Maharshi Dayanand University, Rohtak

SCHEME OF STUDIES AND EXAMINATIONS

FOR

MASTER OF TECHNOLOGY

IN

STRUCTURAL DESIGN

W.E.F. SESSION 2012-13

Maharshi Dayanand University, Rohtak

SCHEME OF STUDIES & EXAMINATION

MASTER OF TECHNOLOGY (STRUCTURAL DESIGN)

SEMESTER-I

EFFECTIVE FROM 2012-13

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessional	Exam.		
MTSD 101	Material Technology	4	-	-	50	100	150	3
MTSD 102	Advanced Structural Analysis	4	-	-	50	100	150	3
MTSD 103	Pre-Stressed Concrete Design	4	-	-	50	100	150	3
MTSD 104	Design of Structures-I	4	-	-	50	100	150	3
	Elective- -I	4	-	-	50	100	150	3
MTSD 105	Structural Engineering Laboratory	-	-	3	50	50	100	3
MTSD 106	Computational Laboratory-I	-	-	3	50	50	100	3
TOTAL		20	-	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).

Maharshi Dayanand University, Rohtak

SCHEME OF STUDIES & EXAMINATION

MASTER OF TECHNOLOGY (STRUCTURAL DESIGN)

SEMESTER-II

EFFECTIVE FROM 2012-13

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessional	Exam.		
MTSD 201	Structural Dynamics & Earthquake Engineering	4	-	-	50	100	150	3
MTSD 202	Stability of Structures	4	-	-	50	100	150	3
MTSD 203	Design of Structures-II	4	-	-	50	100	150	3
MTSD 204	Repairs and Rehabilitation of Structures	4	-	-	50	100	150	3
	Elective-II	4	-	-	50	100	150	3
MTSD 205	Structural Engineering Design Practice Lab	-	-	3	50	50	100	3
MTSD 206	Computational Laboratory-II	-	-	3	50	50	100	3
TOTAL		20	-	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).

Maharshi Dayanand University, Rohtak

SCHEME OF STUDIES & EXAMINATION

MASTER OF TECHNOLOGY (STRUCTURAL DESIGN)

SEMESTER-III

EFFECTIVE FROM 2012-13

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessional	Exam.		
MTSD 301	Design of Structures- III	4	-	-	50	100	150	3
MTSD 302	Professional Practices	4	-	-	50	100	150	3
	Elective-III	4	-	-	50	100	150	3
MTSD 303	Computational Laboratory-III	-	-	3	50	50	100	3
MTSD 304	Seminar & Technical Writing	-	-	2	50	-	50	
MTSD 305	Dissertation Phase-I	-	-	4	100	-	100	
TOTAL		12	-	9	350	350	700	

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).

Maharshi Dayanand University, Rohtak

SCHEME OF STUDIES & EXAMINATION

MASTER OF TECHNOLOGY (STRUCTURAL DESIGN)

SEMESTER-IV

EFFECTIVE FROM 2012-13

Course No.	Course Title	Teaching Schedule			Marks		Total	Duration of Exam (Hrs)
		L	T	P	Sessional	Exam.		
MTSD 401	Dissertation	-	-	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)

List of Electives:

Elective- I

MTSD 107 - Composite Structures

MTSD 108 - Analysis and Design of Plates & Shells

MTSD 109 - Advanced Foundation Design and Geotechnics

MTSD 110 - Material Science

Elective- II

MTSD 207- Advanced Steel Design

MTSD 208 - Advanced Reinforced Concrete Design

MTSD 209- Earth Retaining Structures

MTSD 210- Construction Failures

Elective- III

MTSD 306- High Rise Structures

MTSD 307- Design of Hydraulic Systems

MTSD 308- Design Of Bridges

FIRST SEMESTER

MTSD -101 Material Technologies

L- T- P	Exams Marks	: 100
4- 0- 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.

