R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Advanced Mathematics and Numerical Analysis**	**MTSE-1001**	**3L-1T-0P**	**4**

Course Objective:

CO1:-To solve the numerical solution of partial differential equation give tool and technic to solve numerical of various problem pertaining to hyperbolic, parabolic and elliptic types by finite difference method.

CO2:- To solve the real life application of transforms to boundary value problem in engineering by integral transform

CO3:- To solving Integral equations for Conversion of Linear Differential equation (LDE) to an integral equation (IE) which applicable for solving real life problems.

CO4:- Application of calculus of variation to various engineering problems

CO5:- To solve various problems in the field of engineering by finite elements

Syllabus:

Unit 1:

Numerical solution of Partial Differential Equation (PDE): Numerical solution of PDE of hyperbolic, parabolic and elliptic types by finite difference method.

Unit 2:

Integral transforms: general definition, introduction to Mellin, Hankel and Fourier transforms and fast Fourier transforms application of transforms to boundary value problems in engineering

Unit 3:

Integral equations: Conversion of Linear Differential equation (LDE) to an integral equation (IE), conversion of boundary value problems to integral equations using Greenns function, solution of Integral equation, IE of convolution type, Abelns IE, Integral differential equations, IE with separable variable, solution of Freehold Equation with separable kernels, solution of Freehold and Volterra equations by method of successive approximations.

Unit 4:

Calculus of Variation: Functional and their Variation, Eulerns equation for function of one and two independent variables, application to engineering problems.

Unit 5:

FEM: Variation functional, Euler Lagrangens equation, Variation forms, Ritz methods, Galerkinns method, descretization, finite elements method for one dimensional problem

Course Outcomes:

- On completion of this course the students will be able to solve various problems in the field of engineering employing probability and statistical methods.

Reference Books:

Reference Books

1. B.V. Rammana, Higher Engineering Mathematics, Tata McGraw Hill Pub. Company, 2007.
2. Potter, Goldberg & Edward, Advanced Engineering Mathematics, Oxford University Press.
3. S. S. Shastry, Engineering Mathematics, PHI Learning
4. C.B. Gupta, Engineering Mathematics I & II, McGraw Hill India, 2015
5. Dean G. Duffy, Advanced Engineering Mathematics with MATLAB, CRC Press, 2013.
6. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Inc.
7. S.D. Sharma & Kedarnath, Operations Research, Ramnath & Co.
8. M. K. Jain, Iyengar, Numerical Methods for Scientific and Engineering Computation, New Age

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Theory of Elasticity**	**MTSE--1002**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the concept of plane stress and strain and differential equations of equilibrium in solids.

CO2: Analyze the two-dimensional problems in rectangular co-ordinates.

CO3: Analyze the two-dimensional problems in polar co-ordinates

CO4: Analyze the stress and strain in three-dimensional problems.

CO5: Analyze the various sections of prismatic bars subjected to torsion.

Syllabus:

Unit 1:

Plane Stress & Plane Strain: Plane Stress, Plane Strain, Stress and Strain at a points, Differential equations of equilibrium, constitutive relation : anisotropic materials Linear elasticity; Stress, strain, constitutive relations; Boundary conditions, Compatibility equation, stress function.

Unit 2:

Two Dimensional Problems in Rectangular Co-ordinates: Solutions by Polynomials, Saint-Venantns Principle, Determination of displacements, bending of beams, solution of two-dimensional problem in Fourier series.

Unit 3:

Two Dimensional Problems in Polar Coordinates : General equations in Polar coordinates, Pure bending of curved bars, displacements for symmetrical stress distributions, bending of curved bar, stress distribution in plates with circular holes, stresses in a circular disc general solution.

Unit 4:

Analysis of stress and strain in Three Dimensions : Principal stress and strain, shearing stress and strains, elementary equation of equilibrium , compatibility conditions, problems of elasticity involving pure bending of prismatic bars.

Unit 5:

Torsion of Prismatic Bars : Torsion of prismatic bars, membrane analogy, torsion of a bar of narrow rectangular cross section, torsion of rectangular bars, solution of torsional problem, torsion of rolled

section, torsion of hollow shafts and thin tubes, torsion buckling torsional flexural buckling.

Course outcomes:

- On completion of this course the students will be familiar to the concept of elastic analysis of plane stress and plane strain problems, beams on elastic foundation and torsion on noncircular section.

References Books

1. Timoshenko, S.P. Theory of Elasticity (7th ed.). McGraw –Hill International.

2. Timoshenko, S. P. & Gere, James M. Theory of Elastic Stability (2nd. ed.). McGraw –Hill International Editions, Mechanical Engineering Series.

3. Iyenger, N.G.R. Structural Stability of Columns & Plates. Ellis Horwood Ltd, Publisher

4. Irving Shames, Advanced Solid Mechanics,

5. Popov and Balan, Mechanics of Solids

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Advance Structural Analysis**	**MTSE--1003**	**3L-1T-0P**	**4**

Course Objectives:

After studying this subject, the students will be able to:

CO1: Understand the various methods methods of analysis of determinate and indeterminate structures.

CO2: Understand the matrix concept and various matrices approach for analysis of structures.

CO3: Analyze the plane truss and continuous beams using flexibility method.

CO4: Analyze the plane truss and continuous beams using stiffness method.

CO5: Analyze the plane and space frames, grids using flexibility and stiffness method.

Syllabus:

Unit 1 Review of Basic Methods of Structural Analysis

Structural elements, joints and supports, Stability, Rigidity, Static indeterminacy, Kinematic indeterminacy, Direct and indirect loading, Equilibrium, Compatibility, Force-displacement relations; Analysis of statically determinate structures (trusses, beams, frames), Principle of virtual work, Displacement-based and force-based energy principles.

Unit 2 Matrix Concepts and Matrix Analysis of Structures

Matrix, Vector, Basic matrix operations, rank, Solution of linear simultaneous equations; eigenvalues and eigenvectors.

Introduction, Coordinate systems, Local and global coordinates, displacement and force transformation matrices, Contra-gradient principle; element and structure stiffness matrices, Element and structure flexibility matrices, Equivalent joint loads, Stiffness and flexibility approaches, Evaluation of flexibility and stiffness coefficients, Relationship between flexibility and stiffness methods.

Unit 3 Matrix Method (Flexibility/ Force Method)

Analysis of plane truss and continuous beam by flexibility methods, Energy approach in flexibility method, Effect of support displacement and transformation.

Unit 4 Matrix Method (Stiffness/ Displacement Method)

Analysis of plane truss and continuous beam, by stiffness methods, Energy approach in stiffness method, Approach for global stiffness matrix, Effect of support displacement and transformation.

Unit 5 Matrix analysis of plane and space frames, grids

Symmetrical & anti-symmetrical problems, Analysis of plane and space frames with pin joints and rigid joints and grids by flexibility and stiffness methods

Course outcomes:

On completion of this course students will be able to analyse reinforced concrete beams for strength and deformation behaviour. They will be able to test dynamic testing on steel beams, static cyclic load testing of reinforced concrete frames and non-destruction testing on concrete.

Reference Books:

1. Reddy C. S., Basic Structural Analysis, Tata Mc-Graw Hill,
2. Wearer Jr. W. and Gere J. M., Matrix Analysis of Framed Structures, CBS Publications.
3. Rajsekeran, Sankarsubramanian, Computational structural Mechanics, PHI
4. Pandit G. S. and Gupta S. P., Structural Analysis: A Matrix Approach, Tata Mc-Graw Hill Pvt. Ltd., New Delhi.
5. Jain A. K., Advanced Structural Analysis, Nem Chand Brothers.
6. Kanchi M. B., Matrix Structural Analysis, John Willey Publishers
7. Meek J. L., Matrix Methods of Structural Analysis, Mc-Graw Hill
8. Menon Devdas, Advanced Structural Analysis, Narosa Publishing House, 2009.
9. Aslam Kasmali, Matrix Analysis of Structures, Brooks/Cole Publishing Co., USA, 1999.
10. Ghali A., Neville A. M. and Brown T. G., Structural Analysis: A Unified Classical and Matrix Approach, Chapman & Hall, Sixth Edition, 2007

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Advance Designs of Concrete Structures**	**MTSE--1004**	**3L-1T-0P**	**4**

Course Objectives

After studying this subject, the students will be able to:

CO1: Design and draft detailed drawings of the multi-story buildings and shear walls

CO2: Design and draft detailed drawings of corbels, deep beams, grid floors, column supported slabs.

CO3: Design and draft detailed drawing of combined footing, Raft/Mat foundation and Pile foundation

CO4: Design and draft detailed drawings of ground supported, over-head tanks of various shapes like rectangular, circular and Intze type.

CO5: Design and draft detailed drawings of square, rectangular and circular bunkers, silos and towers subjected to wind load.

