SCHEME & SYLLABI

OF

M.TECH.

Civil Engineering

(Structural Engineering)

w.e.f.

2018 -2019

(As per AICTE Model Curriculum)

CH. BANSI LAL UNIVERSITY, BHIWANI

First Semester:

Subject Code	Subject Name	L-T-P	Credits	Mark Weightage		Course Type
				Internal	External	
18MCES-501	Advanced Structural Analysis	3-0-0	3	25	75	Core-I
18MCES-503	Structural Dynamics and Earthquake Resistant Design	3-0-0	3	25	75	Core-II
	Discipline Specific Elective-I	3-0-0	3	25	75	Programme Elective I
	Discipline Specific Elective-II	3-0-0	3	25	75	Programme Elective II
18MCES-505	CAD in Structural Engineering	0-0-4	2	25	25	Core
18MCES-507	Concrete Technology Lab	0-0-4	2	25	25	Core
18MCES-509	Research Methodology and IPR	3-0-0	2	25	75	Core
	Audit Course- 1	2-0-0	0	25	75	Audit
	Total	**17-0-8**	**18**	**200**	**500**	

Discipline Specific Elective-I

18MCES-511 Theory of Thin Plates and Shells
18MCES-513 Advanced Concrete Technology
18MCES-515 Construction Management

Discipline Specific Elective-II

18MCES-517 Design of High Rise Structures
18MCES-519 Rehabilitation of Structures
18MCES-521 Advanced Structural Design and Detailing

Audit course 1 & 2

18 **AUD- 101 Research Paper Writing**
18 **AUD -102 Disaster Management**
18 **AUD -103 Sanskrit and Technology**
18 **AUD -104 Value Education**
18 **AUD -105 Constitution of India**
18 **AUD -106 Pedagogy Studies**
18 **AUD -107 Stress Management**
18 AUD -108 Personality Development through Life Enlightenment Skills

Second Semester:

Subject Code	Subject Name	L-T-P	Credits	Mark Weightage		Course Type
				Internal	External	
18MCES-502	Advanced Steel Design	3-0-0	3	25	75	Core-III
18MCES-504	Design of Advanced Reinforced Concrete Structures	3-0-0	3	25	75	Core-IV
	Discipline Specific Elective-III	3-0-0	3	25	75	Programme Elective III
	Discipline Specific Elective-IV	3-0-0	3	25	75	Programme Elective IV
18MCES-506	Seminar	0-0-4	2	25	25	Core
18MCES-508	Structural Design Lab	0-0-4	2	25	25	Core
	Audit Course- 2	2-0-0	0	25	75	Audit
18MCES-510	Mini-Project	0-0-4	2	25	75	Core
	Total	**14-0-12**	**18**	**200**	**500**	

Discipline Specific Elective-III

18MCES-512 Computer Aided Design and Expert System in Engineering
18MCES-514 Advanced Solid Mechanics
18MCES-516 Design and Construction of Bridge superstructures

Discipline Specific Elective-IV

18MCES-518 Design of Prestressed Concrete Structures
18MCES-520 Advanced Concrete Materials
18MCES-522 Advanced Foundation Engineering

Third Semester:

Subject Code	Subject Name	L-T-P	Credits	Mark Weightage		Course Type
				Internal	External	
	Discipline Specific Elective-V	3-0-0	3	25	75	Programme Elective V
	Open Elective	3-0-0	3	25	75	Open Elective
18MCES-523	Dissertation Phase-I	0-0-20	10	50	150	Dissertation
	Total	**6-0-20**	**16**	**100**	**300**	

Discipline Specific Elective-V

18MCES-525 Design and construction of Bridge sub-structures
18MCES-527 Condition Assessment and Retrofitting of Structures
18MCES-529 Non-Destructive Testing of Materials

Open Elective

18 OEC- 531 Business Analytics
18 OEC -533 Industrial Safety
18 OEC -535 Operations Research
18 OEC -537 Cost Management of Engineering Projects
18 OEC -539 Composite Materials
18 OEC -541 Waste to Energy

Fourth Semester:

Subject Code	Subject Name	L-T-P	Credits	Mark Weightage		Course Type
				Internal	External	
18MCES-524	Dissertation Phase-II	0-0-32	16	150	350	Dissertation
	Total	**0-0-32**	**16**	**150**	**350**	

Total Credits for the programme = 18 + 18 +16 +16 = 68 Credits

Course code	**18MCES-501**
Course title	**ADVANCED STRUCTURAL ANALYSIS**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To review the basic concepts for determinate structures
2. To introduce matrix method of analysis in trusses
3. To study and use matrix method of analysis for beams, frames
4. To introduce finite element method

UNIT-I

Flexibility Matrix Method:

Compatibility equations, Flexibility coefficients, Application of complimentary energy principles, Basis of the method, Application of flexibility matrix method to various types of structures, Analysis of pin jointed trusses, Rigid frames.

