mode superposition technique**.

UNIT -III VIBRATION ANALYSIS

8

Vibration of continuous system - Natural frequencies and modes shapes of uniform beams - forced vibration response

UNIT-IV MACHINE FOUNDATION

8

Application to Machine Foundation - Design of foundations for Steady State Mechanics - Principles of Dynamic Analysis IS2974 (pts I to V)

UNIT-V EARTHQUAKE RESISTANT STRUCTURES

8

Application to Earthquake Resistant Design with particular Reference to Buildings Provisions of IS 1893

Tutorials

15

Total No. of Periods: 45+15

References:

1. R. W. Clough & J. Penzien "Dynamics Of Structures" McGraw HILL, NY
2. Mario Paz "Structural Dynamics Theor:y And Computation", CBS Publishers, Delhi.
3. Srinivasulu P. & Vaidyanathan, C. V "Hand Book Of Machine Foundations" Tata McGraw Hill. New Delhi.

MST 201	CONCRETE STRUCTURES					L	T	P	C
	Total Contact Hours:45					3	0	0	3
	Prerequisite: Reinforced Concrete Structures - I								
	Course Designed by :Department of civil Engineering								
OBJECTIVES. To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.									
COURSE OUTCOMES (COs)									
CO1	To learn about calculation of deflection and crack width according to IS 456-2000								
CO2	To know about design of special RC elements.								
CO3	To Design flat slabs and flat plates according to ACI method.								
CO4	To know about the inelastic behavior of concrete beams.								
CO5	To analyze problems based on detailing for ductility.								
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low									
1	COs/Pos	a	b	c	d	e			
2	CO1	H	M						
	CO2	H		H					
	CO3	H	M		L	L			
	CO4	H							
	CO5	H	M						
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
			√						
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Review of limits state design of beams, Slabs and columns according to IS: 456-2000
Calculation of deflection and crack width according to IS 456-2000.

UNIT II DESIGN OF SPECIAL RC ELEMENTS 11
Design of Slender columns - Design of Rewalls - Ordinary and shear walls - Design of Corbels - Deep beams and grid floors.

UNIT III FLAT SLABS AND FLAT PLATES 10
Design of flat slabs and flat plates according to ACI method - Design of shear load - reinforcement and edge (Spandrel) beams - Yield line theory and Hillerberg method of design of slabs.

UNIT IV INELASTIC BEHAVIOUR OF CONCRETE BEAMS 9
In elastic behavior of concrete beams - moment - rotation curves - moment redistribution - Baker's method of plastic design, Design of cast in situ Joints in frames.

UNIT V GENERAL 6
Detailing for ductility - Fire resistance of buildings - field control of concrete.

Total No. of Periods: 45

References:

1. Purushothaman P, Reinforced Concrete Structural Elements: Behaviour Analysis and Design, Tata McGraw Hill, 1986.
2. Varghese P. C., Limit State Design of Reinforced Concrete, Prentic Hall of India, 1995.
3. Krishna Raju, N. Advanced Reinforced Concrete Design, CBS Publishers and Distributors, 1986.
4. N. C. Sinha, S. K. Roy, Fundamentals of Reinforced concrete, S. Chand&Company Ltd, 2001.
5. Varghese. P. C. Advanced Reinforced concrete design, Prentice Hall of India, 2005.

MST202	EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION				L	T	P	C
	Total Contact Hours: 45				3	1	0	3
	Prerequisite: Numerical Theory of Elasticity and Plasticity							
	Course Designed by :Department of civil							
OBJECTIVES To learn the principles of measurements of static and dynamic response of structures and carryout the analysis of results.								
COURSE OUTCOMES (COs)								
CO1	To learn Introduction about Basic concepts in stress and strain							
CO2	To know about design of special RC elements							
CO3	To understand the various measurement techniques.							
CO4	To know about the applied measurements and displacement measurements							
CO5	To analyze advanced measuring techniques							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		

2	CO1	H	M			
	CO2	H			L	
	CO3	H	M			L
	CO4	H		M	L	
	CO5	H		M		L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
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PART-A

EXPERIMENTAL STRESS ANALYSIS (ESA)

UNIT – I INTRODUCTION 5

Basic concepts in stress and strain, two dimensional, three dimensional and plane stress problems – stress analysis using equilibrium equations and load relaxation Techniques.

UNIT-II MEASUREMENT TECHNIQUES 10

Strain measurement using mechanical, optical and electrical gauges for static and dynamic stress analysis. Whole field methods, Photoelasticity, stress optic law, plane and circular polariscope, isoclinics, isochromatics, compensation methods of separation of stresses.

PART-B INSTRUMENTATION

UNIT-III MEASURING INSTRUMENTS 5

Basic characteristics and dynamic response measuring instruments, sensing elements, transducer. Measuring & transmission methods, Indicating and recording means.

UNIT-IV DISPLACEMENT MEASUREMENT TECHNIQUES 5

Applied measurements, displacement measurements, measurement of force and torque, load cells, cantilever beams and torque tubes.

UNIT-V ADVANCED MEASURING TECHNIQUES 5

Stress strain measurements and strain bridges, measurements of temperature and pressure, electronic measuring instruments, oscillographs and oscilloscopes, sonic and ultra sonic testers, data loggers, micro-processors, selection and use.

Practical 30

Total No of Periods: 30 + 30 = 60

Text books:

1. ESA by James W.Dally & William F.Ricley

2. Instrumentation, Devices and Systems C.Rangan, G.R. Sanma, V.S.V. mani.

References:

1. ESA & Motion measurements: Dove R.L. & Adams P.H
2. Engineering measurement in instrument LF. Adams.
3. Experimental methods for Engineers; J.P. Holman.
4. Instrumentation for engineering: Dally & Riley.
5. ESA: Sadhu Singh.

MST203	FINITE ELEMENT ANALYSIS					L	T	P	C
	Total Contact Hours: 45					3	0	0	3
	Prerequisite: Structural Analysis-I								
	Course Designed by :Department of civil								
OBJECTIVES To study the energy principles, finite element concept, stress analysis, meshing, linear problems and applications.									
COURSE OUTCOMES (COs)									
CO1	To learn concepts of piecewise Approximation and Finite Elements								
CO2	To know about two dimensional problems in stress analysis								
CO3	To understand the meshing and solution problems.								
CO4	To know about the nonlinear and vibration problems								
CO5	To understand the Application to Thermal Analysis Problems.								
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low									
1	COs/Pos	a	b	c	d	e			
2	CO1	H	L						
	CO2	H		H					
	CO3	H	L		L				
	CO4	H						L	
	CO5	H							
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
			√						
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UNIT-I INTRODUCTION 10
 Boundary Value problem – Approximate Solution - Variational and Weighted Residual Methods – Ritz and Galerkin Formulations – Concepts of piecewise Approximation and Finite Elements - Displacement and Shape Functions Weak formulation Minimum Potential Energy. **Generation of Stiffness Matrix and Load Vector.**

UNIT-II STRESS ANALYSIS 10
 Two dimensional problems – Plane Stress, Plane Strain and Axisymmetric problems – Triangular and Quadrilateral Elements – Natural Coordinates –Isoparametric Formulation – Numerical Integration – Plate Bending and **Shell Elements Brick elements for Fracture Analysis.**

UNIT-III MESHING AND SOLUTION PROBLEMS 10
 Higher Order Elements – P & H methods of refinement – III conditional Elements – Discretisation Errors – **Auto and Adaptive Mesh Generation Techniques** – Error Evaluation.

