REGULATION 2015
M.TECH – STRUCTURAL ENGINEERING
CURRICULUM AND SYLLABUS

SEMESTER–I

S.No	Code	Subject Name	L	T	P	C
Theory						
1	MMA101	Advanced Mathematical Methods	3	1	0	3
2	MST101	Theory of Elasticity and Plasticity	3	0	0	3
3	MST102	Computer Aided Structural Analysis	3	0	2	4
4	MST103	Structural Dynamics	3	0	0	3
5	MST1E1	Elective- I	3	0	0	3
6	MST1E2	Elective- II	3	0	0	3
		Total	18	1	2	19

SEMESTER-II

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

SEMESTER-III

S.No	Code	Subject Name	L	T	P	C
1	MST3E4	Elective- IV	3	0	0	3
2	MST3E5	Elective- V	3	0	0	3
3	MST3E6	Elective- VI	3	0	0	3
4	MST3P1	Project Work Phase I	0	0	12	6
		Total	9	0	12	15

SEMESTER- IV

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

Total Credits for the Programme – 66

LIST OF ELECTIVES

Sl.No.	Code	Subject Name	L	T	P	C
1	MST051	Computer Aided Structural Design	3	0	0	3
2	MST052	Advanced Concrete Technology	3	0	0	3
3	MST053	Design of Bridges	3	0	0	3
4	MST054	Design of Foundation Structures	3	0	0	3
5	MST055	Design of Structures For Dynamic Loads	3	0	0	3
6	MST056	Design of Tall Buildings	3	0	0	3
7	MST057	Environmental Engineering Structures	3	0	0	3
8	MST058	Industrial Structures	3	0	0	3
9	MST060	Maintenance and Rehabilitation of Structures	3	0	0	3
10	MST061	Offshore Structures	3	0	0	3
11	MST062	Optimization in Structural Design	3	0	0	3
12	MST063	Prefabricated Structures	3	0	0	3
13	MST064	Pre-stressed Concrete	3	0	0	3
14	MST065	Stability of Structures	3	0	0	3
15	MST066	Theory of Plates	3	0	0	3
16	MST067	Wind and Cyclone Effects On Structures	3	0	0	3
17	MST068	Design of Shell and Spatial Structures	3	0	0	3
18	MST069	Disaster Resistant Structures	3	0	0	3
19		Research Methodology	3	0	0	3

MMA101 ADVANCED MATHEMATICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVE

- To familiarize the students in the field of differential equations to solve boundary value problems associated with engineering applications.
- To expose the students to variational formulation and conformal mapping and their applications to obtain solutions for buckling, dynamic response, heat and flow problems of one and two dimensional conditions.

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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S				W				
CO2	S			S	M							
CO3	S			S								
CO4	S			S	M			W				
CO5	S			S	M							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I **9**

Laplace Transform Techniques for Partial Differential Equations

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 **9**

Fourier Transform Techniques for Partial Differential Equations

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 Poison's equations.

UNIT III **9**

Calculus of Variations

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 **9**

Conformal Mapping and Applications

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 **9**

Tensor Analysis

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

Tutorials **15**

L=45, T=15, Total No. of Periods: 60

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
3	1	0	3

OBJECTIVE:

- To understand the concept of 3D stress, strain analysis and its applications to simple problems

COURSE OUTCOME:

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S							W				
CO2	S			S	M							
CO3	S			S								
CO4	S			S	M			W				
CO5				S	M							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT-I **9**

Introduction

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 **9**

Stress Strain Analysis

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

UNIT-III **9**

Torsion

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

UNIT-IV **9**

Energy Methods

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

UNIT-V **9**

Plasticity

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. "Therory of Elasticity",McgrawHill Book Co., New York 1988.
2. Sadusingh ," 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
3	0	2	4

OBJECTIVE

- To introduce the students about computer applications, structural analysis, design of 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 -3d Analysis.
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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	M							
CO2	S		M	S	M		M					
CO3	S			S								

CO4	S		M	S	M		M					
CO5	S			S								

Course Assessment Methods:

Direct		**Indirect**	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 Gtstcudl – 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 l 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.

