SEMESTER I		
NUMERICAL METHODS AND OPTIMIZATION TECHNIQUES (Theory and Practice)		
Course Code: MVJCSE101		**CIE Marks: 50**
Credits: L: T: P: 3:2:0		**SEE Marks: 50**
Hours: 40L + 20P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Formulate Linear programming for obtaining solution for real world problems	
2	Learn Non-linear, geometric and dynamic programming techniques for civil engineering problems.	
3	Analyze the civil engineering data and characterize with regression equations and test its efficacy.	
4	Understand the techniques of numerical methods for solving differential equations and their applications.	
5	Understand project management technique for use in real civil engineering projects	
Module-1		
Introduction to optimization techniques: Nature and characteristics of operation research. **Introduction to Linear programming:** Graphical solution, solution by simplex and revised simplex technique.		8 Hrs
Module-2		
Non-Linear Programming: one dimensional minimization methods, elimination methods, Fibonacci method; Dynamic programming- Introduction, Approaches, **Application and case studies:** Geometric programming methods- Introduction, Approaches, conversion of NLP as a sequence of LP.		8 Hrs
Module-3		
Statistical inferences: Methods of least square and regression, multiple regression. **Concept of probability:** Random Variables, Binomial, Poisson and Normal distribution, applications, Chi- squared test and Analysis of Variance.		8 Hrs
Module-4		
Numerical Solutions: Solution of Ordinary differential equations: Euler's method, and Rangakutta 3rd and 4th order method, Taylor's series method Solutions for **Integral Equations:** Trapezoidal rule, Simpson's 1/3rd and 3/8th rule, and Weddle's Rule.		8 Hrs
Module-5		
Numerical solution of Partial Differential Equations: Introduction, Finite difference approximations to derivatives, Explicit methods- Numerical Solution of Laplace Equation, Numerical solution of one- dimensional heat equation by Bender - Schmidt's method and by Crank-Nicholson Method, Implicit method-Numerical solution of one-dimensional wave equation		8 Hrs
Sl. No	**Programs**	
1	Linear programming by graphical solution	
2	Statistical inferences	

3	Methods of least square
4	Multiple regression
5	Concept of probability : Random Variables
6	Binomial distribution
7	Poisson distribution
8	Normal distribution
9	Chi- squared test
10	Analysis of Variance
11	Solution of Ordinary differential equations
12	Solutions for Integral Equations

Reference Books	
1.	S.D. Sharma, "Operations Research (Theory Methods & Applications)", 20th ed., Kedar Nath Ram Nath Publications, Meerut, UP, 2014.
2.	M K Jain, S.R.K Iyengar, R K. Jain, "Numerical methods for Scientific and Engg. Computation", 4th ed., New Age International, New Delhi, 20012.
3.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
4.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
5.	Johnson, R.A. and Bhattacharya, G.K. Statistics-Principles and Methods, 4th ed., John Wiley and Sons, New York, 2001.
6.	Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", 4thed., TataMcGraw-Hill Publishing Company, New Delhi, 2006.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks

and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE)

Total marks: 50+50-100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level

Laboratory-50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

SEMESTER I	
MECHANICS OF DEFORMABLE BODIES (Theory)	
Course Code: MVJCSE102	**CIE Marks: 50**
Credits: L: T: P: 3:0:0	**SEE Marks: 50**
Hours: 40L	**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to	
1	Make students to learn principles of Analysis of Stress and Strain
2	Predict the stress-strain behaviour of continuum
3	Evaluate the stress and strain parameters and their inter relations of the continuum
4	Develop the Propagation of waves in solid media
5	Apply the nonlinear stress strain relationship of concrete for design

Module-1	
Theory of Elasticity: Introduction: Definition of stress and strain and strain at a point, components of stress and strain at appoint of Cartesian and polar coordinates, Octahedral stresses, Constitutive relations, equilibrium equations, compatibility equations and boundary conditions in 2-D and 3-D cases, Generalized Hooke's law.	8 Hrs
Module-2	
Transformation of stress and strain at a point, Principal stresses and principal strains, invariants of stress and strain, hydrostatic and deviatric stress, spherical and deviatric strains maximum shear strain.	8 Hrs
Module-3	
Plane stress and plane strain: Airy's stress function approach to 2-0 problems of elasticity, simple problems of bending of beams. Solution of axisymmetric problems, stress concentration due to the presence of a circular hole in plates.	8 Hrs
Module-4	
Elementary problems of elasticity in three dimensions, stretching of 8Hrs a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy, Propagation of waves in solid media. Applications of finite difference equations inelasticity.	8 Hrs
Module-5	
Theory of Plasticity: One-dimensional elastic-plastic relations, isotropic and kinematic hardening, yield function, flow rule, hardening rule, incremental stress-strain relationship, governing equations of elasto- plasticity, Yield and failure criteria-Stress strain relations for perfect elasto-plastic materials-Von Mises, Tresca and Mohr-Coulon-b stress functions-simple elastic plastic problem-Expansion of a thick walled cylinder - incremental stress-strain relationship. Implementation of plasticity in metals and concrete - principles only - metals - plastic stress strain matrix for metals- nonlinear stress strain relation in concrete.	

