Faculty of Engineering & Technology
P.K.University
Shivpuri (MP)

Evaluation Scheme & Syllabus for
Department Of Civil Engineering

M. Tech .-(Structural Engg.)
(I to IV Semester)

(Effective from session 2019-20)

EVALUATION SCHEME
M.Tech- Structural Engg. (CIVIL)

Semester-I

SUBJECT CODE	SUBJECT NAME	THEORY		PRACTICAL		TOTAL
		SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
MTST-101	Structural Dynamics	30	70	NA	NA	100
MTST-102	Pre-stressed Concrete	30	70	25	25	150
MTST-103	Advanced Steel Design	30	70	NA	NA	100
MTST-104	Advanced Structural Analysis	30	70	NA	NA	100
MTST-105	Research Process & Methodology	30	70	NA	NA	100
MTST-106	Advance concrete Design Lab	NA	NA	25	25	50
MTST-107	CAD lab	NA	NA	25	25	50

Semester-II

SUBJECT CODE	SUBJECT NAME	THEORY		PRACTICAL		TOTAL
		SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
MTST-201	Advanced concrete design	30	70	NA	NA	100
MTST-202	Finite element methods	30	70	NA	NA	100
MTST-203	Concrete technology	30	70	NA	NA	100
MTST-204	Plastic analysis and design	30	70	NA	NA	100
MTST-205	Bridge Engineering	NA	NA	25	25	50
MTST-206	Finite element analysis Lab	NA	NA	25	25	50
MTST-207	Seminar-I	NA	NA	25	25	50

Semester-III

SUBJECT CODE	**SUBJECT NAME**	THEORY		PRACTICAL		TOTAL
		SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
MTST-301	Dissertation phase-I	NA	NA	300	300	600
MTST-302	Seminar-II	NA	NA	25	25	50

Semester-IV

SUBJECT CODE	**SUBJECT NAME**	THEORY		PRACTICAL		TOTAL
		SESS.(30)	EXT.(70)	SESS.(25)	EXT.(25)	
MTST-301	Dissertation phase-I	NA	NA	300	300	600

Department Of Civil Engineering
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I Year I Semester

MTST-101 Structural Dynamics

UNIT I

Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. - Free vibrations of single degree of freedom system - undamped and damped vibrations - critical damping - Logarithmic decrement - Forced vibration of SDOF systems - Harmonic excitation -Dynamic magnification factor – Phase angle – Bandwidth

UNIT II

Introduction to Structural Dynamics : Fundamental objectives of dynamic analysis - Types of prescribed loading - Methods of discretization - Formulation of equations of motion by different methods – Direct equilibration using Newton's law of motion / D'Alembert's principle, Principle of virtual work and Hamilton principle. **Single Degree of Freedom Systems :** Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral.

UNIT III

Multi Degree of Freedom Systems : Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion - Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure.

UNIT IV

Practical Vibration Analysis: Introduction - Stodola method - Fundamental mode analysis - Analysis of second and higher modes - Holzer method - Basic procedure. **Continuous Systems:** Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions - Principles of application to continuous beams.

UNIT V

Introduction to Earthquake Analysis: Introduction - Excitation by rigid base translation - Lumped mass approach - SDOF and MDOF systems - I. S. Code methods of analysis for obtaining response of multi storeyed buildings.

REFERENCES:

1. Dynamics of Structures by Clough & Penzien, McGraw Hill, New york
2. Structural Dynamics by Mario Paz, C.B.S Publishers, New Delhi.
3. Dynamics of Structures by Anil K. Chopra, Pearson Education (Singapore), Delhi.
4. I.S: 1893 - 1984, "Code of practice for Earthquake resistant design of Structures" and latest I.S: 1893 - 2002 (version) Part-1

Department Of Civil Engineering
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I Year I Semester
MTST-102 Pre-stressed Concrete

UNIT I. General Principles of Prestressed Concrete : Pre–tensioning and post – tensioning – Prestressing by straight, concentric, eccentric, bent and parabolic tendons – Different methods and systems of prestressing like Hoyer system, Freyssinet system, Magnel Blaton system – Lee-Mc call system. Losses of Prestress : Loss of prestress in pre-tensioned and post-tensioned members due to various causes like elastic shortening of concrete, shrinkage of concrete, creep of concrete, relaxation of steel, slip in anchorage, bending of member and frictional loss – Analysis of sections for flexure. (10L)

UNIT II. Design of Section for Flexure : Allowable stresses – Elastic design of simple beams having rectangular and I-section for flexure – kern lines – cable profile and cable layout. Design of Sections for Shear : Shear and Principal stresses – Improving shear resistance by different prestressing techniques – horizontal, sloping and vertical prestressing – Analysis of rectangular and I– beam – Design of shear reinforcement – Indian code provisions. (8L)