UNIT-II

Stiffness Matrix Method: Basis of stiffness method, Influence coefficients, Kinematic indeterminacy, Degree of freedom, Action displacement relationship, Matrix approach to stiffness method, Transformation of axes system, Formation of load vectors, Elastic supports, Support displacements, Application of stiffness matrix method to various type of structures e.g. Continuous beams, Trusses, Frames and grids, partially discontinuous structures, Temperature effects.

UNIT-III

Flexibility method for plane frames:

Force transformation matrix; element flexibility matrix; solution procedure (including support movements); Ignoring axial deformations.

Stiffness method for space frames: Introduction; element stiffness matrix of space frame element with 12 DOF and 6 DOF; coordinate transformations; analysis by reduced stiffness method (six DOF per element);

UNIT-IV

Finite Element Method: Introduction to finite element method, Theory of elasticity, Coordinate systems, Rotation of axes, Shape functions, Elements stiffness matrix and load vector, Triangular element in plane stress and strain, Numerical integration, Isoparametric elements, Rectangular elements in flexure, Triangular element, Rectangular element in plane stress and bending combined, Computer programming concepts.

Course Outcomes:

1. Students will have learning about determinacy, loading
2. Ability to analyze statically determinate trusses
3. Ability to analyze beams framed structures using matrix method
4. Knowledge about FEM

REFERENCE BOOKS:

1. Matrix Analysis of Framed Structures by Gere and Weaver.
2. Structural Analysis G.S. Pandit &S.P.Gupta
3. Finite Element Methods by Zeiekiwitz and Cheung.
4. Introduction to Finite Element Method by C.S.Desai and John F. Abel.
5. Advance Structural Analysis by A.K.Jain.

Course code	**18MCES-503**
Course title	**STRUCTURAL DYNAMICS AND EARTHQUAKE RESISTANT DESIGN**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To create an understanding on degrees of freedom & dynamic loading and ability to formulate the equations of motion and apply them to simple dynamic problems.
2. To familiarize on obtaining the natural frequencies & mode shapes and impart the knowledge on mode super position method to undamped forced motion of multi degree freedom systems.
3. To study the codal procedure for lateral loads with examples
4. To design structural members as per IS 13920.

UNIT-I

Introduction to structural dynamics, static and dynamic load types of analysis, Degree of Freedom, Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral

UNIT-II

Introduction to Dynamics analysis, Two degree of freedom system – undamped, free & forced. Multidegree of freedom system- undamped, Hozler's method, Stodola's method, Orthogonality condition, Damped system. Dynamic analysis and Response- Modal Analysis, Response spectrum analysis, Rayleigh's-Ritz method.

UNIT-III

Code based procedure for determination of design lateral loads: static and dynamic analysis procedure

UNIT-IV

Seismic analysis of G+3 storeyed RC building as per IS 1893. Earthquake resistant design of members as per IS 13920.

Course Outcomes: Students will be able to

1. Develop differential equation of motion for an undamped single degree freedom system.
2. Understand different analysis procedures.
3. Understand how to formulate stiffness and mass matrices and carry out free vibration analysis.
4. Do earthquake resistant design of the structural members as per IS 13920.

REFERENCE BOOKS:

1. Mario Paz, and William Leigh, Structural Dynamics, CBS, Publishers, 1987.
2. Roy Craig, Jr. Structural Dynamics, John Wiley & Sons, 1981.
3. A.K. Chpora "Dynamics of Structures Theory and Application to Earthquake Engineering" Pcarson Education,2001.
4. Pankaj Agarwal and Manish Shrikhande " Earthquake resistant design of structures" PHI,2011

Course code	**18MCES-511**
Course title	**THEORY OF THIN PLATES AND SHELLS**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To understand the structural behaviour of shells.
2. To analyze various structures like rectangular plates , cylindrical shells , orthotropic plates , folded plates

UNIT-I

Pure Bending of Plates: Slope and curvature, Relation between bending moments and curvature, Strain Energy.

Symmetrical Bending of Circular Plates: Differential equation in polar coordinates, Uniformly loaded circular plate with or without a hole at the center and with various edge conditions.

UNIT-II

Rectangular Plates: Differential equation of the deflection surface (small deflection theory only).

Fourier series expansion for various type of loads, Rectangular plate with various loadings and edge conditions, Navier's and Levy's methods.

Orthotropic Plates: Differential equation for orthotropic plates. Rigidities for various stiffening systems, Solution for open grids, Navier's solution for orthotropic plates, Working Design of a Coffer slab Construction.

UNIT-III

Shell Structures: Elements of Differential Geometry, Classifications of Shells, Shells of revolution loaded symmetrically with respect to their axis, Membrane theory, Edge disturbance, Application to conical shells, Spherical shells, Shells of revolution under unsymmetrical loading.