Reference Books	
1.	Timoshenko &Goodier, "Theory of Elasticity", 3rd Edition, McGrawl-fill, 2017.
2.	Sadhu Singh, "Theory of Elasticity", 2nd Edition, Khanna Publishers, 2015
3.	Varghese P.C., "Advanced Reinforced Concrete Design", II Ed. , Prentice-Hall of India, New Delhi, 2005.
4.	Verma P.D.S, "Theory of Elasticity", Vikas Publishing Pvt. Ltd, 2nd Edition, 2012.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER I	
STRUCTURAL DYNAMICS AND EARTQUAKE ENGINEERING (Theory)	
Course Code: MVJCSE103	**CIE Marks: 50**
Credits: L: T: P: 3:0:0	**SEE Marks: 50**
Hours: 40L	**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to

1	Learn principles of Structural Dynamics
2	Implement these principles through different methods and to apply the same for free and forced vibration of structures
3	Evaluate the dynamic characteristics of the structures
4	Learn principles of engineering seismology..
5	Interpret the codal provisions as per IS: 1893 (part 1): 2002 and apply it to the design of RC structures

Module-1	
Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, Basic Definition vibration of SDOF (Single Degree of Freedom) Systems , Damped, UnDamped, Free Vibrations equivalent Viscous damping, Logarithmic decrement. Mathematical models of Single-degree-of-freedom systems.	8 Hrs
Module-2	
Dynamics of Single -Degree-of-Freedom Systems (SDOF): Dynamic equations of equilibrium, Mathematical models of Single-degree-of-freedom systems system, Free vibration and forced vibration response of damped and undamped systems. Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility.	8 Hrs
Module-3	
Dynamics of Multi -Degree-of-Freedom Systems (MDOF): Mathematical models of multi-degree-of- freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems - Natural frequencies and mode shapes — Orthogonality property of modes. Response of Shear buildings for harmonic loading without damping using normal mode approach. Response of Shear buildings for forced vibration for harmonic loading with damping using normal mode approach.	8 Hrs
Module-4	
Earthquake Resistant Analysis and Design of Structures : Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modelling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings - codal provisions.	8 Hrs
Module-5	
Seismic response control concepts - Seismic demand, seismic capacity, Overview of linear and nonlinear procedures of seismic analysis, Static Push over analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures.	8 Hrs

Reference Books	
1.	Mukhopadhaya M , "structural dynamics Vibrations", 2nd Edition , Oxford IBH, 2014.
2.	Mario Paz "Structural Dynamics", 5th Edition , CBS publishers, 2004
3.	Vinod Hosur, “Earthquake Resistant Design of Building Structures”, 3rd Edition , WILEY (india), 2016.
4	Duggal, “Earthquake Resistant Design of Structures”, 5th Edition 2017, Oxford University Press,.
5.	Pankaj Agarwal, Manish Shrikande, “Earthquake resistant design of structures” - - 4th Edition, PHI India, 2016.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester I		
ADVANCED DESIGN OF RC STRUCTURES (Theory)		
Course Code: MVJCSE104		**CIE Marks: 50**
Credits: L: T: P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Make students to learn principle of structural design	
2	Design different types of structures	
3	Detail the structures	
4	Evaluate the performance of structures	
5	Develop analytical skills in solving structural problems.	
Module-1		
Basic Design Concepts: 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.		**8 Hrs**
Module-2		
Limit Analysis of R.C. Structures: 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.		**8 Hrs**
Module-3		
Design of Flat slabs: 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.		**8 Hrs**
Module-4		
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.		**8 Hrs**
Module-5		
Design of Elevated Intz type of Water Tank, Design of silos and bunkers.		**8 Hrs**

Reference Books	
1.	Park A and Paulay, "Reinforced and Prestressed Concrete", lst Edition, John Wiley Er sons, 2010.
2.	Kong K F and Evans T H, "Reinforced and Prestressed Concrete", 3rd Edition ,CRC Press, 2013.
3.	Varghese P.C., "Advanced Reinforced Concrete Design II Ed", 2nd Edition, Prentice-Hall of India, New Delhi, 2005.
4.	Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, "Comprehensive RCC Design", 10th Edition , Laxmi Publications, 2015.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER I		
REPAIR AND REHABILITATION OF STRUCTURES (Theory)		
Course Code: MVJCSE105		**CIE Marks: 50**
Credits: L: T: P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Investigate the cause of deterioration of concrete structures.	
2	To strategize different repair and rehabilitation of structures.	
3	To evaluate the performance of the materials for repair	
Module-1		
General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods Er analysis, preliminary investigations, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods, Quality assurance for concrete construction, as built concrete properties strength, permeability, thermal properties and cracking		8 Hrs
Module-2		
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.		8 Hrs
Module-3		
Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance, Preventive measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration, testing techniques		8 Hrs
Module-4		
Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibe reinforced concrete. Techniques for Repair: Rust eliminators and polymer 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.		8 Hrs
Module-5		
Examples of Repair to Structures: Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies.		8 Hrs