Syllabus:

Course Contents

Unit 1: Design of multistorey buildings

Design of multistorey buildings, Ductile detailing of RCC frames for seismic forces, Design of Shear walls; Design examples.

Unit 2: Design of Special R.C. Elements

Design of Corbels, Design of Deep beams, Design of Grid floors, Design of column supported slabs (with/without beams) under gravity loading; Design examples.

Unit 3: Design of Foundations

Design of Combined footing, Raft/Mat foundation and Pile foundation; Design examples.

Unit 4: Design of Structures for storage of liquids

Design of water tanks resting on ground, Underground and Over head tanks, Design of water tanks of various shapes like rectangular, circular and Intze type tanks, Details of IS 3370 (2009), Design examples.

Unit 5: Design of Silos, Bunkers and Towers

Design of square and rectangular bunkers, Design of circular bunkers, Design of Silos;

Design examples.

Design of Towers - Computation of moments due to wind loads, Wind load analysis of a tower with circular group of columns; Design examples.

Course outcomes:

On completion of this course the students will have the confidence to design various concrete structures and structural elements by limit state design and detail the same for ductility as per code requirements.

Reference Books:

1. Varghese, P.C. (2009), Advanced RCC Designs (2nd ed.)/latest edition Prentice-Hall of India Private Limited.
2. Shah and Karve (2003), Text book of Reinforced Concrete. Structures Publications.
3. Punmia, B.C., Jain, Ashok Kumar & Jain, Arun Kumar, RCC Design, Laxmi Publications.
4. N. Krishna Raju - Advanced R.C.C. Design, 2nd / latest edition, CBS Publishers New Delhi.
5. Noel Everard (1987), Theory and Problems of RCC Design, Shaum's Outline Series (2nded.)/latest edition McGraw-hill Professional.
6. Pankaj Agrawal and Manish Shrikhande, Earthquake Resistance Design of Structures, Prentice-Hall of India Private Limited New Delhi.
7. Chandrasekaran, Jai Krishna (1994), Elements of Earthquake Engineering (2nd ed.)/latest edition South Asian Publishers.

IS codes: Latest versions

1. IS: 456 (2000) Code of practice for plain and reinforced concrete, Bureau of Indian Standards, New Delhi.
2. IS: 875 (1987) Code of practice for design loads (other than earthquake) for buildings and structures, Bureau of Indian Standards, New Delhi.
3. IS: 1893 (2016) Criteria for earthquake resistant design of structures, Bureau of Indian Standards, New Delhi.
4. IS: 3370 (2009) Concrete Structures for storage of liquids, Bureau of Indian Standards, New Delhi.
5. IS: 13920 (2016) Ductile Design and Detailing of R.C.C. structures, subjected to Seismic forces, Bureau of Indian Standards, New Delhi.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Analysis of Deep Foundation**	**MTSE—1005(A)**	**3L-1T-0P**	**4**

Course Objectives

After studying this subject, the students will be able to:

CO1: Student will have a deep understand Functions and requisites of a pile foundation

CO2: Student will have a deep understand load carrying capacity of piles by static load by IS Code methods and other behaviour

CO3: Student will have a deep understand load carrying capacity of piles by static load by Pile driving formulae and other behaviour

CO4:. Student will have a deep understand load Group action in piled foundations

CO5: Student will have a deep understand Pile subjected to lateral load and behaviour.

Unit1:-Functions and requisites of a foundation - Different types - Choice of foundation type – Types of deep foundation – Types of pile foundations- Factor governing choice of type of pile –Choice of pile materials.

Unit-2

Load carrying capacity of piles by static formulae- Introduction: IS code method- API method-Piles in cohesive and cohesion less soils – Piles in layered cohesive and cohesionless soils – Settlement of single pile – Piles bearing on rock – Piles in fill and Negative skin friction.

Unit-3

Load carrying capacity of piles by static formulae: Introduction- Pile driving formulae- selection of pile hammers- Determination of temporary elastic compression- Driving stresses in piles- Field measurement- Wave equation analysis.

Unit-4

Group action in piled foundations: Introduction- Minimum spacing of piles- group efficiency-Estimation of group bearing capacity- Effect of pile arrangement- Effect on pile groups of installation methods- precaution against

heave effect in pile group-Settlement of pile group- Reduce differential settlement in pile group.

Unit-5

Pile subjected to lateral load: Introduction- Lateral resistance of single pile-IS 2911 method for lateral resistance of pile- Broms charts for lateral load analysis-Elastic analysis-p-y curves, use of p-y curves- improving lateral resistance of piles- field test on piles.

References

1. J.E. Bowles, "Foundation Analysis and Design", McGraw Hill, 1996.
2. M.J. Tomlinson, "Foundation Design and Construction", Addison Wesley, 2001.
3. M.J. Tomlinson, "Pile Design and Construction Practice", E & FN Spon, 1987.
4. Braja M. Das., "Principles of Foundation Engineering", Thomson Asia Pte , 1987,
London Ltd., Singapore, 2005, A viewpoint publication.
5. P.C. Varghese, "Foundation Engineering", Prentice-Hall of India, New Delhi, 2005.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Theory of plates and shell**	**MTSE—1005(B)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the concept of various plate analysis theories.

CO2: Analyze rectangular plates subjected to various loadings

CO3: Analyze circular plates subjected to various loadings

CO4: Understand the concept of various shell analysis theories

CO5: Analyze shells under different loads.

Course Contents

Unit 1

Introduction to Plate Theory, Assumptions made in the Poission-Kirchoff plate theory, Plate equation and behavior of thin plates in Cartesian coordinates

Unit 2

Analysis of Rectangular Plates Subjected to various loading, Navier's method of solution for simply supported plates, Leavy's method of solution for plates under different boundary conditions.

Unit 3

Analysis of Circular Plates Circular plates, governing differential equation in Polar coordinates

Unit 4

Theory of Surfaces Introduction to space curves and surfaces, shell surfaces and characteristics, classifications of shells.

Unit 5

Introduction to Shell Theory Basic concepts of the theory, equilibrium equations in curvilinear coordinates, force displacement relations, Membrane analysis of shells of revolution and cylindrical shells under different loads.

Reference Books

1. J. N. Reddy: Theory and Analysis of Elastic Plates and Shells: CRC Press
2. H. Kraus: Thin Elastic Shells: John Wiley and Sons
3. S. Timoshenko and W. Krieger: Theory of plates and shells: Mc – Graw Hill
4. J. N. Reddy: Mechanics of Laminated Composite Plates and Shells: CRC Press
5. A. C. Ugural: Stresses in Plates and Shells: Mc Graw Hill
6. K. Chandrashekhara: Theory of Plates: Universities Press

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Computer Aided Analysis and Design**	**MTSE—1005(c)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the various programming languages.

CO2: Understand the computer graphics concepts.

CO3: Analyze and design various buildings using CAD.

CO4: Analyze and design concrete and steel structures.

CO5: Analyze and design of foundations and retaining structures.

Course Contents

Unit: 1. Programming Languages :-Overview of programming languages FORTRAN-77/C++.

Unit: 2. Computer Graphics

Introduction and applications point plotting and line generation, Computer Graphics Co-ordination Systems. X-D windowing and clippling.

Unit: 3. Computer Aided Design

CAD in building design and planning,

Unit: 4 Construction Management, design and detailing of concrete and steel structures.

Unit: 5 Computer Aided Analysis and Design of foundations and retaining structures: Design of shallow foundations; Pile Foundations, Retaining Walls.

Reference Books

1. Lafore, Robert. (2006) Object oriented programming in CPP. Galgotia Publications Pvt. Ltd.

2. Balaguruswamy, E.(2011) Programming in C(5th ed.). Tata McGraw Hill Education Private Limited

3. Syal & Gupta. Computer programming and engineering analysis

4. AutoCAD, SolidEdge, Cadlab software and Manuals

5. Krishnamurthy, C.S. & Rajeev, S. & Rajaraman, A. Computer Aided Design Software and Analytical tools, (2nd ed.). Narosa Publishing House New Delhi.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Rock Mechanics and Foundation Engineering**	**MTSE—1005(D)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the classification and failure criteria of rocks and rock masses

CO2: Estimate the strength and deformability of rock mass.

CO3: Evaluate the rock and rock masses using FEM approach

CO4: Understand the seismic consideration and stress measurement in rocks.

CO5: Estimate foundation capacity of rock mass and design a suitable foundation

Course Contents

Unit 1:

Classification of Rocks and Rock masses, Laboratory and in - situ testing of rock, insitu stresses and their measurement, Analysis and design of underground openings, Failure criteria for rock and rock masses.

Unit 2:

Strength and deformability of jointed rock mass, Stability of rock slopes, Methods to improve Rock mass properties, Rock reinforcement.

Unit 3:

FEM Approach, Numerical modeling of rocks and rock masses, Stability of rock slopes.