MST103 **STRUCTURAL DYNAMICS**

L	T	P	C
3	0	0	3

OBJECTIVE:

To expose the students the principles and methods of dynamic analysis of structures and to prepare them for designing the structures for wind, earthquake and other dynamic loads

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S								
CO2	S			S								
CO3	S			S								
CO4	S			S								
CO5	S			S		M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT-I **12**

Principles of Dynamics - D'Alambert'sPrinciple - 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 **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 **8**

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

UNIT-IV **8**

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

UNIT-V **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. SrinivasuluP. &Vaidyanathan, C. V "Hand Book Of Machine Foundations" Tata McGraw Hill. New Delhi.

MST201 CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	S							

CO2	S			S	S							
CO3	S			S	S							
CO4	S	M		S	S							
CO5	S			S	S	M						

Course Assessment Methods:

Direct		**Indirect**	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I

Overall Review **9**

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
3	1	0	3

OBJECTIVE:
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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	S							
CO2	S			S	S							
CO3	S			S	S	M						
CO4	S			S	S							
CO5	S			S	S							S

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

PART-A
EXPERIMENTAL STRESS ANALYSIS (ESA)

UNIT – I **5**

Introduction

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

INSTRUMENTAITON

UNIT-III **5**

Measuring Instruments

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.

Practicals **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
3	0	0	3

OBJECTIVE:

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	S							
CO2	S			S	S							
CO3	S			S	S	M						
CO4	S			S	S							
CO5	S			S	S							S

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 Axisymetric 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. Zienkicwicz, 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.

MST204 STEEL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

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 sole problems on design of light gauge steel structures.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	S							
CO2	S			S	S							
CO3	S			S	S	M						
CO4	S	M		S	S							
CO5	S			S	S							S

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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., 19**8**1.
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
3	0	0	3

OBJECTIVE

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	S							
CO2	S	W		S	S			W			W	
CO3	S			S	S	M						
CO4	S	M		S	S							
CO5	S			S	S							S

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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
0	0	4	2

OBJECTIVE:

- To provide exposure to the students with hands on experience in advanced structural engineering lab.

COURSE OUTCOMES:

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S	M									
CO2		S				M						
CO3		S		W								
CO4		S				M						
CO5		S	M									

Course Assessment Methods:

Direct		Indirect
Observation Book	1	Course and Survey
Record Book	2	Faculty Survey
Model Examination	3	Industry
	4	Alumni
End Semester Examinations		

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
3	0	0	3

OBJECTIVE:

To introduce the students about computer applications, structural analysis, design of special structures and expert systems with application analysis

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S	S	S	M						
CO2	S	M	S	S	S						M	
CO3			S	S	S	M						
CO4	S		S	S	S							
CO5			S	S	S	M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I

Computer Graphics **9**

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. Billey 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
3	0	0	3

OBJECTIVE:

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	S			M								
CO2	S			M	S							
CO3	S			M		M						
CO4	S		S	M								
CO5	S		S	M	S							

Course Assessment Methods:

Direct		**Indirect**	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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

MST053 DESIGN OF BRIDGES

L	T	P	C
3	0	0	3

OBJECTIVE:

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 design of slab bridges and T - beam bridges.
CO4- To know about the various long span bridges.
CO5- To understand process carried out in bearings and substructure.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S	S								
CO2	S		S	S	S			W				
CO3	S		S	S		M						
CO4	S	M	S	S								
CO5	S		S	S	S							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 Thomes, 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
3	0	0	3

OBJECTIVE:

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.

CO/PO Mapping
S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		M	S	S							
CO2	S	W	S	S	S			W			W	
CO3	S		S	S	M	M						
CO4	S	S	S	S	M							
CO5	S		M	S								S

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 Foundations **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 retailing 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
3	0	0	3

OBJECTIVE:

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S									
CO2	S		S		S			W			W	
CO3	S		S		M							
CO4	S		S	S	M							
CO5	S		M									

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I

Introduction **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

Design against Earthquakes **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 **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 against Wind **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

Special Considerations **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. BelaGoschy, 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, Synyhesis Report CEB, Lousanne, Germany, 1988.