UNIT III. Deflections of Prestressed Concrete Beams : Short term deflections of uncracked members– Prediction of long-time deflections – load – deflection curve for a PSC beam – IS code requirements for max. deflections. (6L)

UNIT IV Transfer of Prestress in Pretensioned Members : Transmission of prestressing force by bond – Transmission length – Flexural bond stresses – IS code provisions – Anchorag e zone stresses in post tensioned members – stress distribution in End bloc k – Analysis by approximate, Guyon and Magnel methods – Anchorage zone reinforcement. (8L)

UNIT V. Statically Indeterminate Structures : Advantages & disadvantages of continuous PSC beams – Primary and secondary moments – P and C lines – Linear transformation concordant and non-concordant cable profiles – Analysis of continuous beams and simple portal frames (single bay and single story) (8L)

REFERENCES : 1. Prestressed concrete by Krishna Raju, Tata Mc Graw Hill Book – Co ., New Delhi.
2. Design of prestress concrete structures by T.Y. Lin and Burn, John Wiley, New York. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi.

Department Of Civil Engineering
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I Year I Semester

MTST-103 Advanced Steel Design

UNIT I

Basic Design Concepts: Behaviour in flexure, Design of singly reinforced rectangular sections, Design of doubly reinforced rectangular sections, Design of flanged beams, Design of shear, Design for Torsion, Limit state of Serviceability: Deflections of Reinforced concrete beams and slabs, short term deflection and long term deflection, estimation of crack width in RCC members, calculation of crack widths.

UNIT II

Limit Analysis of R.C.Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, and applications for fixed and continuous beam. Yield line analysis for slabs: Upper bound and lower bound theorems – yield line criterion – Virtual work and equilibrium methods of analysis for square and circular slabs with simple and continuous end conditions.

UNIT III

Design of Ribbed slabs, Flat slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, Arrangement of Reinforcements.

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two way shears - Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip.

UNIT IV

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels , Design of Procedure of Corbels, Design of Nibs.

UNIT V

Design of Compression members: Estimation of effective length of a column-Code requirements on Slenderness Limits, Design of Short Columns under Axial Compression, Design of Short Columns with Uniaxial Bending, Design of Short Columns under Biaxial Bending, Design of Slender Columns.Design of Combined Footings- Distribution of soil Pressure – Geometry of Two Column Combined Footing – Design Considerations in Combined Footing for Two – Columns.

REFERENCE BOOKS:

1. Reinforced concrete design by Kennath Leet, Tata Mc. Graw-Hill International, editions, 2nd edition, 1991.
2. Reinforced concrete structural elements – behaviour, Analysis and design by P.Purushotham, Tata Mc.Graw-Hill, 1994.
3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced concrete structures, Vol.1, by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, 2004.

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I Year I Semester

MTST-104 Advance structural Analysis

UNIT I

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.

UNIT II

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.

UNIT III

Analysis of plane truss - continuous beam - plane frame and grids by flexibility methods.

UNIT IV

Analysis of plane truss - continuous beam - plane frame and grids by stiffness methods.

UNIT V. 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.

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I Year I Semester

MTST105: Research Process and Methodology

UNIT 1:

Introduction to Research and Problem Definition-Meaning, Objective and importance of research, Types of research, steps involved in research, defining research problem

UNIT 2:

Research Design-Research design, Methods of research design, research process and steps involved, Literature Survey

UNIT 3:

Data Collection-Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research

UNIT 4:

Data Analysis and interpretation-Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results

UNIT 5:

Technical Writing and reporting of research-Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism

Text Books:

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques , New Age International publishers, Third Edition.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005
3. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
4. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches.
Sage publications, 2013.

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I Year II Semester

MTST-201 Advanced concrete design

UNIT I

Basic Design Concepts: Behaviour in flexure, Design of singly reinforced rectangular sections, Design of doubly reinforced rectangular sections, Design of flanged beams, Design of shear, Design for Torsion, Limit state of Serviceability: Deflections of Reinforced concrete beams and slabs, short term deflection and long term deflection, estimation of crack width in RCC members, calculation of crack widths.

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3. Design of concrete structures – Arthus H. Nilson, David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced concrete structures, Vol.1,by B.C. Punmia, A. K. Jain and Arun Jain, Laxmi Publications,20.

MTST-202 Finite element methods

UNIT I

Introduction: Concepts of FEM - steps involved - merits and demerits – energy principles discrimination - Raleigh - Ritz method of functional approximation. Principles of Elasticity: Stress equations - strain displacement relationships in matrix form plane stress, plane strain and axi-symmetric bodies of revolution with axi- symmetric loading.