Unit 4:

Seismic considerations, Measurement of stress and stress in rocks, rock fracturing in compression, stress distribution in rocks

Unit 5:

Foundations on Rock: Shallow foundations, Pile and well foundations, Basement excavation, Foundation construction, Allowable bearing pressure. Tunnels: Rock stresses and deformation around tunnels, Rock support interaction, Tunnel driving methods, Design of tunnel lining

Reference Books

1. Central Board of Irrigation and Power - Manual on Rock Mechanics, 1988.

2. Billings, Structural Geology, PHI

3. E Hock, J Bray, Rock slope engineering

4. T Schebotarioti, Soil Mechanics, T MH

5. W Dunham, Foundations of structure clearance, TMH

6. Oberti and Duvalk, Rock mechanics on the design of structures in rock W. L. John Wiley.

7. Miller, Rock mechanics

8. R. E. Goodman, Introduction to Rock Mechanics, John Wiley & Sons, New York.

9. T. Ramamurthy Engineering in Rocks for Slopes, Foundation and Tunnels, Prentice Hall India Pvt. Ltd.

10. Jaeger, Cook and Zimmerman, Fundamentals of Rock Mechanics, Blackwell Publishing.

11. L. Obert and Wilbur I. Duvall, Rock mechanics and the design of structures in rock, John Wiley & Sons, Inc.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Course Code:

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	SWAYAM/NPTEL-MOOC-1	MTSE—1005(E)/Code as per SWAYAM/NPTEL-MOOC-1	**3L-1T-0P**	**4**

Guideline

SWAYAM/NPTEL-MOOC-1 courses is a programme initiated by Government of India and designed to achieve the three cardinal principles of education via, access, equity and quality. The objective of this effort is to take the best teaching resources to all, including the most disadvantaged SWAYAM seeks to bridge divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

Courses delivered through SWAYAM/NPTEL-MOOC courses are available free of cost to the learners, however learns wanting SWAYAM/NPTEL-MOOC courses Certificate should register for the final proctoral exams that come at a fee and attend in-person at designated center on specified dates.

In perspective of the need to create synergist between the salient features of 'anytime anywhere format of e-learning and traditional classrooms chalk and talk method to develop a unique content delivery mechanism which is responsive to learners' needs and ensuring seamless transfer of knowledge across geographical boundaries. RKDF University proposes to incorporate MOOC courses delivered by SWAYAM/NEPTEL portal. Student can opt any courses from SWAYAM/NPTEL-MOOC courses as an elective Base on following condition

1. He/She has consulted and inform to the departmental coordinator regarding courses selection and mark obtain to him. No Subjected should be repeat from courses which is offer and courses which are selected.

2. He/She can opt from only courses which are not available from University.

3. Only enrollement in the courses and learning from it is free as this is a project supported by MHRD GOI.

4. To get Certificate from SWAYAM-NPTEL. The learner has to separately register and appear for a proctored exam at a fee as decided by host institution/Mooc of Rs. 1000/- Which be bearded by Student only.

5. If student successful appear in exam and obtain certificated of courses of 12 week course to earn 3 credits(As recommended by NPTEL) to suffice for required credit for the award of his/her degree.

6. The NPTEL recommended that an additional 1 credit may be awarded given by University. This credited can be given based on attendances, assignment and tuitorial work submitted by the students.

7. All students would be motived to take courses online with SWAYAM/NPTEL every semester to better prepared for the future so that they can cultivate the habilt of self-study online. The University propose to implement MOOC courses under Department. The University also made provision if student unable to get certificate He/She still be able to appear in the department elective courses and complete there degree

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Lab – I, Advance Concrete Lab**	**MTSE—1006**	**0L-0T-6P**	**6**

Lab – I, Advance Concrete Lab

Course Outcomes

After studying this subject, the students will be able to:

CO1: Perform the various laboratory tests on cement, fine aggregates, coarse aggregates and reinforcement steel bars.

CO2: Perform the various laboratory tests on fresh and hardened concrete.

CO3: Mix Design of concrete and various special concretes.

List of Experiments:

Laboratory work shall be based on the topics of Advanced Concrete and as per the facility available in the institution.

1. To study and perform the important physical tests on various types of cement.
2. To study and perform the important physical tests on fine aggregates.
3. To study and perform the important physical tests on coarse aggregates.
4. To study and perform the physical tests on reinforcement steel bars.
5. To study and perform the various tests on fresh and hardened concrete.
6. To carry out the mix design of concrete as per IS 10262:2019 or latest version.
7. To carry out the mix design of special concretes such as:

- High strength concrete (HSC) (such as M40, M50 and so on)
- Self compacting concrete (SCC)
- Pumpable concrete
- Mass concrete
- OPC with fly ash
- OPC with GGBS
- OPC with industrial or agricultural wastes

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – I**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Lab – II, CAD Lab**	**MTSE—1007**	**0L-0T-6P**	**6**

Lab – II, **CAD Lab**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the various features of software dealing with analysis and design of structures

CO2: Analyze and design the various structures using structural software's.

Introduction and important features of software dealing with analysis and design of structures.

The following structures has to be performed using various analysis and design software's or any open source software's as per the facility available in the institution.

1. Analysis and design of various types of beams subjected to different loadings.
2. Analysis and design of slabs
3. Analysis and design of plane frames with different support conditions.
4. Analysis and design of multi-storey frames

3 Introduction to various softwares for structural analysis and design i.e.;

STAAD Pro, ANSYS, ETABS etc.

4 To analyse the various type of trusses using structural analysis software (Staad-Pro) and verify the results by theoretical methods

5 To analyse the different type of beams using structural analysis software (Staad-Pro) and verify the results by theoretical methods

6 To analyse the portal frame using structural analysis software (Staad-Pro) and verify the results by theoretical methods

7 Analyse of RCC building frame (regular plan configuration) for gravity load combination using structural analysis software (Staad-Pro)

8 Analyse of RCC building frame (regular plan configuration) for various load combination using structural analysis software (Staad-Pro)

9 to 12 Analysis and design of beam and other components

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2**)

Course Content & Grade

Course Code:

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Structural Dynamics**	**MTSE-2001**	**3L-1T-0P**	**4**

After studying this subject, the students will be able to:
CO1: Understand the concept of free and forced vibrations.
CO2: Analyze the Single degree of freedom Systems.
CO3: Analyze the Multi degree of freedom Systems.
CO4: Evaluate the responses by numerical methods.
CO5: Analyze various continuous systems.

Course Contents:

Unit 1: Free and Forced vibrations

Introduction to Structural Dynamics, Time Dependent Problems, Degrees of Freedom, Simple Harmonic Motion, Structural Vibration, Damping, Equations of Motion and Natural Frequency, Modelling of SDOF Structures, D'Alemberts principles, Undamped and damped Free Vibration Response, Logarithmic Decrement, Undamped and damped harmonic and periodic excitation.

Unit 2: Single degree of freedom Systems

Resonant Frequency & Half Power Band Width, Force Transmission and Vibration Isolation, Vibration Measuring Instruments, Equivalent viscous damping, Duhamel's integral, Response to arbitrary and Impulse excitations, Fourier series, Frequency response function, Energy methods, Rayleigh's method.

Unit 3: Multi degree of freedom Systems

Matrix formulation, stiffness and flexibility influence coefficients, eigen value problem, normal modes and their properties. Matrix iteration technique for eigen value, and eigen vectors, Free and forced vibration by modal analysis, orthogonality of modes, Modal Superposition Method.

Unit 4: Numerical Methods and Response Spectrum

Numerical Methods, Methods Based on Interpolation of Excitation, Central Difference Method, Newmark's Method, Response Spectrum concept and characteristics, Special Cases of Response Spectrum, Development of Tripartite Plot.

Unit 5: Continuous Systems

Equations of Motion (for String, Bar, Beam), Axial vibration of bar, Vibration of beams, dynamic matrices for flexural, axial and torsional effects, approximate methods of Rayleigh-Ritz, Galerkin etc.

Reference Books

1. A. K. Chopra, Dynamics of Structures: Theory and Applications to Earthquake Engineering, Prentice Hall of India
2. R. W. Clough, J. Penzien, Dynamics of Structures, McGraw-Hill
3. J. L. Humar, Dynamics of Structures, CRC Press
4. L. Meirovitch, Elements of Vibration Analysis, McGraw-Hill.
5. M. Paz, Structural Dynamics, CBS Publ. New Delhi.
6. S. Timoshenko., Advanced Dynamics, McGraw Hill Book Co, NY.

Course outcomes:

- After completion of the course the students will have the knowledge of vibration analysis of systems/structures with different degrees of freedom and they know the method of damping the systems.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**FEM in Structural Engineering**	**MTSE-2002**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the concept of finite element method in structural engineering.

CO2: Understand the properties and formulation of various finite elements.

