MAHATMA GANDHI UNIVERSITY

SCHEME AND SYLLABI

FOR

M. Tech. DEGREE PROGRAMME

IN

CIVIL ENGINEERING

WITH SPECIALIZATION IN

STRUCTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT

(2013 ADMISSION ONWARDS)

SCHEME AND SYLLABI FOR M. Tech. DEGREE PROGRAMME IN CIVIL ENGINEERING WITH SPECIALIZATION IN STRUCTURAL ENGINEERING AND CONSTRUCTION MANAGEMENT

SEMESTER - II

Sl. No.	Course No.	Subject	Hrs / Week			Evaluation Scheme (Marks)					Credits (C)
			L	T	P	Sessional			ESE	Total	
						TA	CT	Sub Total			
1	MCESC 201*	Microstructure and Innovations in Structural Concrete	3	1	0	25	25	50	100	150	4
2	MCESC 202*	Finite Element Analysis	3	1	0	25	25	50	100	150	4
3	MCESC 203*	Theory of Plates and Shells	3	1	0	25	25	50	100	150	4
4	MCESC 204	Project Planning and Implementation	3	1	0	25	25	50	100	150	4
5	MCESC 205	Elective - III	3	0	0	25	25	50	100	150	3
6	MCESC 206	Elective - IV	3	0	0	25	25	50	100	150	3
7	MCESC 207	Software Laboratory	0	0	3	25	25	50	100	150	2
8	MCESC 208	Seminar - II	0	0	2	50	0	50	0	50	1
Total			**18**	**4**	**5**	**225**	**175**	**400**	**700**	**1100**	**25**

Elective – III (MCESC 205)		Elective – IV (MCESC 206)	
MCESC 205 – 1*	Earthquake Resistant Design	MCESC 206 – 1*	Structural Stability
MCESC 205 – 2*	Structural Reliability	MCESC 206 – 2*	Advanced Steel Structures
MCESC 205 - 3	Construction planning, scheduling and control	MCESC 206 – 3*	Maintenance & Rehabilitation of Structures
MCESC 205 - 4	Environment and Pollution	MCESC 206 - 4	Civil Engineering Material Science

L – Lecture, **T** – Tutorial, **P** – Practical

TA – Teachers' Assessment (Quizzes, attendance, group discussion, tutorials, seminar, field visit etc)

CT – Class Test (Minimum of two tests to be conducted by the Institute)

ESE – University End Semester Exam will have to be conducted by the institute through concerned affiliating University.

* – common for MCESE & MCESC

MCESC 201 MICROSTRUCTURE AND INNOVATIONS IN STRUCTURAL CONCRETE

L	T	P	C
3	1	0	4

Module 1

The Structure of Concrete: - Significance and Complexities, Structure of aggregate phase, Structure of hydrated cement paste, Solids in hydrated cement paste, Voids in hydrated cement paste and Water in hydrated cement paste.

Structure property relationships in hydrated cement paste:- Strength, Dimensional stability and Durability.

Transition zone in concrete: - Significance of transition zone, Structure of transition zone, Strength of transition zone and Influence of transition zone on properties of concrete.

Module 2

Self-compacting Concrete:- Introduction, Definition and terms like Addition, admixture, Binder, Filling ability, Fines (Powder), Flow ability, Fluidity, Passing ability, Robustness, Segregation resistance, Slump-flow, Thixotrophy, Viscosity modifying admixture, constituent materials, Mix design, Test methods and conformation.

Engineering Properties:- Compressive strength, Tensile strength, Modulus of elasticity, Creep, Shrinkage, Coefficient of thermal expansion, Bond to reinforcement, Shear force capacity, Fire resistance and durability.

Requirements:- Basic and Additional requirements and Requirements in fresh state, Consistence classification, Slump flow, Viscosity, Passing ability and Segregation resistance.

Module 3

Effect of Temperature on Concrete:- Stressed, Unstressed and Unstressed residual test methods.

Important material properties of concrete under temperature:- Thermal expansion, Thermal conductivity, Thermal capacity and thermal diffusivity, Modulus of elasticity, Poisson's ratio, Stress-strain relationship and Creep deformation.