UNIT-IV NONLINEAR AND VIBRATION PROBLEMS 10
 Material and Geometric Nonlinearity Methods of Treatment consistent System, Matrice **Dynamic Condensation – Eigen Value Extraction.**

UNIT-V THERMAL ANALYSIS 5
 Application to Thermal Analysis Problems.

Total No. of Periods: 45

References :

1. Bathe, K.J. Finite Elements Procedures in Engineering analysis. Prentice Hall Inc., 1995.
2. Zienkiewicz, O.C. Arid Taylor, R.L. The Finite Elements Method, McGraw Hill, 1987.
3. Chandrupatla, R.T. and Belegunda. A.D, Introduction to Finite Elements in Engineering, 2nd Edition, Prentice Hall of India, 1997.
4. Moaveni.S., Finite Element Analysis: Theory and Application with ANSYS, Prentice Hall Inc., 1999.

MST203	STEEL STRUCTURES	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Design of steel structures				
	Course Designed by :Department of civil				
OBJECTIVES To expose the students the principles and methods of dynamic analysis of structures and to prepare them for designing plastic analysis of structures and design of light gauge steel structures.					
COURSE OUTCOMES (COs)					
CO1	To learn design of members subjected to lateral loads and axial loads				
CO2	To know about design of various types of Connections				
CO3	To understand the analysis and design of steel towers.				
CO4	To know about the plastic analysis of structures				

CO5	To analyze and solve problems on design of light gauge steel structures.					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	H			
	CO2	H				L
	CO3	H		L	M	
	CO4	H				
	CO5	H				M
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
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UNIT-I GENERAL

9

Design of members subjected to lateral loads and axial loads. Analysis and design of Industrial buildings and bents – Sway and non-sway frames – Design of Purlins, Louver rails, Gable column and Gable wind girder – Analysis of Gable Frames – Check for deflection.

UNIT – II DESIGN OF CONNECTIONS

9

Types of connections – Design of framed beam connection – Seated beam connections – Unstiffened, Stiffened seat connections. Continuous beam-to-beam connections and continuous beam-to-column connection both welded and riveted.

UNIT – III ANALYSIS AND DESIGN OF STEEL TOWERS

9

Analysis and design of Transmission Line Towers, Type of bracing patterns – Sag and Tension calculations – Design of self supporting chimney (lined and unlined) and guyed steel stacks – Stresses due to wind and earthquake forces – Design of foundations –Along wind loads - Calculation by Gust Factor Method.

UNIT-IV PLASTIC ANALYSIS OF STRUCTURES

9

Introduction – shape factor – Moment redistribution – Static, Kinematic and Uniqueness theorems – Combined mechanism – Analysis of single bay and two bay portal frames – Methods of plastic moment distribution – Effect of axial force and shear force on plastic moments – Connections Moment resisting connection – Design of continuous beams.

UNIT-V DESIGN OF LIGHT GAUGE STEEL STRUCTURES

9

Types of cross sections – local buckling and lateral buckling – Concepts of Effective width – Design of compression and tension members. Beams, Deflection of beams and design of beam webs. Combined stresses and connections.

Total No. of Periods:45

Text book:

1. Dayarathnam.P , Design of Steel Structures, A.H. Wheeler, 1990.

REFERENCES:

1. Home, M.R., and Monies, L.J, Plastic Design of Low-rise frames, Granada Publishing Ltd., 1981.
2. Salmo C.G., and Johnson J.E., Steel Structure- Design and Behaviour, harper and Row, 1980.
3. Kuzamanovic, B.O. and Williams, N., Steel Design for Structural Engineer, Prentice Hall, 1977.
4. Wie – Wen Yu., Cold – Formed Steel Structures, McGraw Hill Book Company, 1973.
5. William McGuire, Steel Structures, Prentice Hall, Inc., Englewood Cliffs, N.J. 1986

MST205	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Basic Dynamics and Aseismic design							
	Course Designed by :Department of civil							
OBJECTIVES To study the effects of earthquakes analysis and design of earthquake resistant structures								
COURSE OUTCOMES (COs)								
CO1	To learn elements of engineering seismology							
CO2	To know about seismic design concepts							
CO3	To understand the response of structural elements to the dynamic loads.							
CO4	To know about the Indian Standard Codes Of Practice							
CO5	To understand modern concepts.							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1	H						
	CO2	H	M					
	CO3	H						
	CO4	H						
	CO5	H	M					

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT-I ELEMENTS OF ENGINEERING SEISMOLOGY 8

Definitions of magnitude, intensity, epicenter, focus – general features of tectonics of seismic regions in India – seismographs – nature of dynamic loading resulting from Earthquakes.

UNIT-II SEISMIC DESIGN CONCEPTS 12

Review of Theory of Structural vibrations induced under base excitation- Single degree & multiple degree idealizations – Response spectrum approach – Time History Analysis – Building systems with frames, with and without shear walls.

UNIT-III PERFORMANCE OF STRUCTURES 10

Response of Structural elements to the dynamic loads. Ductility and energy absorption – Regular and irregular building types.

UNIT-IV INDIAN STANDARD CODES OF PRACTICE 10

Provisions of Indian standard code IS 1893. Approach to Aseismic analysis of miscellaneous structures such as retaining walls, water tanks, and dams. Importance of detailing IS4326.

UNIT-V MODERN CONCEPTS 5

Base Isolation techniques – Active & Passive control – Case Studies.

Total No. of Periods = 45

References:

1. Jaikrishna & Chandra Sekharan: “Elements of Earthquake Engineering”
2. Chopra.A.K, “Structural Dynamics & Earthquake Engineering” Prentice Hall, N.J., 1995.
3. Dowrick, D.J “Earthquake Resistant Design” John Wiley & Sons, London.
4. Arnold C & Reitharman.R “Building Configuration & Seismic Design”
5. Wiegel, R.I (Ed0: “Earthquake Engineering” Prentice Hall, N.J., 1977.

MST2L1	ADVANCED STRUCTURAL ENGINEERING LAB	L	T	P	C
	Total Contact Hours: 45	0	0	4	2
	Prerequisite: Concrete and Highway lab				
	Course Designed by :Department of civil				
OBJECTIVES To provide exposure to the students with hands on experience in advanced structural engineering lab					

COURSE OUTCOMES (COs)						
CO1	To provide hands on exercises in common concrete mix design by IS Code and other methods					
CO2	To expose the students regarding strain measurement using mechanical and electrical strain gauges					
CO3	To provide hands on exercise flexural behavior of reinforced concrete beams					
CO4	To provide exposure regarding structural behavior of columns					
CO5	To expose the students regarding non-destructive tests on concrete.					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1		H			
	CO2		M			
	CO3		H			
	CO4		H			
	CO5		M			
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/Term Paper/Seminar/Internship (PR)
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Concrete mix design by IS Code and other methods.
2. Strain measurement using mechanical and electrical strain gauges.
3. Study on flexural behavior of reinforced concrete, pre-tensioned and post-tensioned pre-stressed rectangular concrete beams.
4. Study on structural behavior of columns
5. Non-destructive tests on concrete.

References:

1. Krishna Raju N, (2000), "Design of concrete mixes", fourth edition CBS publishers, New Delhi.
2. IS:10262 – (2009), "Indian Standard recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi.
3. SP: 23 – (1982), "Hand book of Concrete mixes", Bureau of Indian Standards, New Delhi.
4. Rajendra C, (2003), "Computer aided concrete Mix design", Allied publishers, New Delhi.