CO3: Analyze the various structural members such as springs, truss/bars, beams, plane, grid and space frames

CO4: Analyze the two-dimensional, three-dimensional and axisymmetric finite elements.

CO5: Analyze of plates, elastic stability, dynamic numerical using FEM.

Course Contents

Unit 1: Introduction to Finite Element Method

Introduction, Basic concepts of finite element analysis, Introduction to elasticity, Virtual work, Variational principle, Galerkin method, Basic finite element concepts, Basic ideas in a finite element solution, General finite element solution procedure, Stiffness matrix and Boundary conditions.

Unit 2: Element Properties

Natural coordinates, Interpolation Polynomials, their selection and derivation in terms of global and local in Cartesian and natural coordinate systems, Convergence requirements, Assembly of Element matrices, Isoparametric Formulation, Lagrange and Hermite interpolation functions, Numerical Integration

Unit 3: General Procedure of Finite Element Method

Stiffness of spring, Analysis of spring, Stiffness of Truss/bar Members, Analysis of Truss, Stiffness of Beam Members, Finite Element Analysis of Continuous Beam, Plane Frame Analysis, Analysis of Grid and Space Frame.

Unit 4: FEM for Two and Three Dimensional Solids

Two Dimensional Solids: Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements - Numerical Evaluation of Element Stiffness -Computation of Stresses, Geometric Nonlinearity and Static Condensation

Axisymmetric Element: Finite Element Formulation of Axisymmetric Element Finite Element Formulation for 3 Dimensional Elements, Examples

Unit 5: Applications of FEM

Plate Bending Problems, Finite Elements for Elastic Stability, Dynamic Analysis, Examples

Reference Books

1. Reddy J. N., An Introduction to Finite Element Method, McGraw-Hill, Intl. Student Edition, 1985.
2. Zienkiewics, The finite element method, Basic formulation and linear problems, Vol.1, 4th Edition, McGraw-Hill, Book Co., 1987
3. Rao S. S, The Finite Element Method in Engineering, Pergaman Press, 2003.
4. Desai C.S. and. Abel J.F, Introduction to the Finite Element Method, Affiliated East West Press, 1972.
5. Cook R. D., Concepts and Applications of Finite Element Analysis, Wiley and Sons, 1989.
6. Buchanan, Finite element Analysis (Schaum Outline S), TMH
7. Chandrupatla T. R., and Belegundu A. D., Introduction to Finite Element in Engineering, Third Edition, Prentice Hall, India, 2007.
8. Krishnamoorthy C. S., Finite Element Analysis Theory and Programming, Tata McGraw Hill Education, 1994

9. Hutton D. V., Fundamentals of Finite Element Analysis, Tata McGraw Hill Publishing Company Limited, New Delhi, 2005

10. Logan D. L., A First Course in Finite Element Method, Cengage Learning, 2012.

11. Bhavikatti S. S, Finite Element Analysis, New Age International Publishers, 2007.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Design of Earthquake Resistant Structures**	**MTSE-2003**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the concepts of Engineering Seismology.

CO2: Understand the concepts Response Spectrum.

CO3: Analyze and design various earthquake resistant members.

CO4: Design earthquake resistant structures for ductile detailing.

CO5: Understand the concept of various seismic control devices.

Course Contents

Unit 1: Engineering Seismology

Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, Earthquake measurement parameters, Characteristics of earthquake and its quantification- Magnitude and Intensity scales, Seismic instruments. Seismic zoning map of India.

Unit 2: Response Spectrum

Response history and strong motion characteristics. Response Spectrum- elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storeyed buildings - using procedures as per codal provisions.

Unit 3: Aseismic Structural Modelling

Structural configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings, Design as per relevant codal provisions, Effect of infill masonry walls on frames, modeling concepts of infill masonry walls. Behavior of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls,

Unit 4 Design of Structure for Earthquake Resistance

Seismic design philosophy, Load combinations, Ductility and energy absorption in buildings. confinement of concrete for ductility, design of columns and beams for ductility, Codal provisions for ductile detailing, Lateral load resisting structural systems.

Unit 5: Seismic Control of Structures

Introduction, concept and types of seismic control systems as active, passive and semi-active systems. Requirements of efficient earthquake resistant structural system, damping devices, base isolation systems. Retrofitting of structures.

Reference Books

1. Chopra Anil Kumar, Dynamics of Structures - Theory and Application to Earthquake Engineering, Pearson Education.
2. Hosur Vinod, Earthquake Resistant Design of Building Structures, Wiley (India).
3. Duggal, S. K., Earthquake Resistant Design of Structures, Oxford University Press.
4. Agarwal Pankaj, Shrikande Manish, Earthquake resistant design of structures, Prentice Hall of India, New Delhi India.
5. Pauley & Priestly, Seismic design of reinforced concrete and masonry buildings, John Wiley & Sons.
6. Stratta.J. L, Manual of Seismic Design, Prentice-Hall India Pvt Ltd.
7. Kramer.S. L., Geotechnical Earthquake Engineering, Prentice-Hall India Pvt Ltd.

8. IS 1893 (Part 1): latest version, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part 1 General Provisions and Buildings, Bureau of Indian Standards, New Delhi.

9. IS 13920 (2016) latest version, Ductility Design and Detailing of RC Structures subjected to Seismic Forces, Bureau of Indian Standards, New Delhi.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2)**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Non Destructive Testing of Materials**	**MTSE-2004**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand and apply laboratory tests for characteristics of various engineering materials.

CO2: Understand and apply the concept of determining the strength of concrete using various non-destructive tests.

CO3: Understand and apply the concept of determining the durability of concrete using various non-destructive tests.

CO4: Understand the concept of various chemical tests

CO5: Understand the concept of various other specialized non-destructive tests.

Course Contents

Unit 1: Engineering Materials

Types, Characteristics and laboratory tests for quality assessment.

Unit 2: Strength tests for Concrete

Rebound hammer, Ultrasonic Pulse Velocity method, CAPO test- Equipment and operation, theory, procedure and interpretation of results, Applications and limitations.

Unit-3: Durability tests for Concrete

Tests for Water absorption and Permeability - Water Permeation Test; Test for Corrosion of reinforcement - Cover meter, Half Cell potentiometer, Resistivity meter and Direct measurement of Corrosion rate, Infrared Thermography.

Unit 4: Chemical Tests

Carbonation test using Phenolphthalein or Rainbow Indicator, Chloride test for chloride determination, X-ray diffraction test - Equipment principle, procedure and interpretation of results.

Unit 5: Other Specialized Tests

Radiographic, Holographic, Eddy current, Microwave and Oscilloscope techniques of NDT.

Reference Books: Latest editions

1. J.F. Hinslay, Non Destructive Testing, MacDonald and Events 1959
2. H.B. Egerton, Non Destructive Testing, Oxford University Press, 1965
3. Krautkramer , Ultrasonic Testing of Materials, Springer Verlag,1969
4. M.A. Novgoresky, Testing of Building Materials and Structures, Mir Pub. 1973
5. American Society of Metals: Handbook, Vol-II Destructive Inspection and Quality Control , 1976
6. J. Prasad C G Krisnadas Nair, Non-Destructive Testing & Evaluation of Materials by, 2 nd / latest edition , Mc Graw Hill Education (India) Pvt. Ltd. New Delhi, 2011.

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Advanced Construction Materials and Concrete Technology**	**MTSE-2005(A)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the properties and uses of various construction materials.

CO2: Understand the concept of concrete technology.

CO3: Understand the various concepts related to permeability and durability of concrete.

CO4: Understand the application of various special concretes used in construction.

CO5: Understand the concept of smart materials.

Course Contents

Unit 1: Construction Materials

Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications, Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications, Masonry blocks using industrial wastes, Construction and demolition wastes

Unit 2: Concrete Technology

Review of types of cements, chemical composition; properties and tests, chemical and physical process of hydration, Review of types of aggregates; sampling and testing; effects on properties of concrete, production of artificial aggregates, Production of concrete, Properties of fresh concrete Chemical and mineral admixtures, Properties of hardened concrete, , Mix Design, Non-destructive Testing of Concrete

Unit 3: Permeability and Durability of Concrete

Concepts of permeability and durability of concrete, factors affecting, reinforcement corrosion, fire resistance, frost damage, sulfate attack, alkali silica reaction, concrete in sea water, statistical quality control, acceptance criteria as per BIS code. Special methods of concreting and curing, Hot weather and cold weather concreting, Guniting (Shotcreting).

