Maharshi Dayanand University, Rohtak

DEPARTMENT OF CIVIL ENGINEERING

Draft Curriculum M.Tech.(Civil Engineering)

SPECIALIZATION

IN

STRUCTURAL ENGINEERING & CONSTRUCTION

W.E.F. SESSION 2014-15.

Maharshi Dayanand University, Rohtak

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SPECIALIZATION

IN

STRUCTURAL ENGINEERING & CONSTRUCTION

SEMESTER-I

EFFECTIVE FROM 2014-15

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessionals	Exam.		
MTSEC 101	Theory and Analysis of Structures	3	1	-	50	100	150	3
MTSEC 102	Advanced Concrete Technology	3	1	-	50	100	150	3
MTSEC 103	Advanced Dynamics of Structures	3	1	-	50	100	150	3
MTSEC 104	Advanced Design of RCC Structures	3	1	-	50	100	150	3
	Elective- -I	3	1	-	50	100	150	3
MTSEC 105	Structural Engineering Laboratory	-	-	3	50	50	100	-
MTSEC 106	Computational Laboratory-I	-	-	3	50	50	100	-
TOTAL		15	5	6	350	600	950	-

NOTE:

1. The paper setter shall set each theory paper of 100 marks covering entire syllabus. However the Examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of A+, A, B, C, D & E. The examination of practical courses shall also be evaluated on the basis of these grades.
2. The sessionals of theory and practical courses shall also be evaluated in the basis of these grades.
3. The choice of student for any elective shall not be binding on the department to offer it.
4. The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).

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SEMESTER-II

EFFECTIVE FROM 2014-15

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessionals	Exam.		
MTSEC 201	Construction Planning, Scheduling & Control	3	1	-	50	100	150	3
MTSEC 202	Finite Element Method	3	1	-	50	100	150	3
MTSEC 203	Numerical Method and Computer Programming	3	1	-	50	100	150	3
MTSEC 204	Prestressed Concrete	3	1	-	50	100	150	3
	Elective-II	3	1	-	50	100	150	3
MTSEC 205	Structural Engineering Design Practice Lab	-	-	3	50	50	100	-
MTSEC 206	Computational Laboratory-II	-	-	3	50	50	100	-
TOTAL		15	5	6	350	600	950	-

NOTE:

1. The paper setter shall set each theory paper of 100 marks covering entire syllabus. However the Examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of A+, A, B, C, D & E. The examination of practical courses shall also be evaluated on the basis of these grades.
2. The sessionals of theory and practical courses shall also be evaluated in the basis of these grades.
3. The choice of student for any elective shall not be binding on the department to offer it.
4. The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).

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SPECIALIZATION

IN

STRUCTURAL ENGINEERING & CONSTRUCTION

SEMESTER-III

EFFECTIVE FROM 2014-15

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessionals	Exam.		
MTSEC 301	Advanced Concrete Technique and Management	3	1	-	50	100	150	3
MTSEC 302	Advanced Steel Structure	3	1	-	50	100	150	3
MTSEC 304	Seminar & Technical Writing	-	-	2	100	-	100	-
MTSEC 305	Dissertation Phase-I	-	-	4	200	-	200	-
TOTAL		6	2	6	400	200	600	-

NOTE:

1. The paper setter shall set each theory paper of 100 marks covering entire syllabus. However the Examiner shall evaluate the performance of the student in the theory paper finally by assigning one of the grades out of A+, A, B, C, D & E. The examination of practical courses shall also be evaluated on the basis of these grades.
2. The sessionals of theory and practical courses shall also be evaluated in the basis of these grades.
3. The choice of student for any elective shall not be binding on the department to offer it.
4. The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s).

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SPECIALIZATION

IN

STRUCTURAL ENGINEERING & CONSTRUCTION

SEMESTER-IV

EFFECTIVE FROM 2014-15

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessionals	Exam.		
MTSEC 401	Dissertation & Viva	-	-	24	200	400	600	3
TOTAL			-	24	200	400	600	

NOTE:

1. The sessionals of Dissertation shall be evaluated on the basis of grades i.e A+,A,B,C,D & E.
2. The Dissertation shall be evaluated by an examination committee consisting of the head of the department, Dissertation Supervisor and one External examiner. The evaluation should be based on above grades.
3. The grading system is define at the end of scheme of studies & examinations and will be supplied by the University to the examiner(s)

GRADING SYSTEM:

For the award of grades in a subject, all component-wise evaluation shall be done in marks. The marks would be converted to grades as per the guidelines given below:

A**ward of Grades Based on Absolute Marks**

The University will follow system of grading for all (irrespective of no. of students) based on absolute marks (**after applying moderation if any**) as given below:

Marks		**Grades**		**Marks**
85	≤	A+	≤	100
75	≤	A	<	85
60	≤	B	<	75
50	≤	C	<	60
40	≤	D	<	50
00	≤	E	<	40

GRADE POINTS:

The grading divisions of academic performance will be as under:-

Letter Grades	Performance	Division
A+	Excellent	First
A	Very Good	First
B	Good	First
C	Fair	Second
D	Pass	Third
F	Repeat	Fail

Note:

1. The Candidate who have passed all the semesters examination in the first attempt obtaining at the 75% marks in aggregate shall be declared to have passed in the first division with Distinction mentioned in the degree.Pass Grade is Grade D and higher grades (over all) subject to as detailed in clause 5(e)

2. Grades F is a Fail grades

'F' Grade

The **F** grades denote poor performance, i.e. failing a subject(or subject component). A student has to repeat all those components of a subject(s), in which he/she obtains 'F' grades, **until a passing grade is obtained, within the stipulated time of completion of that programe as mentioned /compliance of all aforesaid relevant clauses.**

List of Electives

Elective- I

MTSEC 107 - Composite Structures

MTSEC 108 - Bridge Engineering

MTSEC 109 – Structural Stability & Reliability

MTSEC 110 - Material Technology

Elective- II

MTSEC 207- Earthquake Resistant Design

MTSEC 208 -Analysis & Design of Plates and Shells

MTSEC 209- Maintenance & Rehabilitation of Structure

MTSEC 210- Theory of Elasticity

FIRST SEMESTER

MTSEC -101 Theory & Analysis of Structure

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Introduction to matrix methods of analysis: Static indeterminacy and kinematic indeterminacy, degree of freedom, coordinate system : structure idealization stiffness and flexibility matrices, suitability element stiffness equations , elements flexibility equations , mixed force , displacement equations : for truss element, beam element and tensional element.

Transformation of coordinates : Element stiffness matrix ,and load vector : local and global coordinates. Assembly of stiffness matrix from element stiffness matrix : direct stiffness method, general procedure , bank matrix semi bandwidth, computer algorithm for assembly by direct stiffness matrix method.

Analysis of plane truss : Continuous beam, plane frame and grids by flexibility methods. Analysis of plane truss : continuous beam, plane frame and grids by stiffness methods.

Special analysis procedures : Static condensation and sub structuring, initial and thermal stresses. Shear walls: Necessity, structural behaviour of large frames with and without shear walls, approximate methods of analysis of shear walls.

REFERENCES

1. Matrix Analysis of Frames structures by William Weaver J.R and James M.Geve, CBS publications.
2. Advanced Structural Analysis by Ashok.K.Jain, New Channel Brothers.
3. Structural Analysis by C.S.Reddy.
4. Matrix Structural Analysis by Kanchi.
5. Matrix Methods of Structural Analysis by J.Meek.
6. Structural Analysis by Ghali and Neyveli.

MTSEC -102 Advanced Concrete Technology

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Aggregate & Cement: Classification and testing of Aggregates, fibres and its types. Cement : grade of Cement, chemical composition, Hydration of Cement, Structure of hydrated Cement, Special Cement, Water, Chemical and Admixtures.

Principles of Concrete mix design: Methods of Concrete mix design, Design of high strength and high performance concrete. Rheological behaviour of fresh Concrete, Properties of fresh and hardened concrete, Strength, Elastic properties, Creep and Shrinkage, Variability of concrete strength. Non destructive testing and quality control, Durability, corrosion protection and fire resistance.

Advanced Generation of Concrete and its Placement Techniques: Self compacting concrete, vacuum dewatered concrete, Fly-ash Concrete, Fibre reinforced Concrete, Polymer Concrete, Epoxy resins and screeds for rehabilitation : properties and application,emerging trends in replacement of fine aggregates.

Methods of transportation: Placing and curing, extreme whether concreting, Special concreting methods, Under water concreting.

References:

1. Krishnaraju, N., “Advanced Concrete Technology”, CBS Publishers.
2. Nevile, A. M. (1985), “Concrete Technology”, Prentice Hall, New York.
3. Santhakumar A.R (2006), “Concrete Technology”, World Rights Publisher.