Reference Books	
1.	Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures", 3rd Edition,2018
2.	Denison Campbell, Allen Er Harold Roper , "Concrete Structures,Materials, Maintenance and Repair", 7th Edition, Longman Scientific and Technical, 2013.
3.	R.T.Allen and S.C. Edwards , "Repair of ConcreteStructures", 9th Edition, Blakie and Sons, 2015.
4.	Raiker R.N , "Learning for failure from Deficiencies in Design, Construction and Service", 5th Edition, R&D Center (SDCPLO), 2012.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 50 marks and quiz is evaluated for 10 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three (conduct additional quizzes and take best three). The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test, quiz and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER I	
Structural Engineering Lab (Practice)	
Course Code: MVJCSE106	**CIE Marks: 50**
Credits: L: T: P: 1:0:1	**SEE Marks: 50**
Hours: 30	**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to

1	Assess the properties of fresh concrete both normal and Self compacting Concrete
2	Assess the properties of Hardened concrete both normal and Self compacting Concrete
3	Assess the structural behaviour of beams, columns and slabs
4	Determine the response of structural models using shake table

LABORATORY EXPERIMENTS

A. Assessment of Properties of Fresh Concrete

1. Slump Test
2. Vee-Bee Consistometer Test,
3. Compaction Factor Test

B. Properties of fresh SCC

4. Slump Flow
5. J-Ring,
6. L-Box
7. V-Funnel
8. U-Box Tests

C. Mechanical properties of Hardened concrete (Conventional Concrete and Self Compacting Concrete)

9. Compressive strength
10. Flexural Strength
11. Split Tensile strength
12. Modulus of Elasticity (Static and Dynamic) and Bond Strength (Demonstration)
13. NDT methods - UPV Test, Rebound Hammer Test
14. Permeability – Sorption - Diffusion, RCP, Initial Surface Absorption, Water permeability
15. Resistance to Acid, Chloride, Sulphate Attach, Shrinkage and Creep (Demonstration of Experiments)
16. Behaviors of Structural Elements – Beams in Flexure & Shear – Demonstration

Reference Books	
1.	M.S. Shetty, "Concrete Technology - Theory and Practice", 8th edition, S. Chand and Company, New Delhi, 2019.
2.	Neville A.M. "Properties of Concrete", 4th edition, Pearson Publishers, New Delhi,1995.
3.	A.R. Santha Kumar, "Concrete Technology", 2nd edition, Oxford University Press, New Delhi, 2018.

Continuous Internal Evaluation (CIE):
Laboratory-50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):
Laboratory 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester: II		
FINITE ELEMENT METHODS (Theory and Practice)		
Course Code: MVJCSE201		**CIE Marks: 50 + 50**
Credits: L:T:P: 3:0:1		**SEE Marks: 50+ 50**
Hours: 40L + 12P		**SEE Duration: 3 + 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Learn basic principles of finite element analysis procedure.	
2	Formulate and analyze truss and beam problems	
3	Apply finite element solutions to to structural problems	
4	Solve Axi-symmetric problems	

Module-1	
Basic concepts of elasticity - Kinematic and Static variables for various types of structural problems - approximate method of structural analysis - Rayleigh - Ritz method - Finite difference method - Finite element method. Variation method and minimization of Energy approach of element formulation. Principles of finite element method -advantages Er disadvantages - Finite element procedure. Finite elements used for one, two, three dimensional problems - Element aspect ratio - mesh refinement vs. higher order elements - Numbering of nodes to minimize band width.	**8 Hrs**
Module-2	
Nodal displacement parameters - Convergence criterion - Compatibility requirements - Geometric in-variance - Shape function -Polynomial form of displacement function. Generalized and Natural coordinates - Lagrangian interpolation function - shape functions for one, two and Axi-symmetric problems. three dimensional elements.	**8 Hrs**
Module-3	
Iso Parametric elements, Internal nodes and higher order elements, Serendipity and Lagrangian family of Finite Elements, Sub-parametric and Super- parametric elements, Condensation of internal nodes, Jacobean transformation Matrix. Development of strain-displacement matrix and stiffness matrix, consistent load vector.	**8 Hrs**
Module-4	
Application of Finite Element Method for the analysis of one, two dimensional problems, Analysis of simple beams and plane trusses, Application to plane stress / strain / axi symmetric problems using CST Quadrilateral Elements	**8 Hrs**
Module-5	
Application of Finite Element Method for the analysis of two dimensional and three dimensional frame elements, Techniques for Non - linear Analysis.Choice of displacement function (C0, C1 and C2 type), Techniques for Non –linear	**8 Hrs**

Analysis .	