UNIT-IV

Cylindrical Shells: Membrane theory, General theory for circular cylindrical shell loaded symmetrically with respect to its axis, Circular cylindrical tank with various edge conditions.

Folded Plates: Introduction to Folded Plates, Beam action, Plate action, Stress distribution, Introduction to Simpson method.

Course Outcomes:

1. Students will have knowledge about the concepts of analysis of plated and shell structures.
2. Knowledge about the design of various structures.
3. Students will be able to apply concepts on different structures under various loading.

REFERENCE BOOKS:

1. Timoshenko, S."Theory of Plates & Shells" – McGraw Hill.
2. Chatterjee,"Design of Shell Roofs".
3. Paduart, A."Shell Roof Analysis".
4. Donnel, L.H."Beams Plates and Shells".

Course code	**18MCES-513**
Course title	**ADVANCED CONCRETE TECHNOLOGY**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To impart awareness on ingredients of concrete and mix design
2. To discuss behaviour of concrete in fresh and hardened state
3. To learn modern trends of concrete manufacturing

UNIT-I

Aggregates classification-Testing Aggregates, fibres. Cement, grade of Cement, Chemical composition, Hydration of Cement, Structure of hydrated Cement, Special Cement, Water, Chemical and Mineral Admixtures.Principles of Concrete mix design, methods of Concrete mix design, Design of high strength and high performance concrete, Indian Standard Method, American Concrete Institute Method, British Standard Method

UNIT-II

Rheological behaviour of fresh Concrete-Properties of fresh and hardened concrete-Strength, Elastic properties, Creep and Shrinkage, Variability of concrete strength. Effects of age, aggregate content, and its shape, richness of mix, curing on Strength of Concrete, autogenous healing, tensile and flexural strength of concrete, maturity of concrete

UNIT-III

Modern trends in concrete manufacture and placement techniques, Methods of transportation, Placing and curing extreme whether concreting, Special concreting methods, Vacuum dewatering of concrete-Under water concreting, Non destructive testing and quality control.

UNIT-IV

Durability of Concrete; Permeability of Concrete, Sulphate attack, Corrosion of rebar, Carbonation; freezing and thawing, Fire resistance of concrete

Course outcomes:

1. Students will be able to differentiate the ingredients of concrete and can design mix
2. Students will have the knowledge of effects of various parameters on concrete strength
3. Can use modern techniques while concreting
4. Understanding about durability property of concrete

REFERENCE BOOKS:

1. Krishnaraju, N., Advanced Concrete Technology, CBS Publishers, 1985.
2. Nevile, A.M., Concrete Technology, Prentice Hall, Newyork, 1985.
3. A.R. Santhakumar, : Concrete Technology" Oxford Univeersity Press, 2006
4. Metha P.K. &Montevio P.J.M., Concrete Microstructure, properties and Matrials", Published by Indian Concrete Institute, Chennai, 2005.
5. Krishnaraju N. "Design of Concrete Mixes" CBS Publishers

Course code	**18MCES-515**
Course title	**CONSTRUCTION MANAGEMENT**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. An idea of how structures are built and projects are developed on the field
2. An understanding of modern construction practices
3. A basic ability to plan, control and monitor construction projects with respect to time and cost
4. An idea of how to optimise construction projects based on costs

UNIT-I

Project Planning: Introduction to Project Planning Process. Types of Project Plans-Project feasibility plan, Project preliminary plan, Project construction plan. Introduction to network techniques – CPM, PERT and Precedence network. Waste Management: Introduction to waste and waste management. The concepts of waste productivity and its interrelationship with productivity. System concept of waste. Complementarily of waste and resource management.

UNIT-II

Resource Planning: Planning construction Manpower, Scheduling Construction site workers. Planning Construction Materials Materials quantity estimation. Constrained and unconstrained resource scheduling. Resource usage profile, Resource smoothing, Resource leveling. Cost Control: Project cost: Direct and indirect, slope of direct cost curve, Total project cost and optimum duration, Contracting the network for cost optimization.

UNIT-III

Quality Management: Concept of quality management. Product vs. system quality. Quality assurance. Quality circles. Total quality management. ISO-9000 series and construction project. Materials & Inventory Management: Material management. Requirements and purchases. Different methods of inventory management. Mathematical modeling. Suitable inventory model for construction

UNIT-IV

Safety in Construction: Hazards in construction projects, causes of accidents, classification and costs of accidents, measurement of losses, protective equipments, general safety programme for construction. Techniques of construction of piles, Cessions, Wells, Cofferdams and diaphragms, Drilling blasting, Underpinning, Shoring and shuttering of foundation. Formwork: Design and construction of different types of formworks and temporary structures, Stationary and slip formwork techniques.