Cement and Concrete: Portland cement: chemical composition, hydration of cement, structure of hydrated cement, mechanical strength of cement gel, water held in hydrated cement paste and heat of hydration. Cements of different types. Factors affecting the strength of concrete. Elasticity, shrinkage and creep of concrete. Durability of concrete: Permeability of concrete. Chemical attack of concrete, air-entrained concrete and thermal properties of concrete.

The mechanical test of hardened concrete .Light weight and high density concrete. Mix design. Statistical quality control; Biaxial strength of concrete, Fibre reinforced concrete .Metals: Behaviour of common constructional metals in tension and compression. True stress-strain curve for mild steel in simple tension. Theories of failure and yield surfaces ;

Fatigue properties: Nature of fatigue failure, fatigue strength for completely reversed stresses, fatigue strength with super imposed static stress and factors influencing fatigue strength.

Temperature and Creep properties: Low temperature properties ,high temperature properties, creep-stress-time-temperature relations for simple tension, mechanics of creep in tension. Structure of materials and their imperfections. Deformation of crystals and theory of dislocations.

References Books:

1. A.M. Neville, J.J. Brooks, *Concrete Technology*, Low Priced Edition, Pearson Education, 2004.
2. A J Martin, *Mechanical behavior of engineering materials.*
3. S P Timoshenko, *Strength of materials- Part II*
4. M. S. Shetty, *Concrete technology- Theory & Practice*, S.Chand & Company New Delhi, 2005

MTSD -102 Advanced Structural Analysis

L- T- P	Exams Marks	: 100
4- 0- 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.

Methods of structural analysis:

Flexibilty matrix methods for analysis of trusses, analysis of beams, analysis of frames

Stiffness Matrix method for analysis of trusses, analysis of beams, analysis of frames

References Books:

1. Matrix Analysis of Framed Structure by Gere & Weaver.
2. Structural Analysis by Ghali & Neville.
3. Computer Analysis of Structural System by Fleming J.F.
4. Computer Methods of Structural Analysis by Beaufait, Rowan, Hadley, Heckett.
5. Intermediate Structural Analysis by C.K.Wang.

MTSD -103 Pre-Stressed Concrete Design

L- T- P	
4- 0- 0	Exams Marks : 100
	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 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, Kem Points, Cracking Moment, Deflection under service conditions of loading and prestressing, Determination of strength in bending, sheer and bond.

Design Preliminary 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.
References Books:

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.

MTSD -104 Design of Structures-I

L-	T-	P
4-	0-	0

Exams Marks	: 100
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.

Role of Design Engineer, properties of structural steel, merits and demerits of structural steel over reinforced concrete structures.

Steel Structure Design:

Design of tension members, compression members, flexure members and beam-columns junctions, adopting codal provisions of IS:800.Components & its terminology, load estimation, choice of sections, analysis and design for Gantry Girders.

Industrial structures with steel trusses and portal frames. Typical configuration with various elements, loadassessment (deal load, live load, wind load and earthquake load). Different roofing and cladding alternatives and their design, types of purlins and their design, analysis and design of a trusses and portal frames, design of base plate, pedestal and footing considering both hinged and fixed support conditions, design of bracing and preparation of construction drawings.

Welded Connections : Advantages of welding, fundamentals and methods of welding, types of joints, welding symbols, inspection of welding, codal provisions, design of typical welded connections. Bolted connections, Types of bolts, codal provisions, design of typical bolted connections.

Reinforced Concrete Design :

Design approach, stress-strain relationships for concrete and steel, theory for flexural strength, strength of members with flexure, strength of members with flexure and axial load, strength of members with shear, bond and anchorage, service load behaviour.

Design of various structural elements, such as beams, slabs, stairs, columns, walls, footings, etc.etc.Reinforcement detailing for various structural elements alongwith beam-column joints.

References Books:

1. Design of Steel Structures - by Bresler & Lin.
2. Theory of Modern Steel Structures - by Linton Grinter.
3. Design of Steel Structures - by P. Dayaratnam.
4. Reinforced Concrete Structural Elements (behaviour, analysis & design) by P.Purushothoman.
5. Practical Design of Reinforced Concrete by Russell S. Fling.
6. Design of Reinforced Concrete Structures by Ashok Kumar Gupta.