LABORATORY EXPERIMENTS	
Conducting Static analysis of multi-storied buildings using ETABS	
1	Conducting Response spectrum analysis of multi-storied buildings using
2	Conducting Time history analysis of multi-storied buildings using ETABS.
3	Analysis of Bars using ANSYS software.
4	Analysis of Beams using ANSYS software.
5	Analysis of Trusses using ANSYS software.
6	Analysis of Simply supported beams using ANSYS software
7	Analysis of Cantilever beam using ANSYS software.

Course Outcomes: After completing the course, the students will be able to	
CO1	Achieve knowledge of design and development of problem solving skills.
CO2	Understand the principles of stress-strain behaviour of continuum
CO3	Design and develop analytical skills.
C04	Describe the state of stress in a continuum
CO5	Understand the concepts of elasticity and plasticity.

Reference Books	
1.	"Finite Element Analysis"- Krishnamoorthy C S, 2nd Edition 2015, Tata McGraw Hill.
2.	"Introduction to the Finite Element Method", Desai C and Abel J F, 1972 - East West Press Pvt. Ltd.,
3.	"Finite Element Procedures in Engineering Analysis", Bathe K J, 3rd Edition 2015- Prentice Hall.
4.	"Finite Element Analysis in Engineering Design"-Rajasekaran. S, 4th Edition 2013, Wheeler Publishing,.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks.

Laboratory- 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number

of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):
Total marks: 50+50=100
SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks
Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester: II		
ADVANCED DESIGN OF STEEL STRUCTURES (Theory)		
Course Code: MVJCSE202		**CIE Marks: 50**
Credits: L:T:P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Understand design principles and differences between hot-rolled and cold-formed steel structures.	
2	Design and detail various steel structures following relevant codes and industry standards.	
3	Apply design provisions for columns, beams, and beam-columns under different loading conditions.	
4	Design structural sections ensuring required fire resistance as per regulatory requirements.	

Module-1	
Laterally Unrestrained Beams: Lateral Buckling of Beams, Factors affecting lateral stability, IS 800 code provisions, Lateral buckling strength of Cantilever beams, continuous beams, Mono- symmetric and non- uniform beams – Design Examples. Concepts of -Shear Center, Warping, Uniform and Non-Uniform torsion.	**8 Hrs**
Module-2	
Beam-Columns in Frames: Behaviour of Short and Long Beam - Columns, Effects of Slenderness Ratio and Axial Force on Modes of Failure, Biaxial bending, Strength of Beam-Columns, Sway and Non-Sway Frames, Strength and Stability of rigid jointed frames, IS 800 code provisions- numerical examples.	**8 Hrs**
Module-3	
Steel Beams with Web Openings: Shape of the web openings, practical guide lines, and Force distribution and failure patterns, Analysis of beams with perforated thin and thick webs, Design of laterally restrained castellated beams for given sectional properties, Vierendeel girders.	**8 Hrs**
Module-4	
Cold formed steel sections: Techniques and properties, Advantages, Typical profiles, Stiffened and unstiffened elements, Local buckling effects, effective section properties, IS 801& 811 code provisions- numerical examples, beam design, column design. Cavity walls, walls with piers.	**8 Hrs**
Module-5	
Fire resistance: Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance ratings- Numerical Examples.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply principles of Structural Design to analyze and design structural elements.
CO2	Develop analytical skills to evaluate structural performance and design structural components.
CO3	Apply principles of Structural Design and detailing for safe and efficient structures.
CO4	Evaluate structural performance under various loads and conditions.
CO5	Design structural components and systems using industry-standard methods and codes.

Reference Books	
1.	"Design of Steel Structures", N. Subramanian, , 5th Edition 2019, Oxford,IBH.
2.	"Design of Steel Structures", S K Duggal, 3rd Edition 2017, McGraw Hill Education.
3.	"Design of Steel Structures", S. S. Bhavikatti, 4th Edition 2014, I K International Publishing House Pvt. Ltd
4.	IS 800: 2007, IS 811, IS 1641, 1642,1643
5.	INSDAG Teaching Resource Chapter 11 to 20

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER II		
DESIGN CONCEPTS OF SUBSTRUCTURES **(Theory)**		
Course Code: MVJCSE203		**CIE Marks: 50**
Credits: L: T: P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Understand the principles of site investigation, in-situ soil testing, and classification of foundation systems to determine appropriate foundation solutions based on soil conditions	
2	Apply concepts of soil shear strength and settlement analysis to design safe and efficient shallow foundations on various soil types, including layered and sloping grounds.	
3	Analyze the behaviour of raft and combined footings under different loading conditions, considering soil-structure interaction and applying appropriate design methods	
4	Evaluate the performance and design of deep foundations such as piles and caissons, accounting for load transfer mechanisms, group effects, and lateral load resistance	
5	Design foundations for special structures like towers and basements by considering forces, stability requirements, and specific construction techniques	
Module-1		
Introduction, Site investigation, In-situ testing of soils, Subsoil exploration, Classification of foundations systems. General requirement of foundations, Selection of foundations, Computations of Loads, Design concepts		**8 Hrs**
Module-2		
Concept of soil shear strength parameters, Settlement analysis of footings, Shallow foundations in clay, Shallow foundation in sand & C-Φ soils, Footings on layered soils and sloping ground, Design for Eccentric or Moment Loads.		**8 Hrs**
Module-3		
Types of rafts, bearing capacity & settlements of raft foundation, Rigid methods, Flexible methods, soilstructure interaction, different methods of modeling the soil. Combined footings (rectangular & trapezoidal), strap footings & wall footings, Raft – super structure interaction effects & general concepts of structural design, Basement slabs		**8 Hrs**
Module-4		
Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, Laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles.		**8Hrs**
Module-5		
Types of caissons, Analysis of well foundations, Design principles, Well construction and sinking. Foundations for tower structures: Introduction, Forces on tower foundations, Selection of foundation type, Stability and design considerations, Ring foundations –		**8 Hrs**