Course Outcomes:

1. Knowledge of process of development of project in field.
2. How construction is improved in form of speed and accuracy with new construction practices.
3. Learn different stages of planning in a project.
4. Learn how to minimize cost in a project.

REFERENCE BOOKS:

1. Varghese, P.C., “Building Construction”, Prentice Hall India, 2007.
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., Construction Technology, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Course code	**18MCES-517**
Course title	**DESIGN OF HIGH RISE STRUCTURES**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To study the basics of towers design
2. To study the methodology of designing the chimneys
3. To study the design of tall buildings
4. To learn the software for analysis and design.

UNIT-I

Design of transmission/ TV tower, Mast: Configuration, bracing system, analysisand design for vertical transverse and longitudinal loads.

UNIT-II

Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

UNIT-III

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.

UNIT-IV

Application of software in analysis and design.

Course Outcomes: At the end of the course, students will be able to

1. Analyse, design and detail Transmission/ TV tower, Mast with different loading conditions.
2. Analyse, design and detail the RC and Steel Chimney.
3. Analyse, design and detail the tall buildings subjected to different loading conditions using relevant codes.

Reference Books:

1. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., SouthAsian Publishers, New Delhi, 2002.
2. Structural Analysis and Design of Tall Buildings, Taranath B. S., Mc Graw Hill, 1988.
3. Illustrated Design of Reinforced ConcreteBuildings(GF+3storeyed), Shah V. L. &Karve S. R., Structures Publications, Pune, 2013.
4. Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.
5. Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India. 1991.
6. High Rise Building Structures, Wolfgang Schueller, Wiley., 1971.
7. Tall Chimneys, Manohar S. N., Tata Mc Graw Hill Publishing Company, New Delhi

Course code	**18MCES-519**
Course title	**REHABILITATION OF STRUCTURES**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To understand the causes of damage
2. To understand the damage assessment methods of various civil engineering structures
3. To understand the NDT tests
4. To study the various techniques used for rehabilitation

UNIT-I

Aging of structures, performance of structures, need for rehabilitation.

UNIT-II

Distress in structures, damage ,source , cause , effects , case studies , Damage assessment and Evaluation models.

UNIT-III

Damage testing methods : Non Destructive Tests and Core cutting methods.

UNIT-IV

Rehabilitation methods: Repair and rehabilitation of buildings, Seismic strengthening of structures, use of carbon plates, FRP etc. for retrofitting of structures. Concepts of structural health monitoring.

Course Outcomes:

1. Students will be able to assess the distress in structures
2. Student will have deep knowledge about damage assessment methods
3. Will have knowledge about strengthening of the structures using various retrofitting techniques.
4. Understand the concept of structural health monitoring.

REFERENCE BOOKS:

1. Kenneth and L. Carper (2001)
2. R N Raika (1994)
3. Structural Designers and Consultants
4. V K Raina (2010)

Course code	**18MCES-521**
Course title	**ADVANCED STRUCTURAL DESIGN & DETAILING**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

COURSE OBJECTIVES:

1. To study the limit state method of design and use of handbooks
2. Discuss the earthquake resistant design and detailing
3. To study the design and detailing of earthen and masonry structures
4. Detailing of RCC structures as per Indian standards

UNIT-I

Introduction to limit state method of design, provisions in the Indian standard codes for loading wind loads and seismic loads, design and detailing of concrete structures.
BIS Handbook for design, Examples of design using handbook SP-16.

UNIT-II

Design of Structures as per I.S. 1893 for Earthquake Resistant Design Construction.
Design and Detailing Requirements as per 4326-1993.

UNIT-III

Design and detailing of Earthen Buildings as per 13827-1993
Design and detailing of Masonry Structures as per I.S. 13828-1993

UNIT-IV

Design and Ductile Detailing of R.C.C. Structures of R.C.C. Structures as per I.S. 13920-1993
Repair and Seismic Strengthening of Building as per I.S. 13935-1993

COURSE OUTCOMES:

1. Students will be able to use limit state method of design.
2. Students will be able to design buildings as per earthquake zone.
3. Apply the basics of design standards on earthen and masonry structures.
4. Apply codal provisions on masonry and framed structures including special structures.

Reference Books:

1. Pillai and Menon, Reinforced Concrete Design
2. Jain, A.K. Reinforced Concrete, Limit State Method of Design.
3. Punmia, B.C. reinforced Concrete Structures, Vol-II.
4. B.I.S. Codes 1893, 4326, 13827, 13828, 13920, 13935

Course code	**18MCES-505**
Course title	**CAD IN STRUCTURE ENGINEERING**
Scheme (L-T-P)	**0-0-4**
Credits	**2**
Internal Assessment	**25**
External Assessment	**25**
Total	**50**

Course Objectives:

1. To study the design and detailing software tools.

Content:

Learning of Staad Pro, MS Excel and Auto Cad software. Design and detailing of G+5 storey building considering all the loads as per IS Codes.