Unit 4: Special Concrete

Special concrete such as high strength, Lightweight, heavy weight, vacuum processed concrete, Mass concrete, high performance concrete, Pumpable concrete, Self-Compacting concrete, Air entrained concrete, Ferro cement, fiber reinforced concrete, Polymer impregnated concrete, Jet concrete. Recycling & re-use of industrial waste materials. Deterioration and repair technology of concrete, Distress and type of repairs, crack sealing techniques

Unit 5: Smart Materials

Concept and types, **s**ensing technology-Types of sensors - physical measurement using piezoelectric strain measurement, Piezoelectric and Electrostrictive Material - Magneto structure Material, Shape Memory Alloys, Electro rheological Fluids

Reference Books

1. A.M Neville, Properties of Concrete, Pearson Education Asia (P) Ltd, England, 2000.
2. M. L. Gambhir, Concrete Technology, Tata McGraw Hill 3. Concrete Technology,
3. M.S. Shetty, Concrete Technology, S. Chand & Company New Delhi 5.
4. P.K.Mehta and P.J.M.Monteiro, Concrete Microstructure Properties and Materials, Third Edition, Tata McGraw Hill, 2006.
5. Short & Kenniburg, Light Weight Concrete, Asia Publishing House, Bombay
6. J.Newman and B.S. Choo, Advanced Concrete Technology - Testing and Quality, Elsevier, 2003.
7. S.K. Duggal Building Materials, New Age International Publications 2006.
8. L.R Bruntley Building Materials Technology Structural Performance & Environmental Impact

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2)**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Blast Resistant Design of Structures**	**MTSE-2005(B)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the various concepts of blast loading.

CO2: Understand the characteristics of blast and effect on structures

CO3: Evaluate the elastic and elasto-plastic SDOF systems

CO4: Understand the various high strain rates materials.

CO5: Design of structure for blast loading, structural response to blast loading

Course Contents

Unit 1:

Introduction to Blast Loading, Blast Wind, Clearance Time, Decay Parameter, Drag Force, Ductility Ratio, Dynamic Pressure, Equivalent Bare Charge, Ground Zero, Impulse, Mach Number, Overpressure, Reflected Overpressure, Shock Wave Front, Side-on Overpressure Transit Time, Yield. Classification of explosives, types of threats, explosive air blast loading, blast wave scaling laws, prediction of blast pressure, Loading effects due to blasts

Unit 2:

General Characteristics of Blast and Effects on structures, Blast force, Blast load on above and below ground structures, Response of structural elements, Time period of structural members.

Unit 3:

Elastic SDOF systems, elasto-plastic SDOF system,

Unit 4:

Materials behavior at high strain rates Dynamic properties of concrete and reinforcing steel under high strain rates

Unit 5:

Design Stresses for Steel and Reinforced Concrete, Load combinations, Design of structure for blast loading, structural response to blast loading, Architectural and structural aspect of blast resistant building design

Reference Books

1. Dowding, C. H. (1985). Blast vibration monitoring and control (Vol. 297). Englewood Cliffs: Prentice-Hall.

2. Smith P.D., Hetherington J.G. Blast and ballistic loading of structures. Butterworth Heinemann.

3. David Cormie, Geoff Mays and Peter Smith, Blast Effects on Buildings, ICE Publishing

4. IS 4991-1993, Criteria for blast resistant design of structures for explosions above ground, Bureau of Indian Standards, New Delhi.

5. BK Raghu Prasad, Structural Dynamics in Earthquake and Blast Resistant Design, CRC Press.

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2)**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Instrumentation and Experimental Techniques**	**MTSE-2005(C)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Perform force and strain measurement by selecting appropriate tools and technique.

CO2: Apply the concept of types of transducers

CO3: Understand the concept of photoelasticity.

CO4: Apply various Moire Fringe technique.

CO5: Apply model analysis as an effective experimental technique.

Course Contents

Unit 1:

Generalized measurement systems, calibration and sensitivity. Standards of measurements of various quantities. Detectors: Sensor system elements, transducer and devices, Different types of sensors, Modifying and transmitting method. Mechanical, Hydraulic, Electrical and Electronic System.

Unit 2:

Construction details of temperature transducers, vibration and shock measurement. Vibration pick-ups, Force and Load transducers, Velocity transducers, Torque transducers, Pressure measurements and pressure transducers.

Unit 3:

Photoelasticity: Basic optics and polariscope Photoelastic effect: Stress-optic relations, Isoclinics. Isochromatics, Calibration of model, Separation techniques. Fractional Fringe order determination, Analysis of photoelastic data. Introduction to 3D Photoelasticity, Stress Freezing techniques, Slicing Technique and Scattered light photo elasticity.

Unit 4:

Moiré Fringe Technique: Moiré phenomenon, Analysis of Moiré fringes. Measurement of strain, displacement, rotations and slope for in plane and out of plane problems.

Unit 5:

Model Analysis: Different types of model, Laws of structural similitude and non-dimensional analysis, Buckingham Pi theorem, Predictions for prototype, size effect, Applications. Accuracy and reliability of structured models.

Reference Books

1. Dalley .J.W and Riley. W. F, Experimental Stress Analysis, McGraw Hill Book Company, N.Y.
2. Ganesan. T. P, Model Analysis of Structures, University Press, India.
3. Ravisankar. K. and Chellappan. A., Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures, SERC, Chennai, 2007.
4. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi.
5. Sirohi.R.S., Radhakrishna. H.C, Mechanical Measurements, New Age International (P) Ltd.
6. Srinath.L.S, Raghavan.M.R, Ingaiah.K, Gargesha.G, Pant.B and Ramachandra.K, Experimental Stress Analysis, Tata McGraw Hill Company, New Delhi.

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2**)

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Research Methodology and IPR**	**MTSE-2005(D)**	**3L-1T-0P**	**4**

Course Objectives: The course has been developed with orientation towards research related activities and recognizing the ensuing knowledge as property. It will create consciousness for Intellectual Property Rights and its constituents. Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

Syllabus Contents:

Unit 1:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

Unit 2:

Effective literature studies approaches, analysis Plagiarism, Research ethics. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge, Case Studies.

Unit 3:

Effective technical writing, how to write report, Developing a Research Proposal, Format of research proposal, presentation and assessment by a review committee.

Unit 4:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Course Outcomes:

At the end of the course, students will demonstrate their ability to:

1. Understanding and formulation of research problem.
2. Analyze research related information.
3. Understand plagiarism and follow research ethics

4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2)**

Course Content & Grade

Course Code:

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	SWAYAM/NPTEL-MOOC-II	MTSE—2005(E)/Code as per SWAYAM/NPTEL-MOOC-2	**3L-1T-0P**	**4**

Guideline

SWAYAM/NPTEL-MOOC-1 courses is a programme initiated by Government of India and designed to achieve the three cardinal principles of education via, access, equity and quality. The objective of this effort is to take the best teaching resources to all, including the most disadvantaged SWAYAM seeks to bridge divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

Courses delivered through SWAYAM/NPTEL-MOOC courses are available free of cost to the learners, however learns wanting SWAYAM/NPTEL-MOOC courses Certificate should register for the final proctoral exams that come at a fee and attend in-person at designated center on specified dates.

In perspective of the need to create synergist between the salient features of 'anytime anywhere format of e-learning and traditional classrooms chalk and talk method to develop a unique content delivery mechanism which is responsive to learners' needs and ensuring seamless transfer of knowledge across geographical boundaries. RKDF University proposes to incorporate MOOC courses delivered by SWAYAM/NEPTEL portal. Student can opt any courses from SWAYAM/NPTEL-MOOC courses as an elective Base on following condition

1. He/She has consulted and inform to the departmental coordinator regarding courses selection and mark obtain to him. No Subjected should be repeat from courses which is offer and courses which are selected.

2. He/She can opt from only courses which are not available from University.

3. Only enrollement in the courses and learning from it is free as this is a project supported by MHRD GOI.

4. To get Certificate from SWAYAM-NPTEL. The learner has to separately register and appear for a proctored exam at a fee as decided by host institution/Mooc of Rs. 1000/- Which be bearded by Student only.

5. If student successful appear in exam and obtain certificated of courses of 12 week course to earn 3 credits(As recommended by NPTEL) to suffice for required credit for the award of his/her degree.

6. The NPTEL recommended that an additional 1 credit may be awarded given by University. This credited can be given based on attendances, assignment and tuitorial work submitted by the students.

7. All students would be motived to take courses online with SWAYAM/NPTEL every semester to better prepared for the future so that they can cultivate the habilt of self-study online. The University propose to implement MOOC courses under Department. The University also made provision if student unable to get certificate He/She still be able to appear in the department elective courses and complete there degree

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2)**

Course Content & Grade

Course Code: 6TMST-204

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**LAB-III :-NDT-LAB**	**MTSE-2005**	**3L-1T-0P**	**4**

Course Code: 6TMST-205

Course Outcomes

After studying this subject, the students will be able to:

CO1: Perform the various non-destructive tests on concrete.

List of Experiments:

Laboratory work shall be based on the topics of Non-destructive testing and as per the facility available in the institution.