Strength: - Compressive and Tensile. Influence of aggregate type.

Module 4

Supplementary Cementitious Materials:- Different materials, Pozzolanic reaction.

Characterization of Concrete (Concept Only):- X-Ray Diffraction Analysis (XRD):- Introduction, Basic Principle, Identification of Major Phases Present in Cement/Clinker, Sample Preparation and X-Ray Diffractometry in Concrete, Hydrated Cement Paste, Aggregate Interface.

Scanning Electron Microscope (SEM) Analysis: Introduction of Scanning Electron Microscopy, Specimen Preparation, Concrete under the SEM, Mineral Admixtures in Concrete.

Thermo Gravimetric Analysis (TGA): - Introduction, Interpreting TGA Curves related to Concrete.

References:

1. P. Kumar Mehta and Paulo J. M. Monteiro, “Concrete, Microstructure, Properties and Materials” Indian Concrete Institute, Chennai.
2. J.A. Purkiss, “Fire Safety Engineering” Butterworth-Heinemann.
3. E.G. Butcher and A.C. Parnell, “Designing for Fire Safety” John Wiley and Sons.
4. E.E. Smith and T.Z. Harmathy, “Design Buildings for Fire Safety” ASTM Special Technical Publication 685, A Symposium Sponsored by ASTM Committee EQ5 on Fire Standards.
5. A.M. Neville, “Properties of Concrete” Addison Wesley Longman Limited, England.
6. A.M. Neville and J.J. Brooks, “Concrete Technology” Pearson Education, Asia.
7. P.C. Varghese, “Advanced Reinforced Concrete Design” PHI Learning Private Limited, New Delhi.
8. EFNARC, “The European Guidelines for Self-Compacting Concrete, Specification, Production and Use” EFNARC-2005, UK.
9. P.J.M. Bartos, M. Sonebi and A.K. Tamimi, “Workability and Rheology of Fresh Concrete: Compendium of Tests” RILEM Publications S.A.R.L,France.
10. V.S. Ramachandran and James J., “Handbook of Analytical Techniques in Concrete Science and Technology, Principles, Techniques and Applications” William Andrew Publishing, U.S.A.
11. George Widmann, “Interpreting TGA Curves” User Com.

MCESC 202* **FINITE ELEMENT ANALYSIS**

L	T	P	C
3	1	0	4

Module 1

Introduction to FEM - Historical development - Idealization of structures -Mathematical model - General procedure of FEA - Displacement approach.

Variational principles weighted residual approach and method of virtual work. Derivation of equilibrium equations.

Module 2

Shape functions – Polynomials - Lagrangian and Hermition Interpolation – Generalised coordinates – Natural coordinates - Compatibility - C^0 and C^1 elements - Convergence criteria - Conforming & nonconforming elements – Patch test.

Module 3

Stiffness matrix - Bar element - Beam element - Plane stress and plane strain and axisymmetric problems -Triangular elements - Constant Strain Triangle - Linear Strain Triangle – Legrangian and Serendipity elements, static condensation - **Isoparametric elements** - Numerical Integration.- Gauss- Quadrature – Computer implementation of finite element method.

Module 4

General plate bending elements - Plate bending theory – Kirchhoff's theory – Mindlin's theory – locking problems - preventive measures – reduced integration – selective integration-spurious modes.

References:

1. O C Zienkiewicz,."Finite Element Method", fifth Edition,McGraw Hill, 2002
2. R.D.Cook, "Concepts and Applications of Finite Element Analysis", John Wiley & Sons.
3. C.S.Krishnamoorthy, "Finite Element Analysis",Tata McGraw Hill .New Delhi,1987.
4. S.Rajasekharan, "Finite Element Analysis in Engineering Design", S Chand & Co. Ltd.1999.

5. T.Kant, “Finite Element Methods in Computational Mechanics”,Pergamons Press.
6. K.J.Bathe, “Finite Element Procedures in Engineering Analysis”.,Prentice Hall,
7. Mukhopadhyay M.,Matrix “Finite Element Computer and Structural Analysis”,Oxford & IBH,1984.
8. Irving H.Shames,”Energy &Finite Element Methods in Structural Mechanics”.
9. Desai C.S. & Abel J.F., “Introduction to Finite Element Methods”, East West Press.