UNIT II

One dimensional FEM: Stiffness matrix for beam and bar elements - shape functions foe ID elements. Two dimensional FEM: Different types of elements for plane stress and plane strain analysis - displacement models - generalized coordinates - shape functions - convergent and compatibility requirements - geometric invariance - natural coordinate system - area and volume coordinates - generation of element stiffness and nodal load matrices

UNIT III

Iso parametric formulation: Concept - different iso parametric elements for 2D analysis - formulation of 4-noded and 8-noded iso parametric quadrilateral elements - Lagrange elements - serendipity elements. Axi Symmetric Analysis: bodies of revolution - axi symmetric modeling - strain displacement relationship - formulation of axi symmetric elements.

Three dimensional FEM: Different 3-D elements-strain-displacement relationship– formulation of hexahedral and iso-parametric solid element.

UNIT IV

Introduction to Finite Element Analysis of Plates: basic theory of plate bending - thin plate theory - stress resultants - Mindlin's approximations - formulation of 4-noded isoperimetric quadrilateral plate element – Shell Element.

UNIT V

Introduction to non-linear analysis

basic methods – application to Special structures.

REFERENCES:

1. Concepts and Applications of Finite Element Analysis by Robert D.Cook, David S. Malkus and Michael E. Plesha, John Wiley & Sons.
2. Finite element Methods by OC Zienkiewicz
3. Finite element analysis, theory and progarmming by GS Krishna Murthy.
4. Introduction to Finite element Method by Tirupathi Chandra Patila and Belugunudu.
5. Introduction to Finite element Method by JN Reddy.

MTST-203 Concrete technology

UNIT I

Concrete Making Materials: Cement- Bogues compounds – Hydration Process– Types of cement – Aggregates – Gradation Charts – Combined aggregate-Alkali Silica Reaction - Admixtures – Chemical and Mineral admixtures.

UNIT – II

Fresh and Hardened Concrete: Fresh Concrete - workability tests on Concrete Setting times of Fresh Concrete - Segregation and bleeding.

Hardened Concrete : Abram's law- Gel space ratios, Maturity Concept – Stress Behaviour – Creep and Shrinkage – Durability tests on concrete – Non-destructive testing of concrete.

UNIT - III

High Strength Concrete – Micro structure – Manufacturing and Properties- Design 0s HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete.

High Performance Concrete- Requirements and properties of High Performance Concrete- Design Considerations.

UNIT –IV

Special Concrete: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete –Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete. Concrete mix design : Quality Control - Quality assurance - Quality audit- Mix Design method - BIS method, ACI method, DOE method.

UNIT –V

Form work – materials – structural requirements – form work systems – connections – specifications – design of form work – shores – removal for forms – reshoring – failure of form work.

TEXT BOOKS:

1. Properties of Concrete by A.M.Neville, ELBS publications.
2. Concrete Technology by A.K. Santhakumar, Oxford Press.
3. Concrete Technology by M.S.Shetty, S.Chand & Co.

REFERENCES:

1. Special Structural concretes by Rajat Siddique, Galgotia Publications.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications.
3. Concrete: Micro Structure by P.K.Mehta, ICI, Chennai.

Department Of Civil Engineering
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I Year II Semester

MTST-204 Plastic analysis and design

UNIT - I

Analysis of Structures for Ultimate Load: Fundamental Principles – statical method of Analysis – Mechanism method of analysis – Method of analysis, Moment check – Carry over factor – Moment Balancing Method.

UNIT - II

Design of Continuous Beams: Continuous Beams of uniform section throughout – Continuous Beams with different cross-sections.

UNIT - III

Secondary Design Problems: Introduction – Influence of Axial force on the plastic moment – influence of shear force – local buckling of flanges and webs – lateral buckling – column stability.

UNIT - IV

Design of Connections: Introduction – requirement for connections – straight corner connections – Haunched connection – Interior Beam-Column connections.

UNIT- V

Design of Steel Frames: Introduction – Sinole span frames – simplified procedures for Sinole span frames – Design of Gable frames with Haunched Connection. Ultimate Deflections: Introduction – Deflection at ultimate load – Deflection at working load – Deflections of Beams and Sinole span frames.

REFERENCES:

1. Plastic Design of Steel Frames, L.S.Beedle.
2. Plastic Analysis, B.G.Neal.
3. Plastic Analysis, Horve.

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I Year II Semester

MTST-205 Bridge Engineering

UNIT I

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads- Longitudinal forces-Sesmic loads-Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of raodway and footway- General Design Requirements.

UNIT II.

Solid slab Bridges: Introduction-Method of Analysis and Design.

UNIT III

Girder Bridges: Introduction-Method of Analysis and Design-Courbon's Theory, Grillage analogy.

UNIT IV.

Pre-Stressed Concrete Bridges: Basic principles-General Design requirements-Mild steel reinforcement in prestessed concrete member-Concrete cover and spacing of pre- stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT V.

Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Sub-srtucture of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments.

REFERENCES:

1. Design of Concrete Bridges by M.G.Aswani, V.N.Vazirani and M.M.Ratwani.
2. Bridge Deck Behaviour by E.C.Hambly.
3. Concrete Bridge Design and Practice by V.K.Raina.