5. Krishna Raju N, (2003), "Design of reinforced Concrete Structures III Edition, CBS publishers, New Delhi.
6. Krishna Raju N, (1995), "Prestressed Concrete", III Edition, Tata McGraw Hill Publishing Co. New Delhi.
7. Lin T.Y., Burns N.H., (1982), "Design of Prestressed Concrete Structures", III Edition, John Woley and Sons, New York.

MST051	COMPUTER AIDED STRUCTURAL DESIGN				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Computer Aided Structural Analysis							
	Course Designed by :Department of civil							
OBJECTIVES To study the effects of earthquakes analysis and design of earthquake resistant structures								
COURSE OUTCOMES (COs)								
CO1	To learn drafting software packages and usage							
CO2	To know about Computer methods of structural analysis							
CO3	To understand the response of structural elements to the dynamic loads.							
CO4	To know about the computer aided design of steel and RC structural elements							
CO5	To understand knowledge based expert systems.							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1		H					
	CO2		M					
	CO3		H					
	CO4		H					
	CO5		M					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)		
				√				
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

Graphic primitives - Transformations - Basics of 2-D drafting - Modeling of curves and surfaces – Solid modeling – Graphic standards – Drafting software packages and usage.

UNIT II STRUCTURAL ANALYSIS 9

Computer methods of structural analysis – Finite Element programming – Analysis through application packages.

UNIT III STRUCTURAL DESIGN 9

Computer aided design of steel and RC Structural elements – Detailed drawing – bill of materials.

UNIT IV OPTIMIZATION 9

Linear programming – Simplex algorithm – Post optimality analysis – Project scheduling – CPM and PERT application Genetic algorithm and applications.

UNIT V ARTIFICIAL INTELLIGENCE 9

Introduction – Heuristic search – Knowledge based expert systems – Architecture and applications of KBES. Expert system shells. Principles of neural network.

Total No. of Periods = 45

References:

1. C.S. Krishnamoorthy and S. Rejeev, Computer Aided Design, Narosa Publishing House, New Delhi, 1991.
2. H.B. Harrison, Structural Analysis and Design Vol. I & II, Pergamon Press, 1991 E. Hinton and D.R.J. Owen, Finite Element Programming Academic Press 1977.
3. Billy E. Gilled, Introduction to operations Research, A computer oriented algorithmic approach, Tata McGraw Hill 1982.
4. Richard Forsyth (Ed.), Expert System Principles and Case studies – Chapman & Hall.

MST052	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Concrete technology				
	Course Designed by :Department of civil				
OBJECTIVES To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.					
COURSE OUTCOMES (COs)					
CO1	To learn about concrete making material IS specifications				
CO2	To know about properties of fresh concrete and hardened concrete				
CO3	To understand the principles and methods of concrete mix design.				
CO4	To know about the various types of special concrete				
CO5	To understand process of manufacturing of concrete.				
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low					

1	COs/Pos	a	b	c	d	e
2	CO1		H			
	CO2		M			
	CO3		H			
	CO4		H			
	CO5		M			
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I CONCRETE MAKING MATERIALS 9

Aggregates, IS Specifications, Properties, Grading, Methods of combining aggregates, specified grading. Cement, Grades of cement. Chemical composition, Hydration of cement, structure of hydrated cement, Special cements - Water Chemical admixtures. Mineral admixtures.

UNIT II CONCRETE 9

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage. Variability of concrete strength. Concrete testing Methods: Non destructive tests ultrasonic pulse velocity, Rebound Hammer test. Pullout tests.

UNIT III MIX DESIGN 9

Principles of concrete mix design. Methods of concrete mix design. Indian standard Recommended Method. IS 10262-82

UNIT IV SPECIAL CONCRETE 9

Light Weight concrete, Fly ash concrete, Fibre reinforced concrete, Polymer Concrete, Super plasticised concrete, Epoxy resins and screeds for rehabilitation - Properties and Applications-High performance concrete.

UNIT-V CONCRETING METHODS 9

Process of manufacturing of concrete, methods of transportation, placing and curing - Extreme weather concreting, special concreting methods. Vacuum dewatering underwatering concrete, ready mix concentrate.

Total No. of periods: 45

References:

1. Neville, A.M. Properties of Concrete, Pitman Publishing Limited, Lnclon.
2. Shetty M.S., Concrete Technology, S. Chand and Company Ltd. Delhi.
3. RudhaniG., Light Weight Concrete Academic Kiado, Publishing Home of Hungarian Academy of Science, 1963.

MST053	DESIGN OF BRIDGES				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Prestressed Concrete Structures							
	Course Designed by :Department of civil							
OBJECTIVES To study the loads, forces on bridges and design of several types of bridges								
COURSE OUTCOMES (COs)								
CO1	To learn about introduction and investigation for bridges							
CO2	To know about load distribution theories, analysis and design							
CO3	To understand the principles and methods of concrete mix design.							
CO4	To know about the various long span bridges							
CO5	To understand process carried out in bearings and substructure.							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1		H					
	CO2		M					
	CO3		H					
	CO4		H					
	CO5		M					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)		
				√				
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

UNIT I- INTRODUCTION AND INVESTIGATION FOR BRIDGES 9

Components of bridge - Classification - Need for investigation - Bridge site - Data collection - design discharge - linear waterway - economical span - scour depth - traffic projection - **choice of bridge type.**

UNIT II LOADS ON BRIDGES 9

Indian Road Congress (IRC) Bridge codes dimensions – dead and live loads - impact effect - wind and seismic forces - longitudinal and centrifugal forces - hydraulic forces - earth pressure - **temperature effect and secondary stresses.**

UNIT III SLAB AND T - BEAM BRIDGES 9

Design of slab bridges - skew slab culverts - box culverts. T - beam bridges - Pigeaud curves - Courbon's theory - **Hendry Jaeger method** - analysis and design of T - beam bridges.

UNIT IV LONG SPAN BRIDGES

9

Hollow girder bridges - balanced cantilever bridges - continuous girder bridges - rigid frame bridges - arch bridges - bow string girder bridges. Pre-stressed concrete bridges - composite pre-stressed concrete super structures - **erection of precast girders** - continuous construction - recent trends.

UNIT V BEARINGS AND SUBSTRUCTURE

9

Design of bearings for slab, **girder, skew bridges** - Design of piers - abutments - trestles, Joints - expansion joints.

Total No. of Periods: 45

References:

1. Raina VK. "Concrete Bridges Practice" Tata McGraw Hill publishing Company, New/Delhi, 1991.
2. Krishnaraju, N., "Design of Bridges" Oxford and IBH Publishing Co., Bombay, Calcutta, New Delhi, 1998.
3. Dakht, B. and Jaegar, LG., Bridge Analysis simplified, McGraw Hill, 1985.
4. Ponnuswamy, S., Bridge Engineering, Tata McGraw Hill, 1989.
5. Derrick Beckett, An introduction to Structural Design of Concrete Bridges, Surrey University Press, Henley Thames, Oxford Shire, 1973.
6. Taylor, F W, Thomson, S.E. and Smulski E., Reinforced Concrete Bridges, John wiley and Sons, New York, 1955.
7. Edwin H. GaylordJr., Charles N. Gaylord, James, E. Stallmeyer "Design of Steel Structures" McGraw Hill International Editions, 1992.