MCESC 203* **THEORY OF PLATES AND SHELLS**

L	T	P	C
3	1	0	4

Module 1

Plates:- Introduction- classification of plates- thin plates and thick plates – assumptions in the theory of thin plates- Differential equation for cylindrical bending of rectangular plates.

Pure bending of plates:- slope and curvature of slightly bent plates – relation between bending moment and curvature in pure bending – stresses acting on a plate inclined to x and y axes-Particular cases of pure bending of rectangular plates.

Module 2

Laterally loaded rectangular plates:- Small deflections of Laterally loaded thin plates- Differential equation of plates- derivation of fourth order differential equation -Solution techniques for fourth order differential equation – boundary conditions – simply supported, built- in and free edges.

Simply Supported rectangular plates under sinusoidal Load:- Navier solution for simply supported plates subjected to uniformly distributed - Levy's solution for simply supported rectangular plates – uniformly distributed and concentrated load.

Module 3

Circular plates – polar coordinates – differential equation of symmetrical bending of laterally loaded circular plates- uniformly loaded circular plates with clamped edges and simply supported edges– circular plates loaded at the centre.

Module 4

Classical theory of Shells – Structural behaviour of thin shells – Classification of shells – Singly and doubly curved shells with examples – Membrane theory and bending theory of doubly curved shells.-equilibrium equations.

Folded plates – Introduction, Classification, Structural action and analysis.

References:

1. Lloyd Hamilton Donnell, "Beams, plates and shells", Mc Graw Hill, New York.

2. S.P Timoshenko, S.W Krieger, “Theory of plates and shells”, Mc Graw Hill.
3. Owen F Hughes, “Ship structural design”, John Wiley & Sons, New York, 1983.
4. William Muckle, “Strength of ship structures”, Edqward Arnold Ltd, London, 1967.
5. Gol’oenveizen, “Theory of elastic thin shells”, Pergaman press, 1961.
6. J Ramachandran, “Thin shell theory and problems”, Universities press.
7. Krishna Raju N., “Advanced Reinforced Concrete Design”, CBS Publishers and distributers, New Delhi.
8. G.S Ramaswamy, “Design and Construction of Concrete Shell Roofs”, Tata-McGraw Hill Book Co. Ltd.,.

MCESC 204 PROJECT PLANNING AND IMPLEMENTATION

L	T	P	C
3	1	0	4

Module 1: Project planning

Project reports – sanctions – tendering – contracts – execution of works – measurements – payment – disputes – compensation – arbitration.

Module 2: Work and productivity analysis

Work study – factors influencing productivity – tools to assess productivity – productivity improvement techniques – behavioral science aspects – motivation of individuals – management of groups – leadership – communication.

Module 3: Quality in Construction

Evolution of Quality – Quality Management – Quality Control Methods – Factors Affecting Quality of Construction – Quality Standards and Codes in Construction - Concept and Philosophy of Total Quality Management – TQM in Construction.

Module 4: Safety in Construction

Importance of Safety – Safety Aspects of Construction – Causes of Accidents – Human Factors in Construction Safety Management - Site Safety Management – Safety in Various Construction Operations – Safety in Material Handling and Equipments – Safety Codes – Measuring of Safety – Approaches to Improve Safety in Construction.

References:

1. Sengupta and H. Guha (1995), “Construction Management and Planning”, Tata McGrew Hill Publishing Company Pvt. Ltd., New Delhi.
2. Clarkson Oglesby, Henry Parker (1989), Grogory Howell, “Productivity Improvement in Construction”, McGrew Hill Book Company, Inc.
3. R.P. Mohanty and R.R. Lakhe, “Total Quality Mangement”, Jaico Publishing House.
4. S. Seetharaman, “Construction Engineering and Management”, Umesh Publications.
5. K. N. Vaid, “Construction Safety Management”, National Institute of Construction Management and Research.