MTSEC -103 Advanced Dynamics of Structure

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Single degree of freedom system: Equation of motion, Damped and undamped free vibration, Response to harmonic, periodic, impulse load and general dynamic load, Duhamel's integral ;

Multi-degrees of freedom system: Equation of motion, Free vibration analysis,Dynamic response and modal analysis ;

Free and Forced vibration of distributed mass system:
Beams ; Analysis of structural response to Earthquakes: Seismological background, Deterministic analysis of Earthquake.

Reference :

1 R. W. Clough and J Penzien, *Dynamics of structures* , McGraw-Hill, Inc,
2. A K Chropra ,*Dynamics of Structures: Theory and Applications to Earthquake Engineering*, Prentice Hall of India .
3. M. Paz, *Structural Dynamics - Theory and Computation*, Van Nostrand, 1985.
4. *IS: 1893 - 2002 Criteria for Earthquake Resistant Design of Structures*.
L. Meirovitch, *Elements of Vibration* Ed., McGraw-Hill, 1986.

MTSEC -104 Advanced Design of R.C.C Structure

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Yield line method of analysis of slabs

Characteristic features of yield lines: virtual work method, equilibrium method, Strip method of analysis of slabs. Design of grid floor :Approximate method, Rigorous method.

Design of continuous beams

Redistribution of moments: Design of frames, Bunkers and silos, Airy's theory,Janssen's theory.

Design of special RC elements

Design of slender columns: RC walls, ordinary and shear walls, Corbels, Deep beams .

Design of flat slabs

Introduction, components, IS Code recommendations, design methods: design for flexure and shear moments in columns.

References:

1. Pippard A J S, and Baker, J. F. (1957), "The Analysis of Engineering Structures", Edward Arnold Publishers Ltd, London.
2. Krishna Raju N. (1989), "Advanced Reinforced Concrete Design", CBS Publishers and distributers, New Delhi.
3. Krishna Raju. (2003), "Design of Reinforced Concrete Structures" , CBS publishers and distributors, new Delhi.
4. Punmia B. C., Ashok K Jain, Arun K Jain , "Reinforced Concrete", Vol: II, Laxmi Publications, New Delhi
5. P C Varghese, "Limit State Design of reinforced concrete structures".
6. Rajagopalan, "Design of Storage structures".
7. Reynold & Steedman (1551) "Designers handbook"
   Relevant IS Codes.

MTSEC -105 Structural Engineering Laboratory

L- T- P	Exams Marks	: 50
0- 0- 3	Sessionals Marks	: 50
	Total Marks	: 100
	Duration of Exam	: 3 hrs.

1. Mix design of concrete of different grades & using admixtures.
2. Tensile and Flexural strength of concrete of different grades.
3. Tensile strength of different types of steel rebars, rolled steel sections.
4. Testing of simply supported RCC beams for flexural failure.
5. Testing of simply supported RCC beams for shear failure.
6. Testing of RCC column.
7. Non-destructive testing of concrete including rebound hammer and ultrasonic pulse method.
8. Permeability of concrete.
9. Vibration analysis of beams and plates.
10. Buckling load of struts.

References:

1. A.M. Neville & J.J. Brooks, *Concrete Technology*, Pearson Education, Delhi, 2004.
2. A.R. Santhakumar, *Concrete Technology*, Oxford University Press, 2007, New Delhi
3. *Structural Engineering laboratory manual.*
4. *Relevant BIS Codes of practice for mix design*, rebar testing, concrete design etc.

MTSEC -106 Computational Laboratory-I

L-	T-	P
0-	0-	3

Exams Marks	: 50
Sessionals Marks	: 50
Total Marks	: 100
Duration of Exam	: 3 hrs.

Computer programming in C++. ; Development of computer programs to solve problems related to civil engineering using matrix method.

AutoCAD : Creating and editing 2D and 3D drawings, customising AutoCAD, extraction of quantities, interface with other languages, applications for design and drawing of building components, drawing of connections and others.

ELECTIVE-I

MTSEC -107 Composite Structures

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Introduction: definition, Classification and characteristics of Composite materials, advantages and limitations, Current Status and Future Prospects;

Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotropy, Orthotropy and Anisotropy; Characteristics and configurations of lamina, laminate, micromechanics and macro mechanics, Constituent materials and properties;

Elastic behavior of unidirectional lamina: Anisotropic, separately orthotropic and transversely isotropic materials, stress-strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters;

Strength of unidirectional lamina: Macro mechanical failure theories- Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill), Interactive tensor polynomial theory (Tsai-Wu);

Elastic Behavior of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties ;

Bending and vibration of laminated plates: Governing equations, Deflection of simply supported rectangular symmetric angle-ply, specially orthotropic, anti-symmetric cross-ply laminates ; Recent advances: Functionally graded materials, Smart materials

References :

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

MTSEC -108 Bridge Engineering

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Planning of bridges : Investigation for bridges, need for investigation, selection of site, economical span, subsoil exploration, investigation report, importance for proper investigation. Design of RCC bridges: IRC loading, types of bridges, components of bridges, analysis and design of slab bridges and box culvert.