MTSD -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.

MTSD -106 Computational Laboratory

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

MTSD -107 Composite Structures

L- T- P	Exams Marks	: 100
4- 0- 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 macromechanics, 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 Books:

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.

MTSD -108 Analysis and Design of Plates & Shells

L- T- P	
4- 0- 0	

Exams Marks	: 100
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/without lanterns at top.

References Books:

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

MTSD -109 Advanced Foundation Design and Geotechnics

L- T- P	Exams Marks : 100
4- 0- 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.

Review of Index Properties and Soil Classification ,Site Investigations

Foundation Settlement, Bearing Capacity of Foundations

Excavations & Earth Retaining Structures ,Earth Structures

Design of Shallow and Deep Foundations, Ground Modification - Improvement & Land Reclamation

Geoenvironmental Engineering

References Books:

1. Foundation Engineering by Pack, Hansen and Thornburn
2. Foundation Design Manual by Winterkorn and Feng
3. Foundation Analysis and Design
4. Geotechnical Engineering by Venkatramaiyah
5. Soil Mechanics and Foundation Engineering by Alamsingh

MTSD -110 Material Science

L- T- P	Exams Marks : 100
4- 0- 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 Books:

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

SECOND SEMESTER

MTSD -201 Structural Dynamics & Earthquake Engineering

L- T- P	Exams Marks : 100
4- 0- 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: Beam;

Analysis of structural response to Earthquakes: Seismological background, Deterministic analysis of Earthquake

References Books:

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.
5. L. Meirovitch, Elements of Vibration Analysis, 2nd Ed., McGraw-Hill, 1986.

MTSD -202 Stability of Structures

L- T- P	Exams Marks : 100
4- 0- 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.

Torsion of thin walled open sections, warping displacements under pure torsion,-Warping constants for rolled steel section. Strain energy in bending and torsion of members of thin walled open section including the effects of warping. Torsional buckling including the effects of Wagner's effect, flexural torsional buckling(with centroid and shear centres coincident);

Lateral buckling of beams under pure bending central point load through centre of gravity of the section. Cantilever beams with point load at the free end, Application of Rayleigh-Ritz method;

Beam-columns on rigid supports-concentrated and continuous lateral loads with simply supported and built in-ends. Continuous beam with as axial loads. Application of trigonometric series. Inplane buckling of bars;

Approximate calculation of critical loads for bar structures by energy method- a bar on elastic foundation, a bar with intermediate compressive forces, bar under distributed axial loads, a bar with changes in cross section;

Effects of shearing force on the critical load. Buckling of built-up columns. In-elastic in-plane buckling of columns. Tangent and reduced modulus concept, Shanley's contribution, elastic critical loads for rigid frames and triangulated structures, stability functions.

Bending of thin plate. Buckling of thin rectangular plates in compression, shear and bending.

References Books:

1. S.P. Timoshenko and J. M. Gere, Theory of Elastic Stability , MC Graw Hill,
2. A. Kumar, Stability of Structures, Allied Publishers Ltd., New Delhi, 1998
3. M.R.Horns and W.Merchang, The stability of frames, Porgamon press, 1965.
4. M.Gregory , Elastic Instability Civil Engineering series,1967.
5. F.Bleich, Buckling strength of Metal structures,Mc Graw Hill Book co.,1952
6. T.V Galambos, Structural members and frames, Prentice-Hall INC, 1968

MTSD -203 Design of Structures-II

L- T- P	
4- 0- 0	Exams Marks : 100
	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.

Deflection of reinforced concrete beams and slabs. Estimation of crack width in reinforced concrete members. Redistribution of moments in reinforced concrete beams.

Design for torsion. Design of deep beams, ribbed (voided or waffle) slabs, flat slabs, flat plates, spandrel (edge) beams, reinforced concrete walls.