MCESC 205 – 1* EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

L	T	P	C
3	0	0	3

Module 1

Seismic Hazards:- Need of special emphasis to earthquake engineering, Ground shaking, structural hazards, Liquefaction, Lateral spreading, Landslides, Life line hazards, Tsunami and Seiche hazards.

The Earth And its Interior: - The Circulation, Continental drift, Plate tectonics, Plate boundaries, Faults and its geometry.

The Earthquake: - Elastic rebound theory, Terminology like hypocenter, epicenter and related distances.

Seismic Waves: - Terminology, Body waves: - P- waves and S- waves, Surface waves: – Love waves and Rayleigh waves. Calculation of wave velocity, measuring instruments, locating epicenter of earthquakes numerically from traces and wave velocity.

Earthquake Size: - Intensity – RF, MMI, JMA and MSK. Comparison of above. Magnitude – Local magnitude, Calculation (Analytically and graphically), Limitations, Surface wave magnitudes, Moment magnitudes and its Calculation, Saturation of magnitude scales.

Module 2

Earthquake Ground Motion: - Parameters: - Amplitude, Frequency and duration. Calculation of duration from traces and energy.

Response Spectra: - Concept, Design Spectra and normalized spectra, Attenuation and Earthquake Occurrence. Guttenberg- Richter Law.

Concept of Earthquake Resistant Design: - Objectives, Design Philosophy, Limit states, Inertia forces in Structure. Response of Structures – Effect of deformations in structure, Lateral Strength, Stiffness, Damping and ductility.

Floor diaphragms: - Flexible and rigid, Effect of inplane and out of plane loading, Numerical example for lateral load distribution

Torsion and Twists in Buildings: - Causes, Effects, Centre of mass and rigidity.Torsionally coupled and uncoupled system, Lateral load distribution, Numerical example based on IS code recommendation.

Building Configurations: - Size of Building, Horizontal and Vertical layout, Vertical irregularities, Adjacency of Building, Open-ground storey and soft storey, short columns. Effect of shear wall on Buildings. Effect of torsion.

Module 3

R.C.C for Earthquake Resistant Structures: - How to make buildings ductile, Concept of capacity design, Strong Column weak beam, Soft Storey. Ductile design and detailing of beams and shear walls. Calculation of Base shear and its distribution by using codel provision. Detailing of columns and Beam joints. Performance of R.C.C. Building.
Ductile detailing:-Study of IS: 13920-1993.
Repair: - Methods, Materials and retrofitting techniques.

Module 4

Earthquakes in India: - Past earthquakes in India an overview, Behaviour of buildings and structures during past earthquakes and lessons learnt from that.
Seismic Code: - Provisions of IS: 1893-2002.
Masonry Buildings:- Performance during earthquakes, Methods of improving performance of masonry walls, box action, influence of openings, role of horizontal and vertical bands, rocking of masonry piers.
Reduction of Earthquake Effects: - Base Isolation and dampers; Do's and Don'ts During and after Earthquake.

References:

1. Bruce A. Bolt, "Earth quakes", W.H. Freeman and Company, New York
2. Pankaj Agarwal and Manish Shrikhande, "Earthquake Resistant Design of Structures", Prentice Hall of India Private Limited, New Delhi, India.
3. Steven L. Kramer, "Geotechnical Earthquake Engineering", Pearson Education, India.
4. S. K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, New Delhi.
5. Murthy C. V. R, "Earthquake tips, Building Materials and Technology Promotion Council", NewDelhi, India.
6. Pauly. T and Priestley M.J.N , "Seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and sons Inc.

7. David A Fanella, “Seismic detailing of Concrete Buildings”, Portland Cement Association, Illinois.
8. Repair and Strengthening of Reinforced Concrete, Stone and Brick Masonry Buildings, United Nations Industrial Development Organization, Vienna.
9. BIS, IS: 1893(Part 1)-2002 and IS : 13920-1993, Bureau of Indian Standards.
10. Anil K. Chopra, “Dynamics of Structures”,. Pearson Education, India.
11. Kamalesh Kumar, “Basic Geotechnical Earthquake Engineering”,

MCESC 205 – 2* **STRUCTURAL RELIABILITY**

L	T	P	C
3	0	0	3

Module 1

Concepts of structural safety:-Basic statistics:-Introduction-data reduction-histograms-sample correlation.