MST054	DESIGN OF FOUNDATION STRUCTURES					L	T	P	C
	Total Contact Hours: 45					3	0	0	3
	Prerequisite: Foundation Engineering								
	Course Designed by :Department of civil								
OBJECTIVES To study the behavior of various material under impact and seismic loads and know the importance of design structures against earthquakes.									
COURSE OUTCOMES (COs)									
CO1	To learn about soil investigation and basic requirements of foundation								
CO2	To know about types of pile foundations and structural design								
CO3	To understand the types and design of well foundation.								
CO4	To know about the design of foundation for reciprocating and impact machines								
CO5	To understand process of special foundations on expansive soils.								
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low									
1	COs/Pos	a	b	c	d	e			
2	CO1		H						

	CO2		M			
	CO3		H			
	CO4		H			
	CO5		M			
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I SHALLOW FOUNDATIONS 9

Soil investigation – Basic requirements of foundation – Types and selection of foundations. Bearing capacity of soil - plate load test – **Design of reinforced concrete isolated**, strip, combined and strap footings – mat foundation.

UNIT II PILE FOUNDATIONS 9

Introduction – Types of pile foundations – load carrying capacity - pile load test – structural design of straight piles – different shapes of piles cap – structural design of pile cap.

UNIT III WELL FOUNDATION 9

Types of well foundation – Grip length – load carrying capacity – construction of wells – Failures and Remedies – **Design of well foundation – Lateral stability**.

UNIT IV MACHINE FOUNDATIONS 9

Introduction – Types of machine foundation – Basic principles of design of machine foundation – Dynamic properties of soil – vibration analysis of machine foundation – **Design of foundation for Reciprocating machines and Impact machines** – Reinforcement and construction details – vibration isolation.

UNIT V SPECIAL FOUNDATIONS 9

Foundation on expansive soils – choice of foundation – under-reamed pile foundation. Foundation for concrete Towers, chimneys – Design of anchors- **Reinforced earth retaining walls**.

Total No. of Periods: 45

References:

1. Bowles J.E., “Foundation Analysis and Design”, McGraw Hill Publishing co., New York, 1986.
2. Swamy Saran, Analysis and Design of substructures, Oxford and IBH Publishing Co. Pvt. Ltd., 2006.
3. Tomlinson.M.J, “Foundation Design and Construction”, Longman, Sixth Edition, New Delhi, 1995.

4. Varghese.P.C, “Design of Reinforced Concrete Foundations” – PHI learning private limited, New Delhi – 2009.

MST055	DESIGN OF STRUCTURES FOR DYNAMIC LOADS					L	T	P	C
	Total Contact Hours: 45					3	0	0	3
	Prerequisite: Basic Dynamics and Aseismic design								
	Course Designed by :Department of civil								
OBJECTIVES To study the behavior of various material under impact and seismic loads and know the importance of design structures against earthquakes.									
COURSE OUTCOMES (COs)									
CO1	To learn about factors affecting design against dynamic load								
CO2	To know about design against earthquakes as per BIS codes of practice								
CO3	To understand the design against blast and impact as per BIS codes.								
CO4	To know about the design of basic wind speeds								
CO5	To understand special considerations in detailing for ductility.								
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low									
1	COs/Pos	a	b	c	d	e			
2	CO1		H						
	CO2		M						
	CO3		H						
	CO4		H						
	CO5		M						
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
				√					
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

UNIT I ENGINEERING SEISMOLOGY

10

Factors affecting design against dynamic load-Behaviors of concrete, steel, masonry and soil under impact and cyclic loads- **recaps of structural dynamics with reference to SDOF, MDOF and continuous system - ductility and its importance.**

UNIT II INTRODUCTION TO EARTHQUAKE ANALYSIS

10

Earthquakes characterization- response spectra-seismic coefficient and response spectra methods of estimating loads-response of framed, braced frames and shear wall buildings-design as per BIS codes of practices ductility based design.

UNIT-III FUNDAMENTALS OF SEISMIC PLANNING: 10
 Characteristics of internal and external blast- impact and impulse loads-**pressure distribution of building above ground due to external blast** .Underground explosion design of buildings for blast and impact as per BIS codes of practice

UNIT-IV DESIGN APPROACHES: 10
 Characteristics of wind – basic and design wind speeds-effect of permeability of the structures – pressure coefficient- aero elastic and aerodynamics effect-design as per BIS code of practice including gust factor approach –**tall buildings, stacks and chimneys.**

UNIT-V EARTHQUAKE – RESISTANT DESIGN OF STRUCTURAL COMPONENTS AND SYSTEMS: 5
 Energy absorption capacity- ductility of the material and the structure-detailing for ductility-passive and active control of vibrations –**new and favorable materials.**

Total No. of Periods = 45

References:

1. Bela Goschy, design of building to with stand abnormal loading Butterworths 1990.
2. Paulay ,T and Priestly, M.N.J.A seismic design of reinforced concrete and masonry building, John Wiley and Sons 1991.
3. Cowling .C.H.Blast vibration – monitoring and control, Prentice Hall Inc. Eaglewood Cliffs,1985.
4. Kolousek,V.et al.. Wind effects on Civil Engineering Structures, Elsevier, 1984.
5. Concrete Structures under impact and Impulsive Loading, Synthesis Report CEB, Lousanne, Germany, 1988.

MST056	DESIGN OF TALL BUILDINGS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Basic Dynamics and Aseismic design				
	Course Designed by :Department of civil				
OBJECTIVES To study the behavior, analysis and design of tall structures.					
COURSE OUTCOMES (COs)					
CO1	To learn about design criteria based on materials and sequential loading				
CO2	To know about earthquake loading, model analysis and combinations of loading				
CO3	To understand the behavior of various structural systems				
CO4	To know about the Modeling for approximate analysis, Accurate analysis and reduction techniques.				
CO5	To understand special considerations in stability of tall buildings				
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low					

1	COs/Pos	a	b	c	d	e
2	CO1		H			
	CO2		M			
	CO3		H			
	CO4		H			
	CO5		M			
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I DESIGN CRITERIA

5

Design philosophy - Loading, Sequential loading, materials – high performance concrete – Fiber reinforced Concrete – Light weight concrete – **design mix.**

UNIT II LOADING AND MOVEMENT

5

Gravity loading: Dead and live load. methods of live load reduction, Impact gravity loading, construction loads. Wind loading: Static and dynamic approach, Analytical and wind tunnel experimental method.

Earthquake loading: Equivalent lateral force, model analysis, **combinations of loading**, working stress design. Limit state design, plastic design.

UNIT – III BEHAVIOR OF VARIOUS STRUCTURAL SYSTEM

8

Factors affecting growth, Height and Structural form. High rise behavior, Rigid frames, traped frames, Infilled frames, shear walls, coupled shear walls, wall – frames, tubulars, cores, futrigger-braced and hybrid mega systems.

UNIT – IV ANALYSIS AND DESIGN

20

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem Interaction, Analysis for member forces, drift and twist, computerised general three dimensional analysis.

Structural elements: Sectional shapes, properties and resisting capacity, design, deflection, cracking, prestressing, shear flow. **Design for differential movement**, creep and shrinkage effects, temperature effects and fire resistance.

UNIT – V STABILITY OF TALL BUILDINGS

7

Overall buckling analysis of frames, wall-frames. Approximate methods, second order effects of gravity of loading, **P-Delta analysis**, simultaneous first-order and P-Delta

analysis, **Translational, Torsional instability**, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

Total No. of Periods: 45

Text book:

1. Taranth B.S., Structural Analysis and Design of Tall Buildings, McGraw Hill, 1998.

References:

1. Dr. Y. P. Gupta, Editor, Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities Nov.14-16, 1995, New Age International Limited, Publishers, Madras-20.
2. Wolfgang Schueller, High Rise Buildings Structures, John wiley and Sons, 1977.
3. Bryan Stafford smith, Alexcoull, Tall Buildings Structures, Analysis and Design, John Wiley and Sons, Inc., 2005.
4. T. Y. Lin, Stores, Burry, Structural Concepts and systems for Architects and Engineers, John Wiley, 1988.
5. Lynn Beedle, Advance m Tall Buildings, CBS Publishers and Distributors, Delhi 1986.