Design of girder bridges: T-beam bridges: Analysis and design of deck slab, longitudinal girders and cross girders, Pigeaud's method, Courbon's method, Morice and Little method, Hendry, Jaegar method, prestressed concrete bridges(simply supported case only).

Bearings : Introduction to bearings: Importance, bearings for slab bridges, bearings for girder bridges. Design of elastomeric bearings, Joints and appurtenances. Substructure: different types, materials for piers and abutments, substructure design: piers and abutments ,shallow footings , well foundation.

Construction methods: Inspection, maintenance and construction of bridges, case studies of recently constructed major bridges, critical studies of failure of major bridges. Features of suspension bridges and cable stay bridges.

References:

1. Raina V.K (1991), "Concrete Bridge Practice– Analysis, design & economics", Tata Mc–GrawHill, publishing company, New Delhi.
2. Raina V.K (1988), "Concrete Bridge Practice– Construction Maintenance & Rehabilitation", Tata Mc–GrawHill, publishing company, New Delhi.
3. Victor D.J (19991), "Essentials of Bridge Engineering", Oxford & IBH publishing company, New Delhi.
4. Ponnuswami S (1993), "Bridge Engineering", Tata Mc–GrawHill, publishing company, New Delhi.
5. Krishna Raju N (1996), "Design of Bridges", TataMcGrawHill, publishing company, New Delhi.
6. Relevant IS Codes, and IRC Codes.

MTSEC -109 Structural Stability & Reliability

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

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

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.

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.

Stability of plates : Inplane and lateral loads,boundary conditions,critical buckling pressure,aspect ratio. Finite difference method: Introduction to torsional buckling, lateral buckling and inelastic buckling.

Reliability index based analyses: FORM and SORM. Monte Carlo simulations and variance reduction. Reliability of existing structures

References:

1. Ziegler H (1963), "Principles of structural stability", Blarsdell, Wallham, Mass.
2. Timoshenko S. P., Gere G. M. (1963), "Theory of elastic stability", Mc Graw Hill, New York.
3. Don O Brush, B O O Almorth (1963), "Buckling of Bars, plates and shells", Macmillam, New york.
4. Cox H L (1963), "The buckling of plates and shells", Macmillam, New York.
5 N C Nigam, 1983, Introduction to random vibrations, MIT Press, Boston.
6 . A Papoulis, 1993, Probability, random variables and stochastic processes, McGraw-Hill, New York.
7 R E Melchers, 1999, Structural reliability analysis and prediction, John Wiley, Chichester.

MTSEC-110 Material Technology

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Material classifications and important properties: Requirements and selection factors.
Structure of solid material: Crystalline, no crystalline, atomic bonding and generalized properties, crystal structure, crystal planes & directions, crystal imperfections, diffusion mechanism of solid and its application.

Structure, properties and control of multiphase solids: Solid solutions, home rathery's rules for alloys, system, phases and structural constituents, phase diagrams and transformation; iron-carbon system end T.T.T. diagram, heat treatment of steel and other alloys, effect of alloying elements on steel, case hardening and surface treatment

Ceramic materials: General structure and properties of ceramics, silicate glass, refractory, abrasives etc.
Organic materials: Polymer and polymerization, structure and properties of plastics, rubber etc.
Composite material: Component and types (dispersion reinforced, laminar reinforced fiber reinforced) and applications like Ferro cement, reinforced glass and polymer concrete.

Cement and concrete: Hydration mechanism, microstructure and related properties, constituents and admixture, high strength concretes. Structure property relationship in concrete.
Performance of material in service: Corrosion and oxidation, fracture and fatigue, performance under high temperature, radiation damages.

References :

1. Elementary Material Science-By Lawrence
2. Material Science and Metallurgy-By Khanna
3. Material Science-By R Gupta
4. Material Science-By J Patel
5. Concrete-By P.K.Mehta

MTSEC -201 Construction Planning, Scheduling & Control

L- T- P	Exams Marks : 100
3- 1- 0	Sessionals Marks : 50
	Total Marks : 150
	Duration of Exam : 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

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.