Module 2

Probability theory, resistance distribution and parameters:- Introduction- statistics of properties of concrete and steel, statistics of strength of bricks and mortar, dimensional variations-characterisation of variables of compressive strength of concrete in structures and yield strength of concrete in structures and yield strength of steel – allowable stresses based on specified reliability.

Module 3

Probabilistic analysis of loads: - Gravity load-introduction-load as a stochastic process. Wind load-introduction-wind speed-return period-estimation of lifetime wind speed-probability model of wind load.

Basic structural reliability: - Introduction-computation of structural reliability. Monte carlo study of structural safety and applications.

Module 4

Level-2 Reliability method: - Introduction-basic variables and failure surface-first order second moment methods like Hasofer and Linds method-nonnormal distributions-determination of B for present design-correlated variables.

References:

1. Nobrert Llyd Enrick, “Quality control and reliability”, Industrial press New York.
2. A K Govil, “Reliability engineering”, Tata Mc Graw Hill, New Delhi.
3. Alexander M Mood, “Introduction to the theory of statistics”, Mc Graw Hill, Kogakusha Ltd.
4. Ranganathan, “Reliability of structures”.

MCESC 205 - 3 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL

L	T	P	C
3	0	0	3

Module 1: Basic Concepts In the Development of Construction Plans

Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities -Estimating Activity Duration. Estimating Resource Requirements for Work Activities -Coding Systems

Module 2: Relevance of Construction Schedules

The Critical Path Method - Calculations for Critical Path Scheduling -Activity Float and Schedules -Presenting Project Schedules Critical Path Scheduling for Activity-on-Node and with Leads. Lags. and Windows . - Calculations for Scheduling with Leads, Lags and Windows - Resource Oriented Scheduling - Scheduling with Resource Constraints and Preceedences - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Duration -Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Scheduling In Poorly Structured Problems - Improving the Scheduling Process..

Module 3: The Cost Control Problem

The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

Module 4: Quality and Safety Concerns in Construction

Organizing for Quality and Safety - Work and Material Specifications -Total Quality Control -Quality Control by Statistical Methods - Statistical Quality Control with Sampling by attributes - Statistical Quality Control with Sampling by Variables - Safety.

References:

1. Chitkara. K.K(1998) “Construction Project Management: Planning Scheduling and Control”, Tata McGraw Hill Publishing Company, New Delhi,
2. Calin M. Popescu, Chotchal Charoenngam (1995), “Project Planning, Scheduling and Control in Construction : An Encyclopedia of terms and Applications”, Wiley, New York,

3. Chris Hendrickson and Tung Au(2000), “Project Management for Construction - Fundamental Concepts for Owners, Engineers, Architects and Builders”, Prentice Hall Pittsburgh,
4. Moder, J., C. Phillips and E. Davis (1983) “Project Management with CPM, PERT and Precedence Diagramming”, Van Nostrand Reinhold Company, Third Edition, Willis, E. M., Scheduling Construction Projects
5. John Wiley & Sons, Halpin, D. W (1985). “Financial and Cost Concepts for Construction Management”, John Wiley & Sons. New York.

MCESC 205 - 4 ENVIRONMENT AND POLLUTION

L	T	P	C
3	0	0	3

Module 1: Introduction to environment

Components of environment – man and environment

Natural resources – water, land, forest, mineral, energy, food

Module 2: Introduction to environmental pollution

General pollutants; types of pollutants. Pollution – Air, Water, Land, Noise, Thermal, Marine, Pesticide, Radioactive, Plastic Pollution Case studies, Population and the Environment. Environmental ethics, disaster Management.

Module 3: Industrial scenario in India

Industrial activity and Environment - Uses of Water by industry - Sources and types of industrial wastewater - Industrial wastewater and environmental impacts - Regulatory requirements for treatment of industrial wastewater - Industrial waste survey - Industrial wastewater generation rates, characterization and variables - Population equivalent - Toxicity of industrial effluents and Bioassay tests.