Course Outcomes:

1. At the end of the course, students will be able to use the software like Auto Cad and Staad Pro effectively.

Note:

The students will be required to carry out the design of the G+5 storey's individually with different layout of the building in the software. All the structural drawings (prepared using Auto Cad) and design report (prepared in MS Excel and word) should be submitted at the end of the semester. Students should develop the design sheets for various structural components in MS Excel.

Course code	**18MCES-507**
Course title	**CONCRETE TECHNOLOGY LAB**
Scheme (L-T-P)	**0-0-4**
Credits	**2**
Internal Assessment	**25**
External Assessment	**25**
Total	**50**

Course Objectives:

1. To familiarize the students with the concepts of designing concrete mixes using different methods of proportioning and to understand the effects of various parameters.

Content

1. Mix proportioning of concrete as per IS;ACI and BS methods
2. Aggregate testing.
3. Cement Testing.
4. Workability.
5. Admixture effects on workability.
6. Non-destructive testing.
7. Determination of tensile, compressive and flexural strengths of concrete.

Course Outcomes:

1. With the knowledge of this subject students shall be able to design various types of concrete mixes and asses the strength of RCC structures using non-destructive techniques.

Note :

The students will be required to carry out the experiments / exercises from the above list and any other two experiments either from the above list or designed by the department based on the theory course.

Course code	**18 MCES-502**
Course title	**ADVANCED STEEL DESIGN**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To strengthen the basic fundamentals of plastic design of steel structures.
2. To design the tubular structural members.
3. To design the cold form sections

UNIT-1

Concept of Plastic Design: Introduction, Theory of plastic bending, Assumptions, Bending of rectangular section, Plastic hinge, Redistribution of moments, Computation of plastic moment, Shape factor, Overload factor, Method of plastic analysis :Statical Method, Mechanism method, Upper bound, Lower bound and uniqueness theorem, Partial, Complete and over complete failure of indeterminate structures.

Plastic Analysis and design of Beams: Single span and continuous Beam, Moment Balancing Method.

UNIT-2

Tubular Structures: Permissible stresses, tube columns and compression members, tube tension members, tubular roof trusses, joints in tubular trusses, tubular beams and purlins

UNIT-3

Design of Light gauge steel sections: Introduction, brief description of various types of cold formed sections and their design as per IS codes.

UNIT-4

Elevated Steel Tanks: Circular tanks with conical bottom, Rectangular tank, Design considerations, Staging, Pressed steel plate tanks.

Course Outcomes: With the knowledge of this subject students shall be capable of

1. designing steel structures using theory of plastic design.
2. Designing the light gauge sections
3. Analysis and design of tubular structures

Reference Books:

1. Plastic Design by Neal.
2. Plastic Design of Steel Frames by LYNN.S.Beedle.
3. The steel skeleton Volume I and II by J.F. Baker Publication English Language Book Society.
4. Steel Structure-Design and Behaviour Salmon and Johnson Publication Harper and Row.
5. Structural Steel Designer's Hand Book by Merritt.
6. Plastic analysis of steel structures by Hedge G. Philips.
7. Handbook for Structural Engineers, SP: 6(6)-1972.

Course code	**18MCES-504**
Course title	**DESIGN OF ADVANCED REINFORCED CONCRETE STRUCTURES**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course objectives:

1. To study the different types of water tanks
2. To discuss the design philosophies of shear walls
3. To design the RCC slender columns
4. To introduce the deep beams design

UNIT-1

Design of Water Tanks: Underground, OHSR and Intze tank

UNIT-II

Design of Rectangular and Flanged Shear Walls as per IS 13920. Analysis of RC frames for vertical loads by using Substitute Method.

UNIT-III

Design of Slender Columns: Concentrically loaded slender columns, eccentrically loaded slender columns, Slender columns subjected to axial and transverse loads, Structural behavior of columns in braced and unbraced frames, Codal procedure for design of slender columns.

UNIT-IV

Deep Beams: General features, Parameter influencing design, Flexural bending and shear stresses in deep beams. Design provisions of IS-456, Checking for local failures,Strut and tie analysis of deep beams, Detailing of reinforcement in deep beams

Course Outcomes:

1. Students will be able to design the different types of water tanks
2. Students will be familiar to design and analysis of shear walls
3. Students will be able to analyse and design the slender columns
4. Students will be able to design the RCC deep beams

References:

1. Structural Engineers Handbook.
2. Jaikrishna & Jain OP, “Plain and Reinforced Concrete, Nem Chand & Brothers, Roorkee
3. Varghese P C “Advanced Reinforced Concrete Design” Prentice Hall India
4. Dayaratnam P “Reinforced Concrete Structures”, Oxford and IBH Publisher
5. Advanced Reinforced Concrete Design, Varghese P. C., Prentice Hall of India, New Delhi.