Scheduling Techniques: 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..

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.

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

MTSEC -202 Finite Element Method

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

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

Equations & Problems: Equation of Equilibrium, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems.

Basics of finite element method & modeling: Different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach, Weighted residual Method; Finite Element modeling of one and two dimensional problems.

FEM Nodes & Element: Isoparametric elements, four node, eight node elements. Numerical integration, order of integration; Bending of plates, rectangular elements, triangular elements and quadrilateral elements, Concept of 3D modeling.

References:

1. R. D. Cook, *Concepts and Applications of Finite Element Analysis*, John Wiley, NewYork, 2004.
2. O. C. Zienkiewicz and R. L. Taylor, *Finite Element Method*, Butterworth Heinemann publication, 2000.
3. C.S. Krishnamoorty, *Finite element methods*, Tata-Mc Graw Hill, Second Edition, New Delhi, 2002.
4. T. R. Chandupatla & A. D. Belegundu, *Introduction to Finite Elements in Engineering*, Prentice Hall of India Pvt. Ltd., New Delhi, 5th Reprint, 1999.
5. J. N. Reddy, *An introduction to Linear Finite Element Method*, Oxford University.

MTSEC -203 Numerical Method & Computer Programming

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Introduction: Numerical analysis, finite differences, interpolation, numerical solution of algebraic and transcendental equations, iterative algorithms, convergence, Newton-Rapjson procedure,

Numerical Equation: solution of polynomial and simultaneous linear equations, numerical integration, Euler-Maclaurin formula, Newton-Cotes formula, error estimates, numerical solutions of ordinary.

Differential equations: method of Euler, Taylor, Adams Runge-Kutta and predictor-corrector procedures, stability of solution, solution of boundary value problems, finite differences techniques, stability and convergence of solution, finite element method.

Special functions: Legendre's special function, Rodrigue's formula, generating functions for Legendre's polynomials and recurrence formulae, Bessel's function, recurrence formulae, Bessel's function of integral order.

References:

1. Numerical methods for Scientists and Engineers by M.K. Jain, S.R. Iyengar & R.K. Jain, Wiley Eastern Ltd.
2. Mathematical Numerical Analyis By S.C. Scarborough, Oxford and IBH Publishing Company.
3. Introductory methods in Numerical Analysis by S.S. Sastry, Prentice Hall of India. Theory and problems in Numerical Methods by T. Veeranjan and T. Ramachandran, Tata McGraw-Hill Publishing Company, New Delhi-2004.
4. Numerical Methods for Mathematics Sciences and Engineering 2nd ed. By John H. Mathews,Prentice Hall of India, New Delhi 2003.
5. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, Narosa-2001.

MTSEC -204 Prestressed Concrete

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Introduction of Prestressed Concrete : Introduction of Prestressed Concrete Definition, Comparison with Reinforced Concrete, Advantages and Disadvantages. Review (Analysis)Basic Principles, Determination of concrete flexural stresses, Basic Concept Method, C line Method, Load Balancing Method, Classification of Members, Materials for Prestressed Concrete, High strength concrete Short-term & Long-term Properties.
Prestressing Steel, Steel Relaxation and other effects, Auxiliary Materials, Prestress Losses, Stresses in steel due to loads.

Preliminary Design: Design considering No Tension in concrete, Elastic Design allowing and considering Tension, Shapes of concrete sections, Dimensioning and proportioning of section profile, Shear Design, Bond, Bearing and End block design, Introduction of Limit State Method.

Design of Pretensioned and Post-Tensioned Flexural and Compression Members: Dimensioning of Flexural members, Estimation of Self Weight of Beams, Design of Pre-tensioned and Post tensioned members symmetrical about vertical axis. Design of compression members, with and without flexure, its application in the design of Piles, Flag masts and similar structures.

Prestressing of statically indeterminate structures: Advantages, Effect, Method of achieving continuity, Primary, Secondary and Resultant moments, Pressure line, Concept of Linear transformation, Guyon's theorem, Concordant cable profile**,** types analysis of stresses, Differential shrinkage, Flexural strength, Shear strength, Design of composite section. Design of Special Structure:- Prestressed Folded plates, Cylindrical Shells, Pipes, Circular water tanks.

References:

1. T. Y. Lin and H. Burns Ned, Design of Prestressed concrete structures,

   John Willey & Sons, New York- 1982.