Module 4: Prevention Vs Control of Industrial Pollution

Benefits and Barriers - Source reduction techniques - Waste Audit - Evaluation of Pollution prevention options - Environmental statement as a tool for pollution prevention - Waste minimization Circles.

References:

1. P. Aarne Vesilind (1997), “Introduction to Environmental Engineering”, PWS Publishers.
2. Dr. Arumugam & Prof. Kumaresan, “ Environmental Studies”, Saras Publication
3. Surinder Deswal & Dr. Anupama Deswal, “ A Basic Course in Environmental Studies”, Dhanpat Rai and Co (P) Ltd
4. Eckenfelder, W.W. (1999), "Industrial Water Pollution Control", McGraw-Hill.
5. Arceivala, S.J. (1998), "Wastewater Treatment for Pollution Control", Tata McGraw-Hill.
6. Butterworth Heinemann (2001), “Frank Woodard Industrial waste treatment Handbook” , New Delhi.
7. World Bank Group "Pollution Prevention and Abatement Handbook - Towards Cleaner Production', World Bank and UNEP, Washington D.C.1998
8. Paul L. Bishop (2000) "Pollution Prevention: - Fundamentals and Practice", McGraw-Hill International.

MCESC 206 – 1* **STRUCTURAL STABILITY**

L	T	P	C
3	0	0	3

Module 1

Introduction to stability analysis:–Stable, unstable and neutral equilibrium–Stability Criteria. Fourth order Elastica – large deflection of bars differential equation for generalized bending problems–elastic instability of columns–Euler's theory–assumptions–limitations. Energy principles.

Module 2

General treatment of column:- Stability problem as an Eigen value problem–various modes of failure for various end conditions– both ends hinged–both ends fixed–one end fixed other end free– one end fixed other end hinged–Energy approach–Rayleigh Ritz–Galarkin's method.

Module 3

Beam column:–beam column equation–solution of differential equation for various lateral loads–udl and concentrated loads– Energy method – solutions for various end conditions–bottom fixed– bottom hinged –horizontal compression members, buckling of frames.

Module 4

Stability of plates:– inplane and lateral loads– boundary conditions–critical buckling pressure–aspect ratio – Introduction to torsional buckling, lateral buckling and inelastic buckling.

Finite element application to stability analysis– finite element stability analysis–element stiffness matrix –geometric stiffness matrix–derivation of element stiffness matrix and geometric stiffness matrix for a beam element.

References:

1. Ziegler H, "Principles of structural stability", Blarsdell, Wallham, Mass, 1963.
2. Thompson J M, G W Hunt, "General stability of elastic stability", Wiley,New York.
3. Timoshenko, Gere, "Theory of elastic stability", Mc Graw Hill, New York.
4. Don O Brush, B O O Almorth, Buckling of Bars, plates and shells,

5. Cox H L, The buckling of plates and shells, Macmillam, New York, 1963.
6. O C Zienkiewicz ,.Finite Element Method ,fourth Edition,McGraw Hill,
7. R.D.Cook, Concepts and Applications of Finite Element Analysis,JohnWiley &Sons.

MCESC 206 – 2* ADVANCED STEEL STRUCTURES

L	T	P	C
3	0	0	3

Module 1

Design of members subjected to lateral loads and axial loads – Principles of analysis and design of Industrial buildings and bents – Crane gantry girders and crane columns – Bracing of industrial buildings and bents.

Module 2

Analysis and design of steel towers, trestles and masts – Design of industrial stacks – Self supproting and guyed stacks lined and unlined – Stresses due to wind and earthquake forces – Design of foundations.

Module 3

Introduction – Shape factors – Moment redistribution Static, Kinematic and uniqueness theorems – Combined mechanisms – Analysis Portal frames. Method of plastic moment distribution – Connections, moment resisting connections.

Module 4

Design of light gauge sections – Types of cross sections – Local buckling and post buckling – Design of compression and Tension members – Beams – Deflection of beams – Combined stresses and connections.