general concepts.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Achieve Knowledge of design and development of problem solving skills
CO2	Understand the principles of subsoil exploration
CO3	Design and develop analytical skills
CO4	Identify and evaluate the soil shear strength parameters
CO5	Understand the concepts of Settlement analysis

Reference Books	
1.	J.E. Bowles – "Foundation Analysis and Design"- McGraw-Hill Int. Editions, Fifth Ed., 1996.
2.	W.C. Teng – "Foundation Design"- Prentice Hall of India Pvt. Ltd., 1983
3.	Bureau of Indian Standards:IS-1498, IS-1892, IS-1904, IS-6403, IS-8009, IS-2950, IS-11089, IS-11233, IS-2911 and all other relevant codes
4.	Nainan P Kurian – "Design of Foundation Systems"- Narosa Publishing House, Third edition 2015
5.	Swami Saran – "Analysis & Design of Substructures"- Oxford & IBH Pub. Co. Pvt. Ltd., 1998
6.	R.B. Peck, W.E. Hanson & T.H. Thornburn – "Foundation Engineering"- Wiley Eastern Ltd.,Second Edition, 1984.

Continuous Internal Evaluation
(CIE): Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER II		
SPECIAL CONCRETE **(Theory)**		
Course Code: MVJCSE204		**CIE Marks: 50**
Credits: L:T:P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3Hrs.**
Course Learning Objectives: The students will be able to		
1	Provide a comprehensive study of the constituent materials of concrete.	
2	Learn the principles of concrete mix design, and assess the performance of special cement composite	
3	Learn the characteristics and performance of various types of cement-based concrete.	
4	Learn to characterize and predict the behavior of special concrete	
5	Give an insight to repair principles and quality control measures	
Module-1		
Constituent materials: Role of constituents, Components of modern concrete, Rheology, Mineral and Chemical admixtures and their effect on properties of concrete. Special cements: Need, Classifications, Blended cements, modified hydraulic cements, calcium aluminate cements, calcium sulphate based binders, calcium sulfo aluminate cements, shrinkage compensating (or) expansive cements, macro defect-free cements, phosphate cements, fast setting cements, their performance and prescriptive specifications, Methods of mix proportioning: IS method, ACI method and BS method.		**8Hrs**
Module-2		
Ferro cement: Materials, mechanical properties, types and methods of construction, Design of ferrocement in tension and applications. High density concrete: Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods. Self-compacting Concrete (SCC): Properties, microstructure, robustness, applications-adoption of SCC in the precast industry.		

	8Hrs
Module-3	
Other concretes of special properties: High-volume fly ash concretes, geo-polymer concrete, pervious concrete, aerated concrete, reactive powder concrete, bacterial concrete, Heat resistant and refractory concrete. Their significance, materials, general consideration strength and durability aspects. Mixture proportioning and parameters in the development of Special concreting operations: Shotcreting, Pre-placed aggregate, anti-washout concretes, concrete pumping, tremie placement for underwater applications.	**8Hrs**
Module-4	
Special Concretes: Sulfur concrete, Concrete made with waste rubber, Geo synthetics, Nano Concrete, Changes in concrete with respect to time. High strength concretes: Materials and mix proportion, properties in fresh and hardened state, applications. Mass concrete and Roller compacted concrete: Constituents, mix proportioning, properties in fresh and hardened states, applications and limitations.	**8Hrs**
Module-5	
Repair principles, materials and corrosion control measures: Patches, overlay, repair mortars, sprayed concrete, FRP wrapping, corrosion, inhibitors, surface coatings and cathodic protection, Industrial waste materials in concrete Rapid wall panels. Sustainable & durable construction, Quality control and quality assurance during production/construction.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy.
CO2	Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete for special properties.
CO3	Evaluate the effect of the environment on service life performance, properties and failure of structural concrete.
CO4	Apply the concepts, mix proportioning of special concreting operations.
CO5	Analyze the concepts of repair, sustainability and quality control.