2. Y. Guyen, Prestressed concrete Vol-I & Vol.-II, John Willey & Sons, New York-1960.

3. E. W. Bennet, Prestressed concrete theory & design, Chapman & Hall, London-1962.

4. Design of Prestressed Concrete by Gilbert & Mickleborough

5. N. Krishnaraju, Prestressed concrete,Tata McGraw-Hill, New Delhi-2004

6. S. K. Mallik and A. P. Gupta, Prestressed concrete, Oxford & IBH, New Delhi-1982.

7. N.Krishnaraju (1985) “Prestressed Concrete”, Tata McGraw-Hill Publishing Company 3rd Ed.

8. T.Y.Lin (1960), “Design of Prestressed Concrete Structures”, John Wiley and Sons.
9. CBRI, “Building materials and Components”, 1990, India.

MTSEC -205 Structural Engineering Design Practice Lab

L- T- P	Exams Marks	: 50
0- 0- 3	Sessionals Marks	: 50
	Total Marks	: 100
	Duration of Exam	: 3 hrs.

1. Analysis and design of Multi-storey building frames using STAAD. Pro. SAP
2. Analysis and design of Elevated Water Tank using STAAD-Pro., SAP
3. Analysis and design of bridge decks and other structures using STAAD-Pro., SAP
4. Analysis and design of steel trusses using STAAD-Pro., SAP
5. Assessment of loads including that due to wind and earthquake on various structural elements and Systems adopting codal provisions.
6. Dynamic response of structures using PULSE software.
7. Analysis of the structure adopting software.
8. Case studies of actual buildings executed using reinforced concrete.

MTSEC -206 Computational Laboratory-II

L-	T-	P
0-	0-	3

Exams Marks	: 50
Sessionals Marks	: 50
Total Marks	: 100
Duration of Exam	: 3 hrs.

Object oriented programming (OOP) - classes & objects, inheritance, overloading, polymorphism

templates & exception handling.

Construction of C++ programmes using OOP for some structural engineering problems.
Advanced MAT LAB.

Development Analysis: Development of Finite Element Programming for analysis of beams, trusses, frames. ; Analysis of plates and shells using commercial software.

Project Management: Tool & Technique.

ELECTIVE-II

MTSEC -207 Earthquake Resistant Design

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

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. 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.

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.

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.

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. Steven L. Kramer (1995), “Geotechnical Earthquake Engineering”, Pearson Education.
2. Relevant IS Codes, IS: 1893(Part 1)-2002 and IS : 13920-1993, Bureau of Indian Standards.
3. Pankaj Agarwal and Manish Shrikhande, “Earthquake Resistant Design of Structures”, Prentice Hall of India Private Limited, NewDelhi, India.
4. Murthy C. V. R (2002), “Earthquake tips”, Building Materials and Technology Promotion Council, NewDelhi, India
5. Anil K Chopra, “Dynamics of Structures, Theory and Applications to Earth Quake Structures”.

SECOND SEMESTER

MTSEC -208 Analysis & Design of Plates and Shells

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Pure Bending of Plates: Slope & curvature of slightly bent plates, Relations between bending moments and curvature in pure bending of plates, Strain energy in Pure bending of plates ; Symmetrical bending of Circular plates: Differential equation for symmetrical bending of laterally loaded circular plates, uniformly loaded circular plates, Circular plates with circular hole at center, circular plate concentrically loaded.

Small deflections of laterally loaded plates : Differential equation of the deflection surface, Boundary conditions, Simply supported rectangular plates under sinusoidal load, Navier solution for simply supported rectangular plates, Further applications of the Navier solution, Alternate solution for simply supported and uniformly loaded rectangular plates, Concentrated load on simply supported rectangular plates.

Classification of shell structures: importance of membrane theory of shells, shells in the form of a surface of revolution and loaded un-symmetrically with respect to their axes, spherical dome, conical shells, cylindrical shells, Elliptic paraboloid, hyperbolic parabolod and conoids .

General theory of cylindrical shells : Circular cylindrical shell loaded symmetrically with respect to its axis, particular cases of symmetrical deformations of circular cylindrical shells, cylindrical tanks of uniform wall thickness. Design of spherical domes with and without lanterns at top.