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

References:

1. Punmia B.C, “Comprehensive Deign of Steel structures”, Laxmi publications Ltd, 2000.
2. Arya, A.S, “Design of Steel Structures”, Newchand & bros, Roorkee, 1982
3. Ram Chandra, “Design of Steel Structures II”, Standard Book House, Delhi.
4. Dayaratnam, “Design of steel structures”.
5. Rajagopalan, “Design of Storage structures”.
6. Baker, “Steel skeleton”.
7. S.K.Duggal , “Design of Steel Structures”, McGraw Hill.
8. Lynn S.Beedle, “Plastic Analysis of steel frames”.
9. Relevant IS Codes.

MCESC 206 – 3* MAINTENANCE AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

Module 1

General:– Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking.

Influence on servicebility and durability:–Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

Module 2

Maintenance and repair strategies:– Definitions : Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance, Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration , testing techniques.

Module 3

Materials for repair:– Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

Module 4

Techniques for repair:– Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Examples of repair to structures:– Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure–case studies.

References:

1. Denison Campbell, Allen and Harold Roper, “Concrete Structures , Materials, Maintenance and Repair”,Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, “Repair of Concrete Structures” , Blakie and Sons, UK, 1987.
3. M.S.Shetty, “Concrete Technology – Theory and Practice” , S.Chand and Company, New Delhi, 1992.
4. Santhakumar, A.R., " Training Course notes on Damage Assessment and repair in Low Cost Housing "," RHDC–NBO " Anna University, July, 1992.
5. Raikar, R.N., “Learning from failures – Deficiencies in Design ", Construction and Service – R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

MCESC 206 - 4 CIVIL ENGINEERING MATERIAL SCIENCE

L	T	P	C
3	0	0	3

Module 1: Introduction

Classification of engineering materials, Atomic structure and bonding, The architecture of solids, Crystal structure, Mechanical properties, Phase transformation, Alloys and their phase diagrams, Equilibrium microstructure of steel alloys, Heat treatment of steel alloys, Stainless steel, Cast iron.

Module 2: Introduction to concrete

Hydraulic cements, Aggregates for concrete, Proportioning of concrete mixes, properties of fresh cement, Microstructure of cement paste, Strength of concrete – Elastic behavior-Shrinkage and creep.

Module 3: Durability of concrete

Physical and chemical causes, Temperature effects in concrete, Environmental impact of concrete, Corrosion of steel reinforcement.

Module 4: Supplementary cementing materials

Silica fume, fly ash, metakaolin, ground granulated blast furnace slag, rice- husk ash etc. Polymers, plastics, rubber and composite materials

.

References:

1. Young. J. F; Mindess, S; Bentuer, “The Science and Technology of Civil Engineering Materials”, Presntice Hall, New York.
2. Ashby, M.F and Jones, D.R.H (2005), “Engineering materials – An Introduction to properties, Applications and design”.
3. Mehta, P.K and Monteiro. P.J.M, “Concrete: Microstructure, properties and materials”

MCESC 207 **SOFTWARE LABORATORY**

L	T	P	C
0	0	3	2

Application of STRAP / ETABS and ANSYS in modeling, simulation, analysis, design and drafting of structural components using the concepts given in theory papers. The student has to practice the packages by working out different types of problems mentioned below.

STRAP / ETABS

Linear Static Analysis of Continuous Beams, Portal Frames, Truss (2D and 3D), Multistoried Building.

Loading: Dead Load, Live Load, Wind Load (IS: 875 Part 1 / Part 2 / Part 3), Earth Quake Load (IS: 1893 Part 1) and its Combinations as per codal Provisions

Design and Detailing: As per Indian Standards

ANSYS

Linear Static Analysis of Continuous Beams, Portal Frames, Truss (2D and 3D), Plates (Plane Stress and Plane Strain)

MCESC 208 **SEMINAR – II**

L	T	P	C
0	0	2	1

Each student is required to present a technical paper on a subject approved by the department. The paper should be on a recent advancement/trend in the field of structural engineering. He / she shall submit a report of the paper presented to the department.