ReferenceBooks	
1.	Santhakumar A R, "Concrete Technology"- Oxford University Press, New Delhi, 2nd Edition, April 2018.
2.	Mehta, P.K. and Monteiro, P.J.M. 'Concrete: Microstructure, Properties, and Materials" McGraw Hill Education,Edition/Year: 4th Edition, 2014
3.	Gambhir M L, "Concrete Technology: Theory and Practice", Tata McGraw Hill, Publishing Co. Ltd New Delhi, 5th edition, 2014.
4.	Krishnaraju N- "Design of concrete mixes" CBS Publishers and Distributors Pvt Ltd., Delhi, 5th edition, 2018.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may

have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester: II	
ADVANCED DESIGN OF PRE-STRESSED CONCRETE STRUCTURES (Theory)	
Course Code: MVJCSE2051	**CIE Marks: 50**
Credits: L:T:P: 3:0:0	**SEE Marks: 50**
Hours: 40L	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	Understand the general mechanical behavior and design fundamentals of pre stressed concrete member.
2	Analyze and design prestressed concrete members for deflection, crack control, and serviceability requirements.
3	Perform structural analysis and design of prestressed beams, slabs, and other members under various loading conditions.
4	Analyze transfer length, development length, and calculate different types of prestress losses accurately.

Module 1	
Losses of Pre-stress: Loss of pre-stress 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.	**8 Hrs**
Module 2	
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 provision.	**8 Hrs**
Module 3	
Deflections of Prestressed Concrete Beams: Short term deflections of uncracked members, Prediction of long-term deflections, load–deflection curve for a PSC beam, IS code requirements for maximum deflections.	**8 Hrs**
Module 4	
Transfer of Prestress in Pretensioned Members: Transmission of prestressing force by bond, Transmission length, Flexural bond stresses, IS code provisions, Anchorage zone stresses in post tensioned members, stress distribution in End	**8 Hrs**

block, Anchorage zone reinforcements.	
Module 5	
Statically Indeterminate Structures: Advantages and 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.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the losses in prestressed concrete (PSC) members due to pre-tensioning and post-tensioning.
CO2	Design PSC members for flexure and shear strength according to relevant codal provisions.
CO3	Evaluate short-term and long-term deflections in prestressed concrete structures.
CO4	Apply principles to determine transmission length, flexural bond stresses, and anchorage zone stresses in PSC members.
CO5	Analyze continuous prestressed concrete beams subjected to different loading conditions.

Reference Books	
1.	"Prestressed concrete", Krishna Raju, Tata Mc Graw Hill Book – 6th Edition 2018.Co, New Delhi,
2.	"Design of prestress concrete structures", T.Y. Lin and Burn, John Wiley, 3rd Edition 2010, New York,
3.	"Prestressed concrete", S. Ramamrutham, Dhanpat Rai & Sons, 10th Edition 2019.Delhi,
4.	"Prestressed Concrete", by N.Rajagopalan, 2nd Edition 2005, Alpha Science,.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):
Total marks: 50+50=100
SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may

have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester: II	
STABILITY OF STRUCTURES (Theory)	
Course Code: MVJCSE2052	**CIE Marks: 50**
Credits: L:T:P: 3:0:0	**SEE Marks: 50**
Hours: 40L	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	Understand the fundamental principles of structural stability and derive governing differential equations for structural elements.
2	Analyze the buckling behavior of structural elements using classical and energy-based methods.
3	Apply theoretical principles to analyze lateral buckling and torsional instability of beams and thin-walled sections.
4	Evaluate the stability of rectangular plates under in-plane loads using strain energy methods.

Module-1	
Beam – column – Differential equation. Beam column subjected to lateral concentrated load, several concentrated loads, Continuous lateral load. Application of trigonometric series, Euler's formulation using fourth order differential equation for pined – pined, fixed – fixed, fixed – free and fixed – pinned column. Imperfection factor.	**8 Hrs**
Module-2	
Buckling of frames and continuous beams. Elastic Energy method: Approximate calculation of critical loads for a cantilever. Exact critical load for hinged – hinged column using energy approach. Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation. Bars with varying cross section. Effect of shear force on critical load. Column subjected to non – conservative follower and pulsating forces.	**8 Hrs**
Module-3	
Stability analysis by finite element approach – deviation of shape function for a two nodded Bernoulli – Euler beam element (lateral and translation of) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discretised column with different boundary condition – calculation of critical loads for a discretised (two elements) column (both ends built in). Buckling of pin jointed frames (maximum of two active DOF) – symmetrical single bay portal frame. Stability analysis of truss.	**8 Hrs**
Module-4	
Lateral buckling of beams – differential equation – pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin – walled bars of open cross section. Non – uniform Torsion of thin – walled bars of open cross section.	**8 Hrs**

Module-5	
Expression for strain energy in plate bending with in plate forces (linear and non – linear). Buckling of simply supported rectangular plate – uniaxial load and biaxial load. Buckling of uniformly compressed rectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Achieve knowledge of design and development of problem solving skills.
CO2	Understand the principles of strength and stability
CO3	Design and develop analytical skills.
CO4	Appraise the Stability analysis by finite element approach.
CO5	Understand the concepts of Lateral buckling of beams