References :

1. S. P. Timoshenko and Woinowsky-Kriegar, *Theory of plates and shells*, Mc Graw Hill International , New Delhi
2. G. S. Ramaswamy, *Design and construction of concrete shells Roofs*, CBS Publishers, Delhi
3. D. P. Billington, *Thin shell concrete structures*, Mc Graw Hill international, New York
4. W. T. Marshall, *Design of cylindrical shell roofs*, E& FN SPON, London

MTSEC -209 Maintenance & Rehabilitation of Structure

L- T- P	Exams Marks : 100
3- 1- 0	Sessionals Marks : 50
	Total Marks : 150
	Duration of Exam : 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Quality & Construction Properties: Quality assurance for concrete construction as built concrete properties, strength, permeability, thermal properties and cracking. 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.

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

Concrete and mortar: Special concrete and mortar concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fiber reinforced concrete.

Special Coating: Rust eliminators and polymers coating for rebar's during foamed concrete, mortar repair for cracks, shoring and underpinning.

References

1. Raikar, R.N., Learning from failures – Deficiencies in Design, Construction and Service – R&D Centre (SDCPL), Raikar Bhavan, 1987.

2. Allen R.T., and Edwards S.C, Repairs of Concrete Structures, Blaike and Sons, U.K.1987.

MTSEC -210 Theory of Elasticity

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Elasticity- Basic concepts: Body force, surface traction, stresses and strains: three dimensional stresses and strains, analysis of transformation equations of 3D stresses & strains, principal stresses & strains, states of stresses & strain, equilibrium equations, generalized Hooke's Law, compatibility conditions, boundary conditions.

Two dimensional stress–strain problems: Plane stress and plain strain, Analysis of transformation equations, stress–strain relations, equilibrium equations in Cartesian and polar co-ordinates, Airy's stress function, Biharmonic Equilibrium, St Venant's principle–2D problems in Cartesian coordinate, cantilever with concentrated load at free end, Simply supported With UDL, Cantilever with moment at free end.

Analysis of ax symmetric problems and Torsion: General equations in polar co ordinates,stress distribution symmetric about an axis, cylinder subjected to external and internal pressures,Rotating disc as a 2D problem. Effect of circular hole in stress distribution of plates.Torsion of prismatic bar: General solution, Warping function approaches, St. Venant's theory, membrane analogy, Sand heap analogy, Torsion of non circular sections, torsion of multi celled thin wall open and closed sections.

Plasticity: Introduction to plasticity, General concepts, stress, strain curves, ideal plastic body ,plastic flow conditions, theories of failure, plastic work, plastic potential, yield criteria, Simple applications, Elasto plastic analysis for bending and torsion of bars, residual stresses.

References:

1. Timoshenko S P and Goodier J. N (1970), "Theory of Elasticity", Tata Mcgraw Hill International Student Edition.
2. Johnson W and Mellor P. B (1966), "Plasticity for mechanical engineers", Van Nostrand Company Ltd.
3. Sadhu Singh (1988), "Theory of elasticity", Khanna Publishers, Delhi.
4. Srinath L. S (1987), "Advanced mechanics of solids", Tata McGraw– Hill Publishing Company Ltd., New Delhi.
5. Sokolnikoff (1956), "Mathematical Theory of Elasticity", MaGraw Hill. Dalley and Rilley, Experimental Stress Analysis.

THIRD SEMESTER

MTSEC -301 Advanced Construction Techniques & Management

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Sub Structure Construction: Box jacking, pipe jacking, under water construction of diaphragm walls and basement. Tunneling techniques: Piling techniques-driving well and caisson-sinking, cofferdam, cable anchoring and grouting, driving diaphragm walls, sheet piles. Laying operations for built up offshore system, shoring for deep cutting, large reservoir construction with membranes and earth system, well points, dewatering and stand by plant equipment founder ground open excavation

Super Structure Construction: Vacuum dewatering of concrete flooring, Concrete paving Technology: Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections, launching techniques, suspended formwork, erection techniques of tall structures, large span structures, launching techniques for heavy decks- in-situ pre-stressing in high rise structures, aerial transporting ,handling, erecting light weight components on tall structures-erection of lattice towers and rigging of transmission line structures.

Relevance of Construction Management: 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 precedence's, 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.

Construction Equipments : Equipment for excavating, dredging, trenching, tunneling, drilling, blasting. Equipment for compaction, Erection Equipment, types of pumps used in construction, equipment for dewatering and grouting, foundation and pile driving equipment , forklifts and related equipment, portable material, conveyors, hauling equipment.