MST058		INDUSTRIAL STRUCTURES				L	T	P	C
		Total Contact Hours: 45				3	0	0	3
		Prerequisite: Design of steel structures							
		Course Designed by :Department of civil							
OBJECTIVES To understand the concepts of planning and functional requirements, roofs for industrial buildings in various structures and foundation designs.									
COURSE OUTCOMES (COs)									
CO1	To learn about special features and design aspects for the construction of environmental engineering structures.								
CO2	To know about analysis and design of water tanks.								
CO3	To understand the design of special purpose structures.								
CO4	To know about the diagnosing the cause and damage of structural and non								
CO5	To design the pre-stressed concrete pipes.								
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low									
1	COs/Pos	a	b	c	d	e			
2	CO1	H	M						
	CO2	H	M	L					
	CO3	H	M		L				
	CO4	H	M						
	CO5	H	M				L		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT-I PLANNING AND FUNCTIONAL REQUIREMENTS 9

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines from Factories Act.

UNIT-II INDUSTRIAL BUILDINGS 10

Roofs for Industrial Buildings - Steel and RC. Folded Plates and Shell Roofs - Gantry Girders - Design of Corbels and Nibs.

UNIT-III POWER PLANT STRUCTURES 10

Bunkers and Silos, Chimneys and Cooling Towers. High Pressure boilers and piping design - Nuclear containment structures.

UNIT-IV POWER TRANSMISSION STRUCTURES 8

Cables – Transmission Line Towers - Substation Structures - Tower Foundations - Testing Towers.

UNIT-V MACHINE FOUNDATIONS 8

Planning and Design of Machine Foundations

Total No. of Periods: 45

References:

1. Procs. Of Advanced course on Industrial Structures, Structural Engineering Research Centre, 1982.
2. P Srinivasulu and C. V. Vaidyanathan. Handbook of Machine Foundations, Tata McGraw Hill 1976.
3. S.N. Manohar, Tall Chimneys - Design and Construction, Tata McGraw Hill, 1985.
4. AR. Santhakumar and S. S. Murthy, Transmission Line Structures, Tata McGraw Hill. 1992.

MST060	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: repair and rehabilitation of structures				
	Course Designed by :Department of civil				
OBJECTIVES To study the damages, repair and rehabilitation of structures..					

COURSE OUTCOMES (COs)						
CO1	To learn about general consideration in quality assurance, structural appraisal etc					
CO2	To know about techniques for repair in building cracks					
CO3	To understand the reason for ineffective DPC and remedial treatments					
CO4	To know about types, causes for deterioration and preventive measures					
CO5	To learn the concepts of strengthening of existing structures					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H	M		L	
	CO2	M	M	L		
	CO3	M	M		L	L
	CO4	M	M			
	CO5	M	M			
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT-I INTRODUCTION

9

General Consideration – Distresses monitoring – Causes of distresses – Quality assurance – Defects due to climate, chemicals, wear and erosion – Inspection – Structural appraisal – Economic appraisal.

UNIT II BUILDING CRACKS

9

Causes – diagnosis – remedial measures – Thermal and Shrinkage cracks – unequal loading – Vegetation and trees – Chemical action – Foundation movements – Techniques for repair – Epoxy injection.

UNIT III MOISTURE PENETRATION

9

Sources of dampness – Moisture movement from ground – Reasons for ineffective DPC – Roof leakage – Pitched roofs – Madras Terrace roofs – Leakage of Concrete slabs – Dampness in solid walls – condensation – hygroscopic salts – remedial treatments – Ferro cement overlay – Chemical coatings – Flexible and rigid coatings.

UNIT IV DISTRESSES AND REMEDIES

9

Concrete Structures: Introduction – Causes of deterioration – Diagnosis of causes – Flow charts for diagnosis – methods of repair – repairing, spalling and disintegration – Repairing of concrete floors and pavements. Steel Structures : Types and causes for deterioration – preventive measures – Repair procedure – Brittle fracture – Lamellar tearing – Defects in welded joints – Mechanism of corrosion – Design of protect against

corrosion – Design and fabrication errors – Distress during erection. Masonry Structures: Discoloration and weakening of stones – Biotical treatments – Preservation – Chemical preservatives – Brick masonry structures – Distresses and remedial measures.

UNIT V STRENGTHENING OF EXISTING STRUCTURES 9

General principle – relieving loads – Strengthening super structures – plating – Conversion to composite construction – post stressing – Jacketing – bonded overlays – Reinforcement addition – strengthening the substructures – under pinning – Increasing the load capacity of footing – Design for rehabilitation.

Total No. of Periods: 45

References:

1. Allen R.T and Edwards S.C, “Repair of Concrete Structures”, Blakie and Sons, UK, 1987
2. Dayaratnam.P and Rao.R, “Maintenance and Durability of Concrete Structures”, University Press, India, 1997.
3. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical, UK, 1991.
4. Dodge Woodson.R, ”Concrete Structures – protection, repair and rehabilitation”, Elsevier Butterworth – Heinmann, UK, 2009.
5. Peter H.Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications Pvt. Ltd., 2001.
6. Raikar, R.N., “Learning from failures - Deficiencies in Design, Construction and Service” – Rand D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

MST061	OFFSHORE STRUCTURES				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Design of Bridges							
	Course Designed by :Department of civil							
OBJECTIVES To study the optimization methodologies applied to structural engineering								
COURSE OUTCOMES (COs)								
CO1	To know the basic concept in wave theories							
CO2	To study the forces of off shores structures							
CO3	To learn the foundation concept							
CO4	To analyze the modeling of structures							
CO5	To design the off shore structures							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1	H	M					
	CO2	H	H	M				

	CO3	H			L	L
	CO4	M				
	CO5	H			M	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT-I WAVE THEORIES 8

Wave generation process, small and finite amplitude wave theories.

UNIT-II FORCES OF OFFSHORE STRUCTURES 8

Wind forces, wave forces on vertical, inclined cylinders, structures-current forces and use of Morison equation.

UNIT-III OFFSHORE SOIL AND STRUCTURE MODELING 9

Different types of offshore structures, foundation modeling, and structural modeling.

UNIT-IV ANALYSIS OF OFFSHORE STRUCTURES 10

Static method of analysis, foundation analysis and dynamics of offshore structures.

UNIT-V DESIGN OF OFFSHORE COMPONENTS 10

Design of platforms, helipads, Jacket tower and mooring cables and pipe lines.

Total No. of Periods: 45

References:

1. Chakrabarti, S.K. "Hydrodynamics of Offshore Structures", Computational Mechanics Publications, 1987.
2. Thomas H. Dawson, "Offshore Structural Engineering", Prentice Hall Inc. Englewood Cliffs, N.J. 1983.
3. API. "Recommended Practice for Planning Designing and Constructing Fixed Offshore Platforms". American Institute Publication, RP2A Dalls. Tex.
4. Wiegel, R.L. Oceanographical Engineering, Prentice Hall Inc., Englewood Cliffs. N.J. 1964.
5. Brebia. C.A Walker, S. Dynamic Analysis of Offshore Structures. Vol.1, Krieger Publishing Company, Malabar, Florida, 1991.
6. Reddy. D.V and Arockiaswamy. M, Offshore Structures, Vol.1., Krieger Publishing Company Malabar, Florida, 1991.