Reference Books	
1.	"Theory of Elastic Stability"-Stephen P.Timoshenko, James M Gere, 2nd Edition, McGraw – Hill, New Delhi, 8th Edition 2013.
2.	"Structural Stability: Theory and Implementation" by Chen and Lui: Covers theoretical and practical aspects of structural stability.
3.	"Stability of Structures: Principles and Applications" by Chai H. Yoo and Sung Chil Lee
4.	"Structural Stability" by Zdenek P. Bazant and Luigi Cedolin:

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):
Total marks: 50+50=100
SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER II		
NON DESTRUCTIVE TESTING FOR CIVIL ENGINEERS (Theory)		
Course Code: MVJCSE2053		**CIE Marks: 50**
Credits: L: T: P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Understand the principles and applications of various Non Destructive Testing methods	
2	Apply Non Destructive Testing methods for defect detection and evaluation	
3	Analyze and interpret Non Destructive Testing results	
4	Evaluate the suitability of Non Destructive Testing methods for specific industrial applications	
5	Demonstrate knowledge of safety protocols and industrial standards in Non Destructive Testing	
Module-1		
Overview of Non Destructive Testing, Importance of Non Destructive Testing in industries, Types of Non Destructive Testing methods, Applications and limitations		**8 Hrs**
Module-2		
Principles and techniques of Visual Testing and Liquid Penetrant Testing, Equipment and procedures, Advantages and limitations, Applications in industries		**8 Hrs**
Module-3		
Principles and techniques of Magnetic Particle Testing and Radio graphic Testing, Equipment and procedures, Safety considerations, Applications in industries		**8 Hrs**
Module-4		
Principles and techniques of Ultrasonic Testing and Acoustic Emission Testing, Equipment and procedures, Advantages and limitations, Applications in industries		**8 Hrs**
Module-5		
Electromagnetic testing (ET), Thermography testing, Leak testing, Industrial applications and case studies, Future trends in Non Destructive Testing		**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO 1	Upon completing this course, students will be able to explain the fundamental principles and applications of various Non Destructive Testing methods.
CO 2	Students will be able to select and apply appropriate Non Destructive Testing techniques for detecting defects in materials and structures.

CO 3	Students will be able to analyze and interpret Non Destructive Testing results, identifying defects and anomalies.
CO 4	Students will be able to evaluate the suitability and effectiveness of different Non Destructive Testing methods for specific industrial applications.
CO 5	Students will be able to design and implement effective Non Destructive Testing testing protocols, considering safety and industrial standards.

Reference Books	
1.	"Non-destructive Testing: Theory, Practice, and Analysis" by Hung Vu Manh and others.
2.	"Non-destructive Testing Handbook" by American Society for Nondestructive Testing (ASNT).
3.	"Introduction to Nondestructive Testing: A Training Guide" by Paul E. Mix.
4.	"Non-destructive Testing and Evaluation of Materials" by ASM International

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester: II	
STRUCTURAL HEALTH MONITORING (Theory)	
Course Code: MVJCSE2054	**CIE Marks: 50**
Credits: L:T:P: 3:0:0	**SEE Marks: 50**
Hours: 40L	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	Understand the fundamental principles and techniques used in Structural Health Monitoring (SHM).
2	Analyze and evaluate the performance of structural elements using appropriate sensing technologies.
3	Apply signal processing techniques to process SHM data and detect structural damage.
4	Evaluate the real-world application of SHM systems in infrastructure projects and interpret monitoring data for maintenance and repair decisions.

Module-1	
Introduction to Structural Health Monitoring (SHM):Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM as a part of system management, Passive and Active SHM, Non Destructive Evaluation, SHM and Non Destructive Evaluation Condition and Surveillance, basic components of SHM, materials for sensor design.	**8 Hrs**
Module-2	
Application of SHM in Civil Engineering: Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post tensioned cables, monitoring historical buildings.	**8 Hrs**
Module-3	
Sensing Technologies: Types of Sensors: Strain gauges, accelerometers, displacement, and corrosion sensors.Smart Materials: Piezoelectric sensors, fiber optic sensors.Wireless Sensor Networks: Basics of wireless communication for SHM.	**8 Hrs**
Module-4	
Damage Detection and Assessment: Damage Detection Methods: Visual inspection, Non Destructive Testing, vibration-based methods. Diagnostic Algorithms: Statistical and machine learning approaches. Health Assessment: Severity analysis and life prediction.	**8 Hrs**
Module-5	
Applications and Future Trends : Real-World Applications: SHM of bridges, buildings, and dams. Case Studies: Successful SHM projects and structural monitoring in real-time. Future Directions: AI, IoT, and autonomous SHM systems.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental concepts, principles, and significance of Structural Health Monitoring (SHM) in civil engineering.