1. To find compressive strength of concrete using Schmidt Rebound Hammer.
2. To calibrate Rebound Hammer.
3. To check the quality of concrete in the structures using Ultrasonic Pulse Velocity meter.
4. To measure the depth of cover in RCC structures using cover meter.
5. To detect corrosion in reinforcement by Half Cell Potentiometer.
6. To determine the permeability of cement mortar andconcrete in RCC structures.
7. To find rate of corrosion in reinforcement in RCC structures.
8. To find compressive strength of concrete using CAPO test.
9. To perform various destructive tests on concrete specimen.
10. To perform chloride test on RCC structures.
11. To perform carbonation test on RCC structures.

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M.TECH **(Structure Engineering)**

First YEAR (**Semester – 2)**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Lab-IV Advanced Structural Engg. lab**	**MTSE-2006**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the various features of software dealing with analysis and design of structures

CO2: Understand the various features of software dealing with FEM

CO3: Analyze and design the various structures using structural software's.

Introduction and important features of software dealing with analysis and design of structures and Finite element method.

The following structures has to be performed using various analysis and design software's or any open source software's as per the facility available in the institution.

1. Analysis and design of retaining wall.
2. Analysis and design of various types of bridges
3. Analysis and design of various structures using FEM.

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M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Course Code:

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Advances FEM and Programming**	**MTSE-3001(A)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Analyze the various structural members using plate, shell and hybrid elements.

CO2: Analyze dynamic problems and vibration of bars, beams and plate elements using FEM

CO3: Analyze the buckling of struts and plate elements using FEM.

CO4: Analyze shear walls, core walls, bridges and cooling towers using FEM.

CO5: Understand the computational aspects and interpretation of results of FEM and also compare with other methods.

Course Contents

Unit 1

Iso-parametric formulation for plate and shell elements; various types of elements; Hybrid elements.

Unit 2

FEM in dynamic problems, consistent mass matrix; Vibration of bars, beams and plate elements.

Unit 3

FEM in buckling problems, geometric matrix, buckling of struts and plate elements.

Unit 4

Structural modeling by FEM for structures such as shear walls, core walls, bridges and cooling towers.

Unit 5

Computational aspects; interpretation of results; comparison with other methods.

Reference Books

1. Weaver, Johnson, Finite element and structural analysis
2. H. C Martin, Matrix structural analysis
3. C.F. Abel, C.S. Desai, Finite element methods, CBS Publishers New Delhi
4. Buchanan, Finite element Analysis (Schaum Outline S), Tata McGraw Hill
5. Krishnamurthy, Finite element analysis, Tata McGraw Hill
6. Zinkiewicz, O.C. and Taylor, R.L., The Finite Element Method, McGraw-Hill
7. Reddy, J. N., An Introduction to Finite Element Method, McGraw-Hill, Singapore

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M.TECH (Structure Engineering)

Second Year (Semester – 3)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Design of Steel Structure**	**MTSE-3001(B)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the concept of Limit state method in design of steel structures.

CO2: Analyze and design the various types of columns.

CO3: Analyze and design the laterally restrained beams

CO4: Analyze and design beam columns.

CO5: Analyze and design beams subjected to torsion and bending

Course Contents

Unit 1: Introduction to Limit States

Introduction, Standardization, allowable stress design, limit state design, partial safety factors, concept of section, classification; Plastic, compact semi-compact & slender.

Unit 2: Columns

Basic concepts, strength curve for an ideal strut, strength of column members in practice effect of eccentricity of applied loading. Effect of residual stresses, concept of effective lengths, no sway columns, torsional and torsion flexural buckling of columns, Robertson's de sign curve, modification to Robertson approach, design of columns using Robertson approach.

Unit 3: Laterally Restrained Beams

Flexural & shear behavior, web buckling & web crippling, effect of local buckling in laterally restrained plastic and compact beams, combined bending & shear, unsymmetric al bending.

Unrestrained Beams: Similarity of column buckling of beams, lateral torsional buckling of symmetric section, factors affecting lateral stability, buckling of real beams, design of cantilever beams, continuous beams.

Unit 4: Beams Columns

Short & long beam columns, effects of slenderness ratio and axial force on modes of failure, beam column under biaxial bending, strength of beam columns, local section failure & overall member failure.

Unit 5: Beams subjected to Torsion and Bending

Introduction, pure torsion and warping, combined bending torsion, capacity check, buckling check, design methods for lateral torsional buckling.

Reference Books

1. Morsis L.J. Plum, D.R., Structural Steel Work Design, Nichols Pub Co.

2. B. S. Krishnamachar and D. Ajitha Sinha, Design of steel structures Tata McGraw Hill Publishing Co. Delhi.

3. Yu, W.W., Cold Formed Steel Structures Design, John Wiley & Sons; 4th edition, 2010.

4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2013.

5. Narayanan R.et.al., Teaching Resource on Structural Steel Design, INSDAG, Ministry of Steel Publications, 2002

6. Duggal S. K., Limit State Design of Steel Structures, Tata McGraw Hill Publishing Company, Third edition, 2019.

7. Bhavikatti S. S, Design of Steel Structures by Limit State Method as per IS:800-2007, IK International Publishing House Pvt. Ltd., 2009

8. Shah V. L. and Veena Gore, Limit State Design of Steel Structures, IS 800-2007, Structures Publications, 2009.

9. IS 800: latest version, General Construction in Steel - Code of Practice, Bureau of Indian Standards, New Delhi.

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M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Design of Tall Structure**	**MTSE-3001(C)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the lading and design principles for tall structures.

CO2: Understand the behavior of various structural systems

CO3: Analyze and design tall structures using various methods.

CO4: Understand the various structural elements

CO5: Analyze and design various other tall structures such as chimney, TV towers etc.

Course Contents

Unit 1 Loading and Design Principles

Loading- sequential loading, Gravity loading, Wind loading, Earthquake loading, Gust Factor and Karman Vortices. Approximate and Regorlons Methods of analysis for wind and Earthquake Forces, combination of loading, Static and Dynamic approach, Analytical and wind tunnel experimental methods, Design philosophy, Working stress method, Limit state method and Plastic design.

Unit 2 Behavior of Various Structural Systems

Factors affecting growth, Height and structural form, High rise behaviour, Rigid frames, braced frames, Infilled frames, Shear walls, Coupled shear walls, Wall-frames, Tubulars, cores, Outrigger-braced and hybrid mega systems.

Unit 3 Analysis and Design

Modeling for approximate analysis, Accurate analysis and reduction techniques, Analysis of buildings as total structural system considering overall integrity and major subsystem interaction, Analysis for member forces, drift and twist, Computerized three dimensional analysis, Assumptions in 3D analysis, Simplified 2D analysis.

Unit 4 Structural Elements

Sectional shapes, Properties and resisting capacity, Design, Deflection, Cracking, Prestressing, Shear flow, Design for differential movement, Creep and shrinkage Effects, temperature and fire resistance, Ductility and reinforcement details at joint.

Unit 5 Other Tall Structures

Criteria for design of Chimneys, T.V. Towers and other Tall Structures, Case studies.

Reference Books

1. Bryan Stafford Smith and Alexcoull, Tall Building Structures - Analysis and Design, John Wiley and Sons, Inc., 2005.

2. Taranath B.S., Structural Analysis and Design of Tall Buildings, McGraw Hill, 2011.

3. Wolfgang Schueller, High Rise Building Structures, John Wiley and Sons, New York 1977.

4. Beedle.L.S., Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1986.

5. Lin T. Y, Stotes Burry. D, Structural Concepts and systems for Architects and Engineers, John Wiley, 1988.

6. IS 875 (Part 1): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 1 Dead Loads - Unit Weights of Building Materials and Stored Materials, Bureau of Indian Standards, New Delhi.

7. IS 875 (Part 2): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 2 Imposed Loads, Bureau of Indian Standards, New Delhi.

8. IS 875 (Part 3): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 3 Wind Loads, Bureau of Indian Standards, New Delhi.

9. IS 875 (Part 4): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 4 Snow Loads, Bureau of Indian Standards, New Delhi.

10. IS 875 (Part 5): latest version, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures Part 5 Special Loads and Combinations, Bureau of Indian Standards, New Delhi.

11. IS 1893 (Part 1): latest version, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part 1 General Provisions and Buildings, Bureau of Indian Standards, New Delhi.

12. IS 4998-1 (1992): Criteria for design of reinforced concrete chimneys, Part 1: Assessment of loads, Bureau of Indian Standards, New Delhi.

13. IS 6533-2 (1989): Code of practice for design and construction of steel chimneys, Part 2: Structural aspects, Bureau of Indian Standards, New Delhi.

14. IS 11504 (1985): Criteria for structural design of reinforced concrete natural draught cooling towers, Bureau of Indian Standards, New Delhi.