MST062	OPTIMIZATION IN STRUCTURAL DESIGN				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Design of structural steel							
	Course Designed by :Department of civil							
OBJECTIVES To study the optimization methodologies applied to structural engineering								
COURSE OUTCOMES (COs)								
CO1	To know the basic concept in optimization of structures							
CO2	To analyze programming methods for optimal design of structures							
CO3	To study the plastic design of structures							
CO4	To learn the optimization methods							
CO5	To understand the optimization by structural theorems							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1	H		H				
	CO2	H	M					
	CO3	H		M				
	CO4	H			L			
	CO5	H					L	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)		
				√				
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

UNIT I INTRODUCTION

8

Basic Concepts of minimum weight, minimum cost design. Objective function, constraints, classical methods.

UNIT II OPTIMIZATION TECHNIQUES AND ALGORITHMS

10

Linear Programming, Integer Programming, Quadratic programming Dynamic Programming and Geometric Programming, methods for Optimal design of structural elements.

UNIT III COMPUTER SEARCH METHODS**10**

Linear Programming Methods for plastic design of frames. Computer search methods for univariate and multivariate Minimization.

UNIT-IV OPTIMIZATION THEOREMS**8**

Non Linear optimization, one dimensional Minimization methods – Exhaustive Research Dichotomous Search and direct root methods.

UNIT-V GAME THEORY**9**

Optimization by structural theorems. Maxwell, Mitchell and Hayman's Theorems for trusses and frames, **fully stressed design with deflection constraints, optimality criterion methods.**

Total No. of Periods: 45**Reference:**

1. Spunt, Optimum Structural Design, Civil Engineering engineering Mechanics Services, Prentice – Hall, New Jersey 1971.
2. S.S. Rao, Optimization Theory and Application, Wiley Eastern Limited, NewDelhi, 1977.
3. Uri Krisch, Optimum Structural Design, McGraw Hill Book Co. 1981.
4. Richard Bronson, Operations Research, Schaum's Outline Series, McGraw Hill Book Co. Singapore, 1983.

MST063		PREFABRICATED STRUCTURE			L	T	P	C
		Total Contact Hours: 45			3	0	0	3
		Prerequisite: Concrete structures						
		Course Designed by :Department of civil						
OBJECTIVES To study the optimization methodologies applied to structural engineering								
COURSE OUTCOMES (COs)								
CO1	To know the general principles in prefabricated structures							
CO2	To analyze the design of slabs and framed structures							
CO3	To study the design of floors, stairs and roofs							
CO4	To learn the design of walls							
CO5	To analyze the design of industrial building							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1	M	M					
	CO2	H	M	L				
	CO3	H	M		L			
	CO4	H	M		L	L		
	CO5	H	M					

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION 9

General Civil Engineering requirements, specific requirement for planning and layout of Prefabricates plant. IS code specifications.

DESIGN PRINCIPLES

Modular Co-ordination, standardization, Disuniting of Prefabricates, Production, transportation, erection, stages of loading and codal provisions, safety factors, material properties. Deflection control, Lateral load resistance, Location and types of shear walls.

UNIT II REINFORCED CONCRETE 6

Prefabricated Structures – Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs. Framed buildings with partial and curtain walls, single storey industrial buildings with trusses and shells, Crane-gantry systems.

UNIT III FLOORS, STAIRS AND ROOFS 9

Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements. Description of joints, their behaviour and reinforcement requirements. Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term load, ultimate strength calculations in shear and flexure.

UNIT IV WALLS 9

Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, Vertical loads. Eccentricity and stability of wall panels, Design Curves, types of wall joint, their behaviour and design. Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

UNIT V DESIGN OF INDUSTRIAL BUILDINGS 12

Components of single-storey industrial sheds with crane gantry systems. Design of R.C. Roof Trusses, Roof Panels, Design of R.C. Crane-gantry girders, corbels and columns, wind bracing design.

DESIGN OF SHELL ROOFS FOR INDUSTRIAL SHEDS

Cylindrical, Folded plate and hyper-prefabricated shells. Erection and joining, joint design hand book based design

Total No. of Periods: 45

References:

1. B.Lewicki, Building with Large Prefabricates, Elsevier Publishing company, Amsterdam/London/New York, 1966.
2. Koncz T., Manual of Precast Concrete Construction, Vol. I,II and III, Bauverlag, GMBH, 1971.
3. Structural Design Manual, Precast Concrete Connection details, Society for the Studies in the use of Precast Concrete, Netherland BetorVerlag, 1978.

MST064	PRESTRESSED CONCRETE					L	T	P	C
	Total Contact Hours: 45					3	0	0	3
	Prerequisite: Reinforced Concrete Structures								
	Course Designed by :Department of civil								
OBJECTIVES Principle of pre - stressing, Analysis and design of pre - stressed concrete structures.									
COURSE OUTCOMES (COs)									
CO1	To know the principle of pre - stressing								
CO2	To analyze the design of end block and circular pre - stressing								
CO3	To know the design of compression members								
CO4	To learn the design of composite beams and application								
CO5	To understand the concept of pre - stressing in continuous beams								
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low									
1	COs/Pos	a	b	c	d	e			
2	CO1	H	M						
	CO2	H	M	M	M				
	CO3	H	M						
	CO4	H	M		M	L			
	CO5	H	M						
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
				√					
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

UNIT V INELASTIC BUCKLING**9**

Double modulus theory - Tangent modulus theory - **Shanley's model** - Eccentrically loaded inelastic column. Inelastic buckling of plates - Post buckling behavior of plates.

Total No. of Periods: 45**References:**

1. Ashwini Kumar, "Stability Theory of Structures", Allied publishers Ltd., New Delhi, 2003.
2. Chajes, A. "Principles of Structures Stability Theory", Prentice Hall, 1974.
3. Gambhir, "Stability Analysis and Design of Structures", Springer, New York, 2004.
4. Simitser.G.J and Hodges D.H, "Fundamentals of Structural Stability", Elsevier Ltd., 2006.
5. Timoshenko.S.P, and Gere.J.M, "Theory of Elastic Stability", McGraw Hill Book Company, 1963.

MST066		THEORY OF PLATES			L	T	P	C
		Total Contact Hours: 45			3	0	0	3
		Prerequisite: Design Of RC Framed Structures						
		Course Designed by :Department of civil						
OBJECTIVES To study the behavior and analysis of thin plates, anisotropic and thick plates								
COURSE OUTCOMES (COs)								
CO1	To study about the thin plates with differential equations							
CO2	To analyze the rectangular plates by Navier and Levy's method							
CO3	To know the Symmetrical bending of circular plates							
CO4	To learn the finite elements methods							
CO5	To know the about orthotropic plates							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1	H	M					
	CO2	H	M					
	CO3	H			L	L		
	CO4	H	M	M				
	CO5	H						

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I THIN PLATES 10

Thin Plates with small deflection, Laterally loaded thin plates, governing differential equation, various boundary conditions.

UNIT II ANALYSIS METHODS 10

Rectangular plates. Simply supported rectangular plates, Navies solution and Levy's method, Rectangular plates with various edge conditions.

UNIT III CIRCULAR PLATES 10

Symmetrical bending of circular plates, plates on elastic foundation.

UNIT IV SPECIAL AND APPROXIMATE METHOD 8

Energy methods, Finite difference and Finite elements methods.