Design of staircases, corbels, brackets and nibs. Design of pile caps, beam and slab footings, raft foundations.

Design of underground and overhead watertanks.

References Books:

1. Limit State Design of Reinforced Concrete by Dr.P.C.Varghese.
2. Advanced Reinforced Concrete Design by Dr.P.C.Varghese.
3. Design and Construction of Foundations by G.P.Manning.
4. Reinforced Concrete Structures by R.Park and T.Paulay.
5. Reinforced Concrete Structural Elements Behaviour, Analysis and Design by P. Purushothaman.
6. Reinforced Concrete Design Theory and Examples by T.J.MacGinley and B.S.Choo.

MTSD -204 Repairs and Rehabilitation of Structures

L- T- P	Exams Marks	: 100
4- 0- 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.

Investigation and Evaluation of Distressed Structures. Preliminary investigation, detailed investigation, documentation, field observation and condition survey, sampling and material testing, evaluation, final report.

Materials & Technologies for Repair. Surface repair, material requirements, material selection, surface preparation, reinforcing steel, cleaning, repair and protection, bonding repair materials to existing concrete, placement methods.

Strengthening and Stabilisation. Techniques/Design considerations, beam shear capacity strengthening, shear transfer strengthening between members, stress reduction techniques, column strengthening, flexural strengthening, connections stabilisation and strengthening, crack stabilisation.

References Books:

1. Concrete Repairs & Maintenance by Peter H. Emmons & Gajanan M. Subnis.
2. Repair and Rehabilitation of Concrete Structures, ACI Compilation 10.
3. Bridge Repairs & Rehabilitation, ACI Compilation 29.
4. Guide to Investigation of Structural Failures by Jack R. Jonney & ASCE Research Council on Performance of Structures.
5. Strength Evaluation of Existing Concrete Buildings by ACI 437R-91.

MTSD -205 Structural Engineering Design Practice Lab

L-	T-	P
0-	0-	3

Exams Marks	: 50
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.
5. Dynamic response of structures using PULSE software.
6. Analysis of the structure adopting software.
7. Case studies of actual buildings executed using reinforced concrete.

MTSD -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.

C++ programming for structural engineering problems. Application of above for some structural engineering problems.

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

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

ELECTIVE-II

MTSD -207 Advanced Steel Design

L- T- P	Exams Marks : 100
4- 0- 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 for tension and compression members, connections, design of plate girders, crane girders and trusses.

Multi-storyed buildings. Silos, bins and hoppers.

Design of steel tanks and staging.

Design of bridges, trusses, lateral bracings, sway brackens and stress reversals.

Design of continuous beams and frames by plastic theory

References Books:

1. K.Mukhanov, *Design of Metal structures.*
2. B Bresler, T Y Lin and J B Scalzi, *Design of Steel structures*.
3. P Dayaratnam, *Design of Steel Structures*

MTSD -208 Advanced Reinforced Concrete Design

L- T- P	Exams Marks : 100
4- 0- 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.

Estimation of crack width and deflection of reinforced concrete beams.

Analysis and design of building frames subjected to wind load ;

Earthquake forces and structural response.

Ductile detailing of RCC frames. Design of beam-column joints ;

Design of deep beam.

Design of shear walls.

References Books:

1. R. Park and T. Pauley, Reinforced concrete structures, John Wiley and sons
2. A. K. Jain, Reinforced Concrete: Limit State design, NemChand and Bros. 1999.
3. J. Krishna and OP Jain, Plain and Reinforced Concrete, Vol. I I, Roorkee, Nem Chand and Bros.
4. H. Nilson, D. Darwin and C. W. Dolar, Design of Concrete structures, Tata McGraw Hill
5. T. Paulay and M.J.N. Priestley , Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons Inc

MTSD -209 Earth Retaining Structures

L- T- P	Exams Marks	: 100
4- 0- 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.