15. IS 13920 (2016): Ductility Design and Detailing of RC Structures subjected to Seismic Forces, Bureau of Indian Standards, New Delhi.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year **(Semester – 3)**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Stability Theory in Structural Engineering**	**MTSE-3001(D)**	**3L-1T-0P**	**4**

Course Outcomes

After studying this subject, the students will be able to:

CO1: Understand the concept of stability theory.

CO2: Analyze torsional buckling problems.

CO3: Analyze lateral instability of beams.

CO4: Analyze the buckling of plates.

CO5: Analyze the stability problems using energy and matrix methods

UNIT 1

Concepts of Stability, Euler Buckling Load, Critical Load of Laced, Battened and Tapped columns, Inelastic Buckling of column.

UNIT 2

Torsional Buckling, Torsional Flexural Buckling.

UNIT 3

Lateral Instability of Beams, Beam Columns.

UNIT 4

Local Buckling and post buckling behaviour of plates.

UNIT 5

Application of Energy method and matrix method in stability problems.

Reference Books

1. Timoshenko, S. P. & Gere, James M. Theory of Elastic Stability (2nd. ed.). McGraw –Hill International Editions, Mechanical Engineering Series.
2. Iyenger, N.G.R. Structural Stability of Columns & Plates. Ellis Horwood Ltd, Publisher.
3. Principles of Structural Stability Theory by Alexander Chajes, Waveland Pr Inc

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Course Code:

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	SWAYAM/NPTEL-MOOC-1	MTSE—3001(E)/Code as per SWAYAM/NPTEL-MOOC-3	**3L-1T-0P**	**4**

Guideline

SWAYAM/NPTEL-MOOC-1 courses is a programme initiated by Government of India and designed to achieve the three cardinal principles of education via, access, equity and quality. The objective of this effort is to take the best teaching resources to all, including the most disadvantaged SWAYAM seeks to bridge divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

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In perspective of the need to create synergist between the salient features of 'anytime anywhere format of e-learning and traditional classrooms chalk and talk method to develop a unique content delivery mechanism which is responsive to learners' needs and ensuring seamless transfer of knowledge across geographical boundaries. RKDF University proposes to incorporate MOOC courses delivered by SWAYAM/NEPTEL portal. Student can opt any courses from SWAYAM/NPTEL-MOOC courses as an elective Base on following condition

1. He/She has consulted and inform to the departmental coordinator regarding courses selection and mark obtain to him. No Subjected should be repeat from courses which is offer and courses which are selected.

2. He/She can opt from only courses which are not available from University.

3. Only enrollement in the courses and learning from it is free as this is a project supported by MHRD GOI.

4. To get Certificate from SWAYAM-NPTEL. The learner has to separately register and appear for a proctored exam at a fee as decided by host institution/Mooc of Rs. 1000/- Which be bearded by Student only.

5. If student successful appear in exam and obtain certificated of courses of 12 week course to earn 3 credits(As recommended by NPTEL) to suffice for required credit for the award of his/her degree.

6. The NPTEL recommended that an additional 1 credit may be awarded given by University. This credited can be given based on attendances, assignment and tuitorial work submitted by the students.

7. All students would be motived to take courses online with SWAYAM/NPTEL every semester to better prepared for the future so that they can cultivate the habilt of self-study online. The University propose to implement MOOC courses under Department. The University also made provision if student unable to get certificate He/She still be able to appear in the department elective courses and complete there degree

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Design of Prestressed Concrete Structures**	**MTSE—3002(A)**	**3L-1T-0P**	**4**

Course Objective

After studying this subject, the students will be able to:

CO1: Understand the concept of prestressed concrete and various types of losses in prestress.

CO2: Analyze and design prestressed concrete sections.

CO3: Analyze and design prestressed concrete members for shear and torsion.

CO4: Analyze and design prestressed concrete beams.

CO5: Analyze and design of special prestressed concrete structures.

Course Contents

Unit 1: Introduction, Prestressing Systems and Material Properties

Introduction, Types of Prestressing, Pre-tensioning and Post-tensioning Systems, Concrete and steel in prestressed members, Pressure line or Thrust line, Concept of load balancing, stresses in Tendons, cracking moment, types of losses in prestressed concrete.

Unit 2: Analysis and design of prestressed concrete sections

Analysis and design of Members under Axial load, Analyses at Transfer and at Service, Analysis and design of Members under Flexural loads for various types of sections, Calculation of Deflection, Calculation of Crack Width, Cracking moment, Kern points, Analysis and design of Members under compression and bending, Detailing Requirements as per relevant codal provisions.

Unit 3: Analysis and design for shear and torsion

Analysis and Design for Shear, Types of Cracks, Stress in Uncracked and uncracked Beam, Analysis and Design for Torsion, Stresses in an Uncracked Beam, Pure Torsion. Transfer of Prestress, End zone reinforcement, anchorage zone reinforcement, Detailing requirements as per relevant codal provisions.

Unit 4: Analysis and design of beams

Limit state design philosophy, design loads and strengths, serviceability criteria, Design of pretensioned, post-tensioned and Partially prestressed beams, Effects of prestressing indeterminate structures, Concordant Tendon Profile, Guyon's theorem, Design of continuous prestressed concrete beams.

Unit 5: Special topics

Composite Sections, One-way Slabs, Two-way Slabs, Circular Prestressing: Prestressed Concrete Pipes, Liquid Storage Tanks, Ring Beams, Design of special structures Poles, Piles, Railway sleepers, etc.

Reference Books

1. Y. Guyen, Prestressed concrete (Vol. I and II), John Willey & Sons
2. N. Krishnaraju, Prestressed concrete, Tata McGraw-Hill
3. T. Y. Lin and N. H. Burns, Design of Prestressed concrete structures, John Willey & Sons
4. S. K. Mallik and A. P. Gupta, Prestressed concrete, Oxford & IBH
5. IS 1343: latest version, Prestressed Concrete - Code of Practice, Bureau of Indian Standards, New Delhi.
6. IS: 3370 (Part 3) latest version Code of practice for concrete structures for storage of liquids - Prestressed Concrete Structures, Bureau of Indian Standards, New Delhi.

The ME students are required to undergo three weeks industrial training during summer vacation of 1st year ME in any Industry/Research Organization /Laboratory/ Engineering Organization/Government Training Institutes/Public Sector undertaking / Academic Institutions of repute. They may also attend Industry/ Job Oriented Courses / Online courses. The students are required to submit a detailed training report and certificate. Evaluation will be done in III semester and is based on report, presentation and subsequent viva voce.

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R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year **(Semester – 3)**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Foundation Engineering**	**MTSE—3002(B)**	**3L-1T-0P**	**4**

Courses Outcomes

CO1:-To determine the selection of foundation and sub-soil exploration on various types of soil CO2:-To determine various methods of analysis the bearing capacity of shallow foundation.

CO3:-To determine the selection and mechanics of pile foundation.

CO4:-To determine the important of foundations on problematic soil & Introduction to Geosynthetics.

CO5:-To determine the lateral earth pressure on the retaining wall.

Courses Content

UNIT 1.

Selection of foundation and Sub-soil exploration/investigation: Types of foundation, Factors affecting the selection of type of foundations, Steps in choosing types of foundation based on soil condition. Objectives and planning of exploration program, methods of exploration-wash boring and rotary drilling-depth of boring, Soil samples and soil samplers-representative and undisturbed sampling, Field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods, Bore log, report writing.

UNIT 2.

Shallow Foundation: Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Rankine, Terzaghi, Skempton, Meyerhof), Bearing capacity determination using IS Code. Settlement, components of settlement & its estimation, permissible settlement, Proportioning of footing for equal settlement, allowable bearing pressure. Bearing capacity from in-situ tests (SPT, SCPT, PLATE LOAD), Factors affecting bearing capacity, Contact pressure under rigid and flexible footings. Floating foundation.

UNIT 3.

Pile foundations: Introduction, Load transfer mechanism, Types of piles and their function, Factors influencing selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, Piles subjected to vertical loads- pile load carrying capacity from static formula, dynamic formulae (ENR and Hiley), Pile load test, Pile group: carrying capacity, efficiency and settlement. Negative skin friction.

UNIT 4.

Foundations on problematic soil & Introduction to Geosynthetics: Significant characteristics of expansive and collapsible soils, footing on such soils, Problems and preventive measures. Underreamed pile foundation-its concept, design & field installation. Introduction to geosynthetics-materials, types, functions and uses.

UNIT 5.

LATERAL EARTH PRESSURE: Active, Passive and Earth pressure at rest. Rankine's theory of earth pressure, Earth pressures in layered soils, Coulomb's earth pressure theory, Culmann's graphical method.

RETAININGWALLS: Types of retaining walls- stability of retaining walls against overturning, sliding, bearing capacity and drainage from backfill. Reinforced earth retaining walls.