MST056 DESIGN OF TALL BUILDINGS

L	T	P	C
3	0	0	3

OBJECTIVE

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S	S								
CO2	S	W	S	S	S			W			W	
CO3	S		S	S		M						
CO4	S		S	S								
CO5	M		S	M								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 Systems **8**

Factors affecting growth, Height and Structural form. High rise behavior, Rigid frames, traced 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.

MST057 ENVIRONMENTAL ENGINEERING

STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S									
CO2	S	W	S		S			W			W	
CO3	S		M									
CO4	S	S	M	S								
CO5	S		S									

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 concret 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. Apllied Scienmce Publishers, 1981.

MST 058 INDUSTRIAL STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

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 classification of industries and industrial structures.
CO2- To know about design of industrial buildings and its components .
CO3- To understand the analysis of power plant structures.
CO4- To know about power transmission structures
CO5- To learn the concepts of planning and design of machine foundations.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S									
CO2	S		M		S							
CO3	S		S		S	M						
CO4	S	S	S	S								
CO5	S		S		S							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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.

MST 060 MAINTENANCE AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE

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.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S		M		S					
CO2	S		S		S							
CO3	S	M	S		M	S						
CO4	S		S	S	S							
CO5	S		S		S							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 – Conversation 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
3	0	0	3

OBJECTIVE

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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S	M	S							
CO2	S	M	S		M			W				
CO3	S		S	M	M							
CO4	S		S									
CO5	S		S		M							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 IncEnglewood 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
3	0	0	3

OBJECTIVE:

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

CO/PO Mapping
S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	M		M		S	M						
CO2	S		S	M				M				
CO3	S	W	S	S								
CO4	S		M	S	S	S						
CO5	S		S		S	M						

Course Assessment Methods:

Direct		**Indirect**	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I **8**

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

UNIT II **10**

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

UNIT III **10**

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

UNIT-IV **8**

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

UNIT-V **9**

Optimization by structural theorems. Maxwell, Mitchell and Heyman'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
3	0	0	3

OBJECTIVE:

To Study the design principles, analysis and design of elements**.**

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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				M							
CO2	S	W	S	S				W				
CO3	S		S	S								
CO4	S	W	S	S	M							
CO5	S		S	S		M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		

6	End Semester Examinations		

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
3	0	0	3

OBJECTIVE

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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S	S								
CO2	S	M	S	M			S					
CO3	S		S	M	S			W				
CO4	S	S	S	S								
CO5	W		S	M	S							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I

Introduction **9**

Principles of Pre-stressing types and systems of pre-stressing, need for High Strength materials. Analysis methods losses, deflection (short-long term), camber, cable layout. Behavior under flexure – codal provisions (IS, British, ACI and DIN), ultimate strength.

UNIT II

End Block & Circular Prestressing **9**

Design of flexural members, Design for Shear, bond and torsion. Design of End blocks and their importance Design of tension members – application in the design of pre-stressed pipes and pre-stressed concrete cylindrical water tanks.

UNIT III

Design Of Compression Members **9**

Design of compression members with and without flexure its application in the design pipes, flag masts and similar structures.

UNIT IV

Composite Construction **9**

Composite beams – analysis and design, ultimate strength – their applications. Partial pre-stressing – its advantages and applications.

UNIT-V

Continuous Beams **9**

Application of pre-stressing in continuous beams, concept of linear transformation, concordant cable profile and cap cables. Special structures like pre-stressed folded plates, pre-stressed cylindrical shells, pre-stressed concrete poles.

Total No. of Periods: 45

Text books:

1. Pre-stressed Concrete by Krishna Raju, TataMcGraw Hill Publishing CO. 2nd Edition, 1988.
2. Fundamentals of Pre-stressed Concrete by N.C. Sinha & S.K. Roy S. Chand & Co., 1985.