Course code	**18MCES-512**
Course title	**COMPUTER AIDED DESIGN AND EXPERT SYSTEM IN ENGINEERING**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To have information about developing interactive software.
2. To apply concepts to develop interactive software for analyzing the structures.
3. To develop expert systems for applications in civil engineering.

UNIT-I

Computer Aided Design: Introduction, Computer graphics, Geometric modeling, Three dimensional graphics, Raster graphic fundamentals, Computer aided linkage displays andsynthesis, Interactive acceleration analysis.

UNIT-II

Programming Using Matrix Methods of Structural Analysis: Assembly of matrices,Solution of equilibrium equations, Flow charts.

UNIT-III

Interactive Computer Programming: Computer programs for design of simple civil engineering structural elements.

Expert System in Engineering: Introduction, History, Advantages and limitations of expert systems.

UNIT-IV

Components of Expert Systems: Knowledge base, Inference Engine, User's Interface.

Development of Expert Systems: Problem formulation, Application to engineering analysis & design consideration and Operations, Representative applications in civil
engineering.

Course Outcomes:

1. Knowledge about developing computer programmes.
2. Able to develop computer programmes for analyzing the civil engineering structures.
3. Students will be able to develop expert systems to solve complex structures using matrix method of structural analysis.

References:

1. William M. Newman And Robert F. Sproul , "Principle of Interactive Computer Graphics"
2. William Weaver, "Matrix Analysis of Framed Structures"
3. Waterman, D.A. ,"A guide to Expert Systems"
4. Jackson, P, "Introduction to Expert Systems"

Course code	**18MCES-514**
Course title	**ADVANCED SOLID MECHANICS**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To have knowledge about elastic and inelastic stress analysis
2. To apply concept of stress analysis of basic structural elements with linear and non linear behaviour.

UNIT-1

Analysis of Stresses: Basic concepts of the theory of elasticity; theory of stresses; stresses on an arbitrary plane; principal stresses; stress invariants; plane state of stress; equilibrium and boundary conditions.
Analysis of Strains: Infinitesimal and finite strains; strain-displacement relationships; compatibility conditions; stress strain relationships; plane stress and plane strain.

UNIT-2

Yield criteria and Ideally Plastic Solids: Theories of failure; Ideally Plastic solids; Stress Space and Strain space; Stress strain relations (plastic flow).
Bending of Beams: Introduction to Energy methods; Straight Beams and Asymmetrical bending; centre of flexure; shear stresses in thin walled open sections; bending of curved beams.

UNIT-3

Torsion: Torsion of prismatic, circular, elliptical and triangular bars; Membrane Analogy; Thin wall tubes and thin rectangular sections; centre of twist and flexural centre.

UNIT-4

Elastic Stability: Eular's buckling load; general treatment of column stability and buckling as an eigen value problem; Energy methods for buckling problems.
Introduction to Composite Materials: Stress-Strain relations; Basic cases of elastic symmetry; failure criteria of composite materials.

Course Outcomes:

1. Students will have knowledge about stress analysis

Students will be capable of understanding behaviour of complex structures under various loading conditions

References:

1. Timoshenka S.P. and J N Goodier, "Theory of Elasticity", McGraw Hill
2. Calladine CR, "Plasticity for Engineers", Ellis Herwood
3. Srinath LS "Advanced Mechanics of Solids", Tata McGraw Hill
4. D.S Chandrasekharaiah and L. Debnath, Continuum Mechanics, Prism Books Pvt. Ltd, Bangalore

Course code	**18MCES-516**
Course title	**DESIGN AND CONSTRUCTION OF BRIDGE SUPER STRUCTURES**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To introduce bridge and its components
2. To design the culvert
3. To design the RCC solid slab deck and girder bridge
4. To introduce concept of rehabilitation of bridges

UNIT-1

Introduction-definition and components of bridges. Layout and planning of bridges-classification, investigations for bridges, preliminary data collection, choice of type of the bridges.

UNIT-II

Design of R.C Solid Slab Bridges and culverts. Different Types of Bearings and Design of Elastomeric Bearings

UNIT-III

Design of R.C. Girder Bridges, Introduction to Arch Bridges, Suspension and Cable Stayed Bridges

UNIT-IV

Special aspects in analysis and design, based on construction methodology. Inspection and maintenance and rehabilitation of bridges.