Earth Pressure: Fundamental relationships between the lateral pressures and the strain with a back ill. Rankine and Coulomb theories, Active, passive and pressure at rest;

Backfill with broken surface, wall with broken back, concentrated surcharge above the back fill, earth pressure due to uniform surcharge, earth pressure of stratified backfills, saturated and partially saturated backfill. Passive earth pressure in engineering practice. Assumption and conditions, point of application of passive earth pressures;

Bulkheads: Definition and assumptions, conditions of end supports and distribution of active earth pressure and bulkheads, bulkheads with free and fixed earth supports, equivalent beam method, Improvements suggested by Row, Tschebotarioff's method, Anchorage of bulkheads and resistance of anchor walls, spacing between bulkheads and anchor walls, resistance of anchor plates, Consideration of effects of ground water, seepage, surcharge loading together with possibility of shallow and deep sliding failures on retaining structure ;

Sheet Pile wall: Free earth system, fixed earth system, Dead man;

Tunnel and Conduit: Stress distribution around tunnels, Types of conduits, Load on projecting conduits;

Arching and Open Cuts: Arching in soils, Braced excavations, Earth pressure against bracings in cuts, Heave of the bottom of cut in soft clays;

Reinforced earth retaining structures- Design of earth embankments and slopes; Recent advances in Earth retaining structures.

References Books:

1. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.
2. J. Bowel, Foundation Engineering , Analysis and Design. McGrwHill
3. P. Raj, Geotechnical Engineering, Tata McGraw Hill
4. R F Craig, Soil Mechanics, Chapman and Hall(ELBS)

MTSD -210 Construction Failures

L- T- P	Exams Marks : 100
4- 0- 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.

Meaning of construction failure, historical references, main broad causes of failures such as design deficiency, use of improper materials and poor workmanship, removal of formwork at early stage, inadequate supervision and inspection, subsidence of foundations, fire, flood, earthquake, etc.

Factors affecting durability of concrete structures with emphasis on corrosion of reinforcement and codal provisions for design of durable concrete structures.

Cracks in concrete and masonry structures their reasons and measures to reduce or/and to avoid such cracks.

Professional & legal responsibility. Measures to reduce frequency and severity of constructions failures.

References Books:

1. Construction Failures by Jacob Feld.
2. Learning from Failures : Deficiency Design, Construction & Service by R.N.Raiker.
3. Concrete Reinforced Concrete Deterioration & Protection Edited by V.Moskvin.
4. Building Failures. Diagnosis and Avoidance by W.H.Ransom.
5. Building Disasters & Failures by Geoff Scott.
6. Common Defects in Buildings Published by HMSO, London.
7. Design & Construction Failures, Lesson from Forensic Investigation by Dov Kaminetzky - 1991.
8. The Testing of Concrete in Structure, Second Edition by J.H.Bungey.

THIRD SEMESTER

MTSD -301 Design of Structures- III

L-	T-	P
4-	0-	0

Exams Marks : 100
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.

Bunkers, Silos, Chimneys & Marine Structures:

Different methods of computing static pressure such as Jenssen's method, Airy's method, Flood atterns, flood irregularities an their effects,

Design of botton cone, side walls, roof slab etc.

Battery of Bunkers and Silos Construction aspects.

References Books:

1. Design and Construction of Silos and Bunkers by Sargis S. Safarion and Evnest C. Harris
2. Design and Construction of Chimneys by S. N. Manohar

MTSD -302 Professional Practices

L- T- P	Exams Marks	: 100
4- 0- 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.

Participants in design professionals, clients, structural design engineer, other consultants, architects,Understanding their roles, responsibilities and interrelationship.

Meaning of terms like site, project, contracts etc.

Codes of conducts for professionals: Handing approvals, procedures, office organisation & structure

Professional fees and accounting procedures, Tax planning, professional associations, social obligations. History of professional associations. Trends in professional practice.

References Books:

1. Estimation and Costing – S.C.Rangawala
2. Estimation and Costing (Civil Engineering) – B.N.Dutta
3. Civil Engineering Contracts and Estimates – B.S.Patil
4. Estimation, Costing and Valuation – N. Chakraborty.