Essential Reading:

1. Sharma S.C. "*Construction Equipment and Management* ", Khanna Publishers New Delhi, 1988.
2. Deodhar, S.V. "*Construction Equipment and Job Planning* ", Khanna Publishers, New Delhi, 1988.
3. Dr. Mahesh Varma, "*Construction Equipment and its Planning and Application* ", Metro-politan Book Company, New Delhi-, 1983.
4. National Building Code of India, Part-IV and VII – 2006.
5. Rai Mohan and Jai Singh.M.P," *Advances in Building Materials and Construction*" CBRI Roorkee
6. SP-23 (S&T) – Hand Book on concrete Mixes based on Indian standards

MTSEC -302 Advanced Steel Structure

L- T- P	Exams Marks	: 100
3- 1- 0	Sessionals Marks	: 50
	Total Marks	: 150
	Duration of Exam	: 3 hrs.

NOTE: Eight questions are to be set from whole syllabus and the students will have to attempt five questions in all.

Design & Principles: 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.

Analysis and design: Analysis and design of steel towers, trestles and masts. Design of industrial stacks: Self supporting and guyed stacks lined and unlined, stresses due to wind and earthquake forces. Design of foundations for shallow, deep and pile foundation.

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

Design of light gauge section: 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 (2000), “Comprehensive Deign of Steel structures”, Laxmi publications Ltd.
2. Arya, A.S. (1982), “Design of Steel Structures”, Newchand & bros, Roorkee.
3. Ram Chandra(1970), “Design of Steel Structures II” , Standard Book House, Delhi,
4. Dayaratnam(2004), “Design of steel structures”.
5. Rajagopalan(1998), “Design of Storage structures”, Tata McGraw Hill.
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.

MTSEC -304 Seminar & Technical Writing

L- T- P	Sessionals Marks :100
0- 0- 2	Total Marks :100

Every student will be required to present a seminar talk on a topic approved by the Department except on his/her dissertation & submit the report to the Department. The committee constituted by the Head of the Department Will evaluates the presentation and will award the marks.

NOTE: A Student who is awarded the 'F' grade will be required to repeat the seminar on the same topic.

MTSEC-305 Dissertation Phase-I

L- T- P	Sessionals Marks : 400
0- 0- 4	Total Marks : 400

Every student will carry out dissertation under the supervision of a Supervisor(s). The topic shall be approved by a Committee constituted by the Head of the concerned Deptt. Every student will be required to present two seminar talks, first at the beginning of the Dissertation (Phase-I) to present the scope of the work and to finalize the topic, and second towards the end of the semester, presenting the work carried out by him/her in the semester. The committee constituted will screen both the presentations so as to award the sessional grades out of A+, A, B, C, D E and F. A student scoring 'F' grade shall have to improve this grade before continuing his/her Dissertation in the 4^{th} semester failing which he/she shall have to repeat the Dissertation (Phase-I) next time in the regular 3^{rd} semester.

FOURTH SEMESTER

MTSEC - 401 Dissertation

L- T- P	Exams Marks	: 400
0- 0- 24	Sessionals Marks	: 200
	Total Marks	: 600
	Duration of Exam	: 3 hrs.

The Dissertation Phase-1 will be continued as dissertation in 4th Semester. The award of sessional grades out of A+, A, B, C, D and E will be done by an internal Committee constituted by the Head of the Deptt. This assessment shall be based on presentation (s), report, etc. before this committee. In case a student scores 'F' –grade in the sessional, failing which he/ she will not be allowed to submit the dissertation. At the end of the semester, every student will be required to submit three bound copies of his/her Master's dissertation of the office of the concerned Department. Out of these, one copy will be kept for department record & one copy shall be for the supervisor.

A copy of the dissertation will be sent to the external examiner by mail by the concerned department, after his/her appointment and intimation from the university. Dissertation will be evaluated by a committee of examiners consisting of the Head of the Department, dissertation supervisor(s) and one external examiner. There shall be no requirement of a separate evaluation report on the Master Dissertation from the external examiner. The external examiner shall be appointed by the University from a panel of examiners submitted by the respective Head of Deptt., to the Chairman, Board of Studies. In case the external examiner so appointed by the University does not turn up, the Director/ Principal of the concerned college, on the recommendation of the concerned Head of the Deptt. Shall be authorized, on behalf of the University., to appointed an external examiner from some other institution. The student will defend his/her dissertation through presentation before this committee and the committee will award one of the grades out of A+, A, B, C, D E and F. Student scoring 'F' grade in the exam shall have to resubmit his /her Dissertation after making all correction / improvements and this dissertation shall be evaluated as above.

Note: The Scheme of awarding the Grades to the student in the course will be supplied by the University to the examiner(s).