Reference Book:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers DistributionLtd.,NewDelhi.2014.
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi,7thEdition,2017(Reprint).
3. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition 2017.
4. Joseph E bowles, "Foundation Analysis and design", McGraw Hill Education, 5th Edition, 28th August 2015.
5. Shamsher Prakash et al, "Analysis, Design of foundations and Retaining Structures" Sarita Prakashan.
6. Murthy, V.N.S., "Advanced Foundation Engineering", CBS Publishers and Distributors
7. Coduto D.P., Foundation design; principles and practices, Pearson Publication

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year **(Semester – 3)**

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Bridge Engineering**	**MTSE—3002(C)**	**3L-1T-0P**	**4**

Courses outcome

CO1:- Student will be developing the requirement of various types of bridge super structures such as R.C and steel bridge.

CO2:- Student will be able to analysis & design of R.C. Bridge. It is include various examples

CO3:- Student will be able to analysis & design of Steel Bridge. It is including various examples.

CO4:-Student will be able to analysis & designs of Pier, Abutment and Wing Walls of Bridge,

CO5:-Student will be able to analysis & designs of Foundation and Bearings of Bridge,.

Courses content

UNIT 1: Types of Bridge Super Structures

Introduction and types, temporary bridge superstructures, military bridges, other temporary bridges, permanent bridges, R.C.C. bridges, Pre-stressed concrete bridges, steel bridges, movable steel bridge. Consideration of loads and stresses in road bridges: Introduction, loads, forces and stress, dead loads, bridge loading as per relevant IRC and IRS specifications traffic lanes, foot way, kerbs, railing and parapet loading, impact, wind load, longitudinal forces, Temperature effect of live load on back fill and on the abutment.

UNIT 2: Design of R.C. Bridge

Slab culvert, pipe culvert, T-beam, box culvert bridge super structure, Courbon's theory for load distribution, balanced cantilever bridges, design examples.

UNIT 3: Design of Steel Bridges

Types of steel superstructure, plate girder bridge, truss bridge, wind forces of lattice girder bridge, bracings, arch and bowstring girder bridge, design example.

UNIT 4: Pier, Abutment and Wing Walls

Types of piers and abutments, stability analysis of piers and abutments, design of piers, Forces on piers, stability, abutment, bridge code provision for abutments, wing walls, design examples.

UNIT 5: Foundations and Bearings

Types of bridge foundations and general design criteria, shallow foundations, deep foundations, piles, wells and pneumatic caissons, river training works.

Bearings: functions and types of bearings, necessity of bearings, design of elastomeric bearings, expansion joints, necessity and types of expansion joints, design considerations.

References Books:

1. Victor, D.J., Essential of Bridge Engineering , Oxford & IBH Publishing Co., New Delhi.
2. Rowe, R.E., Concrete Bridge Design , C.R. Books Ltd., London
3. Krishna Raju N, Design of Bridges, Oxford & IBH Publishing Co., New Delhi.
4. Bakht. B and Jaeger, L.C., Bridge Analysis Simplified, McGraw Hill Book Co. Inc.
5. Ponnuswamy, S., Bridge Engineering, Tata McGraw Hill, New Delhi.
6. Bakht, B. and Jaeger, L.G., Bridge Deck Analysis Simplified, McGraw Hill International Edition, Singapore
7. Aswani M.G., Vazirani V.N. and Ratwani M.M., Design of Concrete Bridges,

Khannapublishers, New Delhi.
8. Hambly E.C., Bridge Deck Behaviour.
9. Sastry V.V., Design of Bridges, Dhanpat Rai & Co
10. Raina V.K., Concrete Bridge Design and Practice, Tata McGraw Hill, New Delhi.
11. Jagadeesh .T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013
12. Indian Standard Codes and IRC codes related to bridges

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**RETROFITTING AND REHABILITATION OF STRUCTURES**	**MTSE—3002(D)**	**3L-1T-0P**	**4**

CO1:-apply the various methods of repair, retrofitting and rehabilitation techniques for masonry and concrete structures.
CO2:-evaluate the existing condition of infrastructure, the materials for repair and retrofitting, the maintenance and strengthening techniques .
CO3:-evaluate suitable technique and materials for Seismic retrofitting and design of retrofitted structural components.
CO4:-apply efficient retrofitting and rehabilitation in order to extend the durability of existing structure in a sustainable manner

Unit-1

Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.

Unit-2:-Damage Assessment:

Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems

Unit-3:-Influence on Serviceability and Durability

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

Unit -4:-Maintenance and Retrofitting Techniques

Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building

Unit-5:- Materials for Repair and Retrofitting

Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Course outcomes:

After studying this course, students will be able to:

1. Understand the cause of deterioration of concrete structures.

2. Able to assess the damage for different type of structures

3. Summarize the principles of repair and rehabilitation of structures

4. Recognize ideal material for different repair and retrofitting technique

REFERENCE BOOK:

1) Testing of Concrete in Structure by Bungey (Surrey University Press)
2) Non Destructive Testing by Malhotra & Carino (CRC Press)
3) Corrosion of Steel in Concrete by Broomfield John P. (Taylor & Francis)
4) Concrete Technology, by Neville, A. M. and Brooks, J. J., Prentice Hall
5)Concrete Durability, by Thomas Dyer, CRC Press, Taylor & Francis Group
6) Handbook on Non Destrucive Testing of Concrete; Edited by Malhotra, V. M. and Carino, N. J., CRC Press
7)Composites for Construction, by L. C. Bank, John Wiley & Sons, Inc.
8) ACI 440.2R-08. Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures, American Concrete Institute

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Course Code:

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	SWAYAM/NPTEL-MOOC-IV	MTSE—3002(E)/Code as per SWAYAM/NPTEL-MOOC-4	**3L-1T-0P**	**4**

Guideline

SWAYAM/NPTEL-MOOC-IV courses is a programme initiated by Government of India and designed to achieve the three cardinal principles of education via, access, equity and quality. The objective of this effort is to take the best teaching resources to all, including the most disadvantaged SWAYAM seeks to bridge divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

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2. He/She can opt from only courses which are not available from University.

3. Only enrollement in the courses and learning from it is free as this is a project supported by MHRD GOI.

4. To get Certificate from SWAYAM-NPTEL. The learner has to separately register and appear for a proctored exam at a fee as decided by host institution/Mooc of Rs. 1000/- Which be bearded by Student only.

5. If student successful appear in exam and obtain certificated of courses of 12 week course to earn 3 credits(As recommended by NPTEL) to suffice for required credit for the award of his/her degree.

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7. All students would be motived to take courses online with SWAYAM/NPTEL every semester to better prepared for the future so that they can cultivate the habilt of self-study online. The University propose to implement MOOC courses under Department. The University also made provision if student unable to get certificate He/She still be able to appear in the department elective courses and complete there degree

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Seminar**	**MTSE-3003**	**0L-0T-4P**	**4**

Students have to give a seminar both in written and oral formats based on the following:

- Recent advancement in the field of Civil Engineering practice and research.
- Scope of further technological advancement in various fields of Civil Engineering.
- Various new techniques, field problems and innovative ideas
- Any other relevant topics

R.K.D.F. UNIVERSITY, BHOPAL

M.TECH **(Structure Engineering)**

Second Year (**Semester – 3**)

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credits
M.TECH (Structure Engineering)	**Dissertation-1**	**MTSE-3004**	**0L-0T-8P**	**8**

- Identify structural engineering problems reviewing available literature.
- Identify appropriate techniques to analyze complex structural systems.
- Apply engineering and management principles through efficient handling of project

Ram Krishna Dharmarth Foundation University, Bhopal

(NAAC A+ Grade University)

M.Tech (Structure Engineering)

Semester – IV

Course Content & Grade

Branch	Subject Title	Subject Code	Contact Hours per Week	Total Credit
M.TECH (Structure Engineering)	Dissertation Part- II	MTSE-4001	0L-0T-2P	2

Course Outcomes: After studying this course, students will be able to,

CO1- The programme of instruction will consist of advanced subjects of the respective specialization. The complete programme is distributed over four semesters with two semesters per academic year. Course work is offered in the first two semesters (except for PG programme in Civil engineering where it is extended up to third semester) and the dissertation work will be carried out during third and fourth semesters. Every branch of M.E/ M. Tech programme will have a curriculum and syllabi for the courses recommended by the board of studies and approved by the academic council. The academic programmes of the Institute follow the credit system.

CO2- Every candidate shall be required to submit the record of dissertation work at the end of fourth semester.

Course Content

The objective of Dissertation Part-I is to promote a systematic understanding of the knowledge, critical awareness of current problems, originality in the application of knowledge and the quality of work. The ideal work may be characterized by a new result in design, development and implementation. It should have the potential of industrial/scientific acceptance. Dissertation Part-II should be seen in continuation with Dissertation Part-I. The researcher should continue the research work in the two parts.