Course Outcome: At the end of the course the student will understand

1. the design theories for super structure of bridges
2. The student will be able to design the Deck slab.
3. The student will possess the knowledge to design long span bridges.
4. Students will have deep knowledge about the special aspects used in designing of bridges

References :

1. Pama&Gusens , Bridge Deck analysis
2. Edward V. Humbly, Bridge deck behaviour
3. D. Johnson Vector , Essentials of bridge engineering
4. Ponnuswamy S “Bridge Engineering”, McGraw Hill

Course code	**18MCES-518**
Course title	**DESIGN OF PRESTRESSED CONCRETE STRUCTURES**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course Objectives:

1. To Explain the prestress system and losses
2. To impart the concept of prestressing into slabs
3. To design the beams using prestress methods
4. To impart the knowledge of prestressing into compression and tension members using IS codes

UNIT-I

Principles of prestressing-Materials of prestressing-Systems of prestressing-Loss of prestress-Deflection of Prestressed Concrete members.

UNIT-II

Slabs-Pre-tensioned and Post-tensioned beams-Design for flexure, bond and shear –IS code provisions-Ultimate flexural and shear strength of prestressed concrete sections-Design of end anchorate zones using IS code method.

UNIT-III

Composite beams-Analysis and design. Partial prestressing-non –prestressed reinforcements. Analysis of Continuous beams-cable layout-Linear transformation-Concordant cables.

UNIT-IV

Design of compression members and tension members. Circular prestressing-Water tanks-Pipes –Analysis and design-IS Codal provisions.

Course Outcome:

1. Students will be able to use the concepts of pre-stressed concrete, dealing with load analysis.
2. Students will be introduced to types pre stressed concrete structures and their design methodology.
3. The students will be able to analyze and design pre-stressed concrete members like slabs and beams.
4. The students will be able to design the compression and tension members using prestress methodology

References

1. Lin.T.Y., Burns, N.H., Design of Prestressed Concrete Structures, John Wiley & Sons, 1982.
2. Raja Gopalan N. Prestressed Concrete, Narosa Publishing House, New Delhi, 2002.
3. Krishnaraju N. Prestressed Concrete Tata McGraw Hill

Course code	**18MCES-520**
Course title	**ADVANCED CONCRETE MATERIALS**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

COURSE OBJECTIVES:

1. To study the fibre reinforced concrete
2. Discuss the fly ash classifications and its properties along with uses
3. To study the polymer concrete and ferro cement
4. To introduce high performance concrete and light weight concrete

UNIT-1

FIBRE REINFORCED CONCRETE: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Composite Material approach, Application of fibre reinforced concrete.

FERRO CEMENT: Constituent materials and their properties, Mechanical properties of fero cement, Construction techniques and application of ferro cement

UNIT-II

FLY ASH CONCRETE: Classification of Indian Flyashes, Properties of Flyash, Reaction Mechanism, Proportioning of Flyash concretes, Properties of Flyash concrete in fresh and hardened state, Durability of flyash concrete.

POLYMER CONCRETE: Terminology used in polymer concrete, Properties of constituent materials, Ploymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.

UNIT-III

HIGH PERFORMANCE CONCRETE: Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.

GEOPOLYMER CONCRETE: Mechanism of Geopolymer Concrete**,** Ingredients of geopolymer concrete, mix proportioning, permeability, durability and applications.

UNIT-IV

LIGHT WEIGHT CONCRETE: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete.

HEAVY WEIGHT CONCRETE: Properties of heavy weight concrete, design and applications of heavy weight concrete

SELF COMPACTING CONCRETE

COURSE OUTCOMES:

1. Students have knowledge about fibre reinforced concrete
2. Students will be able to select the various types of fly ash.
3. Students will have the knowledge of polymer concrete and ferro cement.
4. Students will be familiar to high performance, geopolymer and light weight concrete

References:

1. Concrete, its Properties and Microstructure by P.K. Mehta, and P.J.M. Monterio.
2. Ferrocement by B.K. Paul, and R.P. Pama
3. Fibre Reinforced Concrete by Bentur and Mindess
4. Flyash in Concrete by Malhotra and Ramezanianpour

Course code	**18MCES-522**
Course title	**ADVANCED FOUNDATION ENGINEERING**
Scheme (L-T-P)	**3-0-0**
Credits	**3**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**
Duration of Exam	**3 HRS**

Note: Nine questions are to be set by the examiner. Question No. 1 will be compulsory and based on the entire syllabus. It will contain ten short answer type questions. Two questions are to be set from each unit. The student is required to attempt five questions in all by selecting one question from each unit and question no. 1, which is compulsory. All question carry equal marks.

Course objectives:

1. To study the basics of foundation engineering
2. To design the shallow foundations in depth including the settlement
3. To discuss the pile footing using examples
4. To study the soil liquefactionand remedial measures

UNIT-I

Shallow Foundations: Design considerations - factors of safety (including limit state), allowable settlements, location and depth of foundations, Codal provisions. Presumptive bearing capacity. Bearing capacity theories. Layered soils. Choice of shear strength parameters. Bearing capacity from N-values, static cone tests, plate load tests.