MTSD -303 Computational Laboratory-III

L-	T-	P
0-	0-	3

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

Advanced AutoCAD

3-D Commands

AutoCAD shape file - font file

AutoCAD menu file

AutoCAD script file - interface with C++

AutoCAD DXF file - interface with other CAD Software.

Auto LISP programming for structural detailing drawing.

Application of professional software in structural engineering (like STAAD/Pro, Strap, etc.)

Introduction to artificial intelligence in structural engineering domain.

MTSD -304 Seminar & Technical Writing

L- T- P	Sessionals Marks : 50
0- 0- 2	Total Marks : 50

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.

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

MTSD -305 Dissertation Phase-I

L- T- P	Sessionals Marks : 100
0- 0- 4	Total Marks : 100

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.

ELECTIVE-III

MTSD -306 High Rise Structures

L- T- P	Exams Marks : 100
4- 0- 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.

Analysis of tall building frames, Lateral load analysis, multi bay frames, gravity loads, settlement of foundation.

Analysis of shear walls - plane shear walls, infilled frames, coupled frames, frames with shear walls. Principle of three dimensional analysis of tall buildings;

Perforated cores, pure torsion in thin tubes, bending and warping of perforated cores.

Analysis of floor system in tall buildings, Vierendal girders, diagrid floors.

Elastic and inelastic stability of frames and shear walls. Analysis of thermal stresses.

References Books:

1. B S Smith & A Coull, *Tall Building Structures:* - John Wiley & Sons.
2. W. Schueller, *High Rise Building Structures*: John Wiley & Sons.

MTSD -307 Design of Hydraulic Systems

L- T- P	
4- 0- 0	

Exams Marks	: 100
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.

Objectives of hydraulic structures in Water resources systems, preliminary investigation and preparation of the reports, design of water storage structures ; (1)High dams-gravity dams(zonal method design), over flow and non over flow section.(2) Low dams- weirs, earthen dams, vented dams (Barrage), instrumentation and maintenance of dam structures.

Collection and conveyance of water. Design of intakes, conveyance system of Irrigation, drinking and hydro power. Design of canal net work.

Hydraulic design of pressure pipes, hydrostatic tests on pipes, design of distribution systems-pressure in distribution systems, nomo graphs, Hardy cross and numerical methods, computer added design (CAD).

References Books:

1. Creager, Justin & Hinds, *Engineering for Dams*, Vols - I, II, III.
2. Varshney, *Hydraulic and Irrigation Structures*.
3. Varshney, *Hydraullic and Irrigation Structures*.

MTSD -308 Design Of Bridges

L- T- P	Exams Marks : 100
4- 0- 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: Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges, general design considerations.

Short Span Bridges : Load distribution theories, analysis and design of slab culverts, tee beam and slab bridges.

Long Span Girder Bridges: Design principles of continuous bridges, box girder bridges, balanced cantilever bridges.

Design Of Prestressed Bridges: Flexural and torsional parameters–Courbon's theory– Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces –Eccentricity – Live load and dead load shear forces–Cable Zone in girder – check for stresses at various sections – check for diagonal tension– Diaphragms – End block –short term and long term deflections.

Design Of Plate Girder Bridges, Bearings And Substructures: Design of riveted and welded plate girder bridges for highway and railway loading – wind effects – main section, splicing, curtailment, stiffeners – Different types of bearings –Design of earings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of foundations.

References Books:

1. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2008.
2. Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 1990
3. Jagadeesh.T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd. 2004.
4. Raina V.K." Concrete Bridge Practice" Tata McGraw Hill Publishing Company, New Delhi, 1991.
5. Bakht, B. and Jaegar, L.G., "Bridge Analysis Simplified", McGraw Hill, 1985.
6. Derrick Beckett, "An introduction to Structural Design of Concrete Bridges", Surrey University Press, Henley Thomes, Oxford Shire, 1973.

FOURTH SEMESTER

MTSD -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).