References:

1. T.Y. Lin, Design of Prestressed Concrete Structures, John Wiley and Sons, Inc.1960.
2. Leonhardt. F., Prestressed Concrete, Design and Construction, Wilhelm Ernst and Shon, Berlin, 1964.
3. Freyssiner, Prestressed Concrete.
4. Military Engineers Hand Book.
5. Evans, R.H and Bennett, E.W. Prestressed Concrete, Champman and Hall, London, 1958.

MST065 STABILITY OF STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE

To study the concept of buckling and analysis of structural elements.

COURSE OUTCOMES (COs)

CO1- To know the fundamentals of probability
CO2- To learn the resistance parameters and loads
CO3- To analyze the reliability of structures
CO4- To know the application concept
CO5- To understand the risk decision problems

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S	S							
CO2	S			M	S		M	W				
CO3	S		S		S							
CO4	S				M		M					
CO5	S		M		S	M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I

Buckling of Columns **9**

States of equilibrium - Classification of buckling problems - concept of equilibrium, energy, imperfection and vibration approaches to stability analysis - Eigen value problem. Governing equation for columns - Analysis for various boundary conditions - using Equilibrium, Energy methods. Approximate methods - Rayleigh Ritz, Galerkins approach - Numerical Techniques - Finite difference method - Effect of shear on buckling.

UNIT II

Buckling of Beam-Columns and Frames **9**

Theory of beam column - Stability analysis of beam column with single and several concentrated loads, distributed load and end couples Analysis of rigid jointed frames with and without sway – Use of stability function to determine the critical load.

UNIT III

Torsional And Lateral Buckling **9**

Torsional buckling – Combined Torsional and flexural buckling - Local buckling. Buckling of Open Sections. Numerical solutions. Lateral buckling of beams, pure bending of simply supported and cantilever beams.

UNIT IV

Buckling of Plates **9**

Governing differential equation - Buckling of thin plates, various edge conditions -Analysis by equilibrium and energy approach – Finite difference method.

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
3	0	0	3

OBJECTIVE

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 navies 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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S		M							
CO2	S	M	M		S							
CO3	S		S	S	M			W				
CO4	S		S		S	M						
CO5	S		M		S							

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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

Anisotroic 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.

MST 067 WIND AND CYCLONE EFFECTS ON STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVE:

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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			S		M						
CO2	M	S		S	S			W				
CO3	M	M	M	M								
CO4	S		S									
CO5	M			M								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I **10**

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

UNIT II **5**

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

UNIT III **12**

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

UNIT IV **12**

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

UNIT V **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
3	0	0	3

OBJECTIVE:

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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		M	S			S					

CO2	S		M				S	W				
CO3	S	W	M		S		S					
CO4	S		S	S			S					
CO5	S		S				M					

Course Assessment Methods:

Direct		**Indirect**	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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'sTheoroms 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
3	0	0	3

OBJECTIVE:

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

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		S	S		M						
CO2	S		S	S				W				
CO3	S		S		S							
CO4	S		S		S							
CO5	S	S	S			M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

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 consruction 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. RaikerR.N.Learning from failures Deficiencies in Design, Construction and Service R&D Centre (SDCPL) RaikerBhavan, Bombay 1987.

RESEARCH METHODOLOGY

Objectives

- 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 after successful completion of this course, the students should be able to

CO 1: To describe research concepts.
CO 2: To Get adequate knowledge about mathematical modeling
CO 3: To describe experimental modeling
CO 4: To understand analysis of results.

CO 5: To know about report writing

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak							
COs	Programme Outcomes(POs)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	S	M				M	M
CO 2	S	M				M	M
CO 3	S	M				M	M
CO 4	S	M				M	M
CO 5	S	M				M	M

ASSESSMENT METHOD:

DIRECT		**INDIRECT**	
1.	Internal Test	**1.**	Student exit survey
2.	Assignment	**2.**	Faculty Survey
3.	Seminar	**3.**	Industry
4.	Online Test	**4.**	Alumni
5.	End Semester Exam		

1. 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.

2. 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.

3 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.

4 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.

5 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: 45

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.