UNIT-2

Settlement: Total and differential settlement. Stress distribution. Consolidation settlement in clays (with correction factors). Immediate settlement. Settlement in sands from N-values, elastic solutions. Static cone tests, Plate load tests.

UNIT-3

Deep foundations: Type of Piles. Construction methods. Axial capacity of single piles-static formulae, Skin friction and end bearing in sands and clays. Axial capacity of groups. Settlement of single piles and groups. Uplift capacity (including underreamed piles). Negative skin friction. Pile load tests. Pile integrity tests. Codal provisions. Laterally Loaded Piles: Short and long piles; Free head and fixed head piles; Lateral load capacity of single piles; Lateral deflection; Elastic analysis; Group effect; Lateral load test; Codal provisions.

UNIT-4

Foundations in difficult soils: Expansive soils, chemically aggressive environment, soft soils, fills, regions of subsidence.Soil Liquefaction and remedial measures, stone column, vibrfloatation, deep compaction.

Course Outcomes:

1. Students will have the knowledge of basics of footing
2. Students will be able to analyse and design the shallow and deep footings
3. Students will be able to design the pile foundation for heavy structures
4. Students will have the knowledge of foundations in difficult soils

References:

1. Joseph E. Bowles Foundation Analysis and Design.
2. Kaniraj S.K., Design aids in soil mechanics and foundation engineering.
3. Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley,1980.

Course code	**18MCES-506**
Course title	**Seminar**
Scheme (L-T-P)	**0-0-4**
Credits	**2**
Internal Assessment	**25**
External Assessment	**25**
Total	**50**

The objective of this course is to provide a foundation for research work to the student. The student will get a topic from his/her supervisor. He/she will concentrate on the topic and will explore different aspects. He/she will make a presentation before a committee which will consist of

1. Chairperson
2. Supervisor and/ Co-supervisor
3. Faculty member nominated by the Chairperson preferably in Structural Engineering

The assessment will be based on the presentation and the report submitted by the student.

Course code	**18MCES-508**
Course title	**STRUCTURAL DESIGN LAB**
Scheme (L-T-P)	**0-0-4**
Credits	**2**
Internal Assessment	**25**
External Assessment	**25**
Total	**50**

Course Objectives:

1. To study the design and detailing of concrete structures.

Course Outcomes: At the end of the course, students will be able to

1. design and detail the slender columns.
2. design and detail the bunkers and silos.
3. design and detail the liquid retaining structures.
4. design and detail the deep beams.

Content:

Design and detailed drawing of slender columns, bunkers, silos, deep beams, OHSR, underground water tank.

Notes:

1. **Each Laboratory Class/Section shall not be of more than about 20 students.**
2. **To allow fair opportunity of practical hands-on experience to each student, each experiment may either be done by each student individually or in a group of not more than 3-4 students. Larger groups be strictly discouraged / disallowed.**
3. **Pre-experimental & post experimental quiz / questions may be offered for each Lab experiment to reinforce & aid comprehension of the experiment.**

Course code	**18MCES-510**
Course title	**MINI PROJECT**
Scheme (L-T-P)	**0-0-4**
Credits	**2**
Internal Assessment	**25**
External Assessment	**75**
Total	**100**

The objective of mini project is to develop in students the professional quality of synthesis employing technical knowledge obtained in the field of Engineering & Technology through a project work involving design, analysis augmented with creativity, innovation and ingenuity.

This course is meant to enable the students to take up investigative study in the broad relevant field of engineering, either hardware or software or involving both hardware and software to be assigned by the department on an individual basis, under the guidance of a supervisor from the department. This is expected to provide a good initiation for the student(s) in R&D work.

The activities under mini project may normally include:

1. Literature survey on the assigned topic.
2. Working out a preliminary approach to the problem relating to the assigned topic.
3. Conducting preliminary analysis/modelling/simulation/experiment/design.
4. Compilation of the project work and presenting it in two seminar talks in a semester, before a committee having M. Tech. coordinator and supervisor(s).
5. Submit a written spiral bound report on the work conducted to the M.Tech. Coordinator.

The internal evaluation of the Mini project will be done at the end of the semester through a seminar by the committee consisting of the following:

1. **Chairperson/Head of Department/Nominee** **:** Chairperson
2. **M. Tech. Coordinato**r : Member Secretary
3. **Respective Project Supervisor(s)** **:** Member(s)

Final exam will be conducted by the internal examiner (M.Tech. Coordinator/faculty nominated by Chairperson) and external examiner to be appointed by the Controller of Examinations from the panel of examiners submitted by the Dept.

M. Tech. coordinator will be assigned a load of 1 hour per week excluding his/her own guiding load & project supervisor(s) (guiding teacher) will be assigned the load of 1 hour per week per student subject to a maximum load of 2 hours.