UNIT V ANISOTROPIC PLATES AND THICK PLATES 7

Orthotropic plates and grids, moderately thick plates.

Total No. of Periods: 45

References:

1. Szilard. R., Theory of analysis of Plates, Prentice Hall Inc.
2. Timoshenko, S. and Krieger S.W. Theory of Plates and Shells McGraw Hill Book Company, New York 1990.

MST067	WIND AND CYCLONE EFFECTS ON STRUCTURES	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Coastal Engineering				
	Course Designed by :Department of civil				
OBJECTIVES To study the concept of wind and cyclone effects for the analysis and design of structures					
COURSE OUTCOMES (COs)					
CO1	To know the basic concept in spectral studies				

CO2	To have knowledge about wind tunnels					
CO3	To study about the effect of wind on structures					
CO4	To understand the design method					
CO5	To know the cyclone effect on structures					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H		L		
	CO2	M	M			
	CO3	M	M			
	CO4	M		M	L	
	CO5	M				L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION 10

Introduction Spectral studies, Gust factor, Wind velocity, Method of measurement, Variation of speed with height, shape factor, aspect ratio: drag effects.

UNIT II WIND TUNNEL STUDIES 5

Wind Tunnel Studies, Types of tunnels, modeling requirement. Interpretation of Results, Aero-Elastic Model.

UNIT III EFFECT OF WIND ON STRUCTURES 12

Wind on structures, Rigidity structures, Flexible structures, Static and dynamic effects. Tall buildings, chimneys.

UNIT IV DESIGN OF SPECIAL STRUCTURES 12

Application to design, IS 875 code method, Buildings, Chimneys, Roofs, Shelters.

UNIT V CYCLONE EFFECTS 6

Cyclone effect on Structures, cladding design, window glass design.

Total No. of Periods: 45

Text books:

1. Cook,N.J. The Designer’s Guide to Wind Loading of Building Structures, Butter-worths, 1989.
2. Kolousek. Et at., Wind Effect on Civil Engineering Structures, Elsevier Publications , 1984.

Reference:

1. Peter Sachs, Wind Forces in Engineering , Pergamon Press ,New York, 1972.
2. Lawson T.V., Wind Effects on Building Vol. I and II, Applied Science Publishers, London, 1980.

MST068	DESIGN OF SHELL AND SPATIAL STRUCTURES				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Industrial structures							
	Course Designed by :Department of civil							
OBJECTIVES Study the behavior and design of shells, folded plates, space frames and application of FORMIAN software								
COURSE OUTCOMES (COs)								
CO1	To understand the types of shells							
CO2	To have knowledge about structural behavior of shells							
CO3	To study about the general principles							
CO4	To understand the design of space frames							
CO5	To know the optimization of structures							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1	H						
	CO2	H	M	H				
	CO3	H						
	CO4	H			L	L		
	CO5	H						
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)		
				√				

4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016
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UNIT I INTRODUCTION OF SHELLS 10

Classification of Shells, types of Shells, Structural action, membrane theory, Shells of revolution and Shells of translation, examples, limitations of membrane theory.

UNIT II FOLDED PLATES - ANALYSIS & DESIGN 10

Folded plate Structures, Structural behaviour, types, design by ACI- ASCE Task Committee method.

UNIT III SPACE FRAMES 5

Space frames- Configuration- types of nodes- general principles of design Philosophy- Behaviour.

UNIT IV ANALYSIS & DESIGN OF SPACE FRAMES 10

Analysis of Space frames- Formex Algebra, FOR MAIN – detailed design of space frames.

UNIT V OPTIMIZATION 10

Optimization by Structural theorems- Maxwell, Mirchell and Heyman's Theorems for trusses and frames, fully Stressed design with deflection constrains, genetic Algorithm.

Total No. of Periods: 45

References:

1. Wilhelm Flugge, stresses in shelts, Springer- Verlag
2. Timoshenko, S. Theory of Plates and Shells, McGraw Hill, 1990
3. Ramasamy, G.S., Design and Construction of Concrete Shells Roofs, CBS publishers, 1986.
4. Principles of Space Structures by Dr. N. Subramanian- 1999, Wheeler Publishing Co.
5. Proceedings of International Conference of Space Structures, AnnaUniversity, November 1997.
6. Uri krish, Optimum Structural Design, McGraw Hill Book Co. 1981.

MST069	DISASTER RESISTANT STRUCTURES	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Repair and Rehabilitation of structures				
	Course Designed by :Department of civil				
OBJECTIVES To know the various types of disasters caused by the natural and disaster prone areas in India					
COURSE OUTCOMES (COs)					
CO1	To understand the behavior concept of structures				
CO2	To have knowledge about response of the structure for various disasters				
CO3	To understand detailing of structures				
CO4	To know about various modern materials				
CO5	To have idea about assessment of structures				

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M				
	CO2				L	
	CO3	H				
	CO4		H			L
	CO5	M		M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I BEHAVIOUR OF LIFE- LINE STRUCTURES 9

Philosophy for design to resist earthquake, cyclone and flood- National and International codes of practice. By laws of urban and semi- urban areas. **Traditional and modern structures.**

UNIT II COMMUNITY STRUCTURES 9

Response of dams, bridges, buildings- strengthening measures- safety analysis and rating- **Reliability assessment.**

UNIT III REHABILITATION AND RETROFITTING 9

Testing and evaluation- classification of structures for safety point of view- methods of strengthening for different disasters- qualification test.

UNIT IV DETAILING OF STRUCTURES AND COMPONENTS 9

Use of modern materials and their impact on disaster reduction- use of modern analysis, design and **construction techniques optimization** for performance.

UNIT- V DAMAGE ASSESSMENT OF STRUCTURES 9

Damage surveys- Maintenance and modifications to improve hazard resistance- Different types of foundation and its impact on safety- **Ground improvement techniques.**

Total No. of Periods: 45

Text books:

1. V. Moshrin ct. all concrete and Reinforced Concrete- Deterioration and Protection- Mir Publishers- Moscow 1980.
2. R.T. Alien and S.C. Edwards, Repair of Concrete Structures, Blakie and Sons. U.K. 1987.

References:

1. Proceedings IABSE 14th Congress “Civilisation through Civil Engineering”- New Delhi, May 1992.
2. Raiker R.N. Learning from failures Deficiencies in Design, Construction and Service R&D Centre (SDCPL) Raiker Bhavan, Bombay 1987.

LIST OF OPEN ELECTIVE (OE)

MST070	RESEARCH METHODOLOGY					L	T	P	C
	Total Contact Hours: 45					3	0	0	3
	Prerequisite: Professional Courses								
	Course Designed by :Department of civil								
OBJECTIVES To know the various types of Formulation of Research Task, modeling and simulation, analysis of reports and report writing.									
COURSE OUTCOMES (COs)									
CO1	To understand the basic concept of Formulation of Research Task.								
CO2	To have knowledge about mathematical modeling and simulation								
CO3	To understand experimental modeling.								
CO4	To know about of analysis of report.								
CO5	To know about of concept of report writing.								
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low									
1	COs/Pos	a	b	c	d	e			
2	CO1	M	M						
	CO2	H	M		L				
	CO3	H	M						
	CO4	M	M		L	L			
	CO5	M	M	M					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
					√				
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

UNIT-I RESEARCH CONCEPTS**9**

Concepts, meaning, objectives, motivation, types of research, approaches, research (Descriptive research, Conceptual, Theoretical, Applied & Experimental).

Formulation of Research Task – Literature Review, Importance & Methods, Sources, quantification of Cause Effect Relations, Discussions, Field Study, Critical Analysis of Generated Facts, Hypothetical proposals for future development and testing, selection of Research task.

UNIT-II MATHEMATICAL MODELING AND SIMULATION 9

Concepts of modeling, Classification of Mathematical Models, Modeling with Ordinary differential Equations, Difference Equations, Partial Differential equations, Graphs, Simulation, Process of formulation of Model based on Simulation.

UNIT-III EXPERIMENTAL MODELING 9

Definition of Experimental Design, Examples, Single factor Experiments, Guidelines for designing experiments. Process Optimization and Designed experiments, Methods for study of response surface, determining optimum combination of factors, Taguchi approach to parameter design.

UNIT-IV ANALYSIS OF RESULTS 9

Parametric and Non-parametric, descriptive and Inferential data, types of data, collection of data (normal distribution, calculation of correlation coefficient), processing, analysis, error analysis, different methods, analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity and non-linearity of model.

UNIT-V REPORT WRITING 9

Types of reports, layout of research report, interpretation of results, style manual, layout and format, style of writing, typing, references, tables, figures, conclusion, appendices.

Total No. of Periods: 45

TEXT BOOKS

1. Willktnsion K. L, Bhandarkar P. L, „Formulation of Hypothesis“, Himalaya Publication.
2. Schank Fr., „Theories of Engineering Experiments“, Tata Mc Graw Hill Publication.

REFERENCE BOOKS

1. Douglas Montgomery, „Design of Experiments“, Statistical Consulting Services, 1990.
2. Douglas H. W. Allan, „Statistical Quality Control: An Introduction for Management“, Reinhold Pub Corp, 1959.
3. Cochran and Cocks, „Experimental Design“, John Willy & Sons.
4. John W. Besr and James V. Kahn, „Research in Education“, PHI Publication.
5. Adler and Granovky, „Optimization of Engineering Experiments“, Meer Publication.
6. S. S. Rao, „Optimization Theory and Application“, Wiley Eastern Ltd., New Delhi, 1996.

MST057	ENVIRONMENTAL ENGINEERING STRUCTURES	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Environmental Science				
	Course Designed by :Department of civil				

OBJECTIVES To understand the concepts of water tank designs, purpose of special structures and diagnosing the cause and damage.						
COURSE OUTCOMES (COs)						
CO1	To learn about special features and design aspects for the construction of environmental engineering structures.					
CO2	To know about analysis and design of water tanks.					
CO3	To understand the design of special purpose structures.					
CO4	To know about the diagnosing the cause and damage of structural and non-structural cracks					
CO5	To design the pre-stressed concrete pipes.					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	H				
	CO2	H	M	M	L	
	CO3	H				L
	CO4	H				
	CO5	H	M			L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√	
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION

4

IS codes for design of water retaining structures. Special features and design aspects for the construction of environmental engineering structures.

UNIT II ANALYSIS AND DESIGN OF WATER TANKS

12

Design of concrete roofing system a) Cylindrical domes b) Conical domes design of folded plates for roofing with concrete. (V Type only)

UNIT III DESIGN OF SPECIAL PURPOSE STRUCTURES

12

Underground reservoirs and swimming pools, Structural design including foundation of water retaining structures such as settling tanks, clari-floculators, aeration tanks etc., -effect of earth pressure and uplift considerations – selection of materials of construction.

UNIT IV REPAIR AND REHABILITATION OF STRUCTURES

12

Diagnosing the cause and damage, identification of different types of structural and non-structural cracks - repair and rehabilitation methods for Masonry, Concrete and steel Structures.

UNIT V DESIGN OF PIPES

5

Structural design of reinforced cement concrete, pr-stressed concrete pipes.

Total No. of Periods: 45

Text book:

1. Reinforced Concrete by P. Dayaratnam
2. Prestressed Concrete by Krishna Raju. Tata McGraw Hill Publishing Co.2nd Edition 1988.
3. Reinforced Concrete by N.C. Sinha & S.K. Roy – S. Chand and Co. 1985.

References:

1. Hulse R., and Mosley. W.H., Reinforced concrete Design by Computer, Macmillan Education Ltd., 1986
2. Ramaswamy, G.S., Design and Construction of Concrete shell roofs, CBS Publishers, India 1986.
3. Greem, J.K. and Perkins, P.H. Concrete liquid retaining structures. Applied Scienmce Publishers, 1981.

MST070	RESEARCH METHODOLOGY				L	T	P	C
	Total Contact Hours:45				3	0	0	3
	Prerequisite: Professional Courses							
	Course Designed by : Department of Civil Engineering							
OBJECTIVES								
<ul style="list-style-type: none"> • To Get adequate knowledge about research concepts • To describe mathematical modeling and simulation • To understand experimental modeling • To get knowledge about the interpretation of result 								
COURSE OUTCOMES (COs)								
CO1	To describe research concepts.							
CO2	To Get adequate knowledge about mathematical modeling							
CO3	To describe experimental modeling							
CO4	To understand analysis of results							
CO5	To know about report writing							
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low								
1	COs/Pos	a	b	c	d	e		
2	CO1	H	M	L	M	M		
	CO2	H	M	L	M	M		
	CO3	H	M		M	M		
	CO4	H	M	L	M	M		
	CO5	H	M		M	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
					√	
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

I. RESEARCH CONCEPTS 9

II. Concepts, meaning, objectives, motivation, types of research, approaches, research (Descriptive research, Conceptual, Theoretical, Applied & Experimental).

Formulation of Research Task – Literature Review, Importance & Methods, Sources, quantification of Cause Effect Relations, Discussions, Field Study, Critical Analysis of Generated Facts, Hypothetical proposals for future development and testing, selection of Research task.

II MATHEMATICAL MODELING AND SIMULATION 9

Concepts of modeling, Classification of Mathematical Models, Modeling with Ordinary differential Equations, Difference Equations, Partial Differential equations, Graphs, Simulation, Process of formulation of Model based on Simulation.

III EXPERIMENTAL MODELING 9

Definition of Experimental Design, Examples, and Single factor Experiments, Guidelines for designing experiments. Process Optimization and Designed experiments, Methods for study of response surface, determining optimum combination of factors, Taguchi approach to parameter design.

IV ANALYSIS OF RESULTS 9

Parametric and Non-parametric, descriptive and Inferential data, types of data, collection of data (normal distribution, calculation of correlation coefficient), processing, analysis, error analysis, different methods, analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity and non-linearity of model.

V REPORT WRITING 9

Types of reports, layout of research report, interpretation of results, style manual, layout and format, style of writing, typing, references, tables, figures, conclusion, appendices.

TEXT BOOKS

1. Wilkinson K. L, Bhandarkar P. L, „Formulation of Hypothesis“, Himalaya Publication.
2. Schank Fr., „Theories of Engineering Experiments“, Tata Mc Graw Hill Publication.

REFERENCE BOOKS

1. Douglas Montgomery, “Design of Experiments“, Statistical Consulting Services, 1990.

2. Douglas H. W. Allan, "Statistical Quality Control: An Introduction for Management", Reinhold Pub Corp, 1959.
3. Cochran and Cocks, „Experimental Design“, John Willy & Sons.
4. John W. Besr and James V. Kahn, „Research in Education“, PHI Publication.
5. Adler and Granovky, "Optimization of Engineering Experiments", Meer Publication.
6. S. S. Rao, „Optimization Theory and Application“, Wiley Eastern Ltd., New Delhi, 1996.