CO2	Analyze the performance of structural elements using a range of sensing technologies and data acquisition systems.
CO3	Apply signal processing techniques and diagnostic methods to detect damage and assess the condition of structures.
CO4	Evaluate and interpret SHM data to make informed decisions about maintenance, repair, and retrofit strategies for civil infrastructure.
CO5	Gain practical experience in the application of SHM systems through real-world case studies and applications.

Reference Books	
1.	"Vibration-based Structural Health Monitoring", R. B. H. Topping and M. J. S. Brito, 1st Edition, 2019, Published by CRC Press.
2.	"Structural Health Monitoring", Daniel Balageas, Claus - Peter Fritzenam Alfredo Guemes, 5th Edition 2006Published by ISTE Ltd., U.K..
3.	"Health Monitoring of Structural Materials and Components-Methods with Applications", Douglas E Adams, 6th Edition 2007, John Wiley and Sons,.
4.	"Non-Destructive Testing of Materials and Structures", R. V. Rao, 1st Edition, 2011, Published by Tata McGraw-Hill Education Pvt. Ltd., India.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):
Total marks: 50+50=100
SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same com

plexity in terms of COs and Bloom's taxonomy level.

SEMESTER II		
DESIGN OF HIGH RISE STRUCTURES (Theory)		
Course Code: MVJCSE2061		**CIE Marks: 50**
Credits: L: T: P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Learn principles of stability of tall buildings	
2	To design the tall buildings for earthquake and wind resistance	
3	To evaluate the performance of tall structures for strength and stability	
4	To analyze and mitigate the effects of lateral loads on tall buildings	
5	To develop and implement advanced structural systems and materials that enhance the sustainability	
Module-1		
Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads		**8 Hrs**
Module-2		
Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.		**8 Hrs**
Module-3		
Behavior of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Futigger – braced and hybrid mega system. .		**8 Hrs**
Module-4		
Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces.		**8 Hrs**
Module-5		
Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation. Structural elements: sectional shapes, properties and resisting capacities, design,		**6 Hrs**

deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire.	

Course Outcomes: After completing the course, the students will be able to	
CO 1	Achieve Knowledge of design and development of problem solving skills
CO 2	Understand the principles of strength and stability
CO 3	Design and develop analytical skills.
CO 4	Summarize the behavior of various structural systems.

Reference Books	
1.	Taranath B.S, "Structural Analysis and Design of Tall Buildings"- McGraw Hill
2.	Wilf gang Schuller, "High rise building structures"- John Wiley
3.	Bryan Stafford Smith & Alexcoull, "Tall building structures Analysis and Design"- John Wiley
4.	T.Y Lin & D.Stotes Burry, "Structural concepts and system for Architects and Engineers"- John Wiley
5.	Dr. Y.P. Gupta – Editor, "Proceedings National Seminar on High Rise Structures-Design and Construction practices for middle level cities"- New Age International Limited.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER II		
RELIABILITY ANALYSIS OF STRUCTURES **(Theory)**		
Course Code:MVJCSE2062		**CIE Marks: 50**
Credits: L:T:P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3Hrs.**
Course Learning Objectives: The students will be able to		
1	To learn principles of reliability	
2	To implement the Probability Concepts for the Reliability Analysis	
3	To evaluate different methods of reliability analysis.	
4	To analyze the system reliability	
Module-1		
Preliminary Data Analysis: Graphical representationHistogram, frequency polygon, Measures of central tendency- grouped and ungrouped data, measures of dispersion, measures of asymmetry. Curve fitting and Correlation: Fitting a straight line, curve of the form y = abx, and parabola, Coefficient of correlation.		**8Hrs**
Module-2		
Probability Concepts: Random events-Sample space and events, Venn diagram and event space, Measures of probability-interpretation, probability axioms, addition rule, multiplication rule, conditional probability, probability tree diagram, statistical independence, total probability theorem and Baye's theorem.		**8Hrs**
Module-3		
Random variables: Probability mass function, probability density function, Mathematical expectation, Chebyshev's theorem. Probability distributions: Discrete distributions- Binomial and poison distributions, Continuous distributionsNormal, Log normal distributions.		**8Hrs**
Module-4		
Reliability Analysis: Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second Moment Method (Hasofer-Lind's method)		**8Hrs**
Module-5		

System reliability: Influence of correlation coefficient, redundant and non-redundant systemsseries, parallel and combined systems, Uncertainty in reliability assessments-Confidence limits, Bayesian revision of reliability. Simulation Techniques: Monte Carlo simulation- Statistical experiments, sample size and accuracy, Generation of random numbersrandom numbers with standard uniform distribution, continuous random variables, discrete random variables	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply Knowledge of design and development of problem solving skills.
CO2	Compare and evaluate the principles of reliability.
CO3	Design and develop analytical skills.
CO4	Summarize the Probability distributions.
CO5	Analyze the concept of System reliability.

ReferenceBooks	
1.	Ang, A. H. S., and Tang, W. H."Probability concepts in engineering planning and design"- Volume –I, John Wiley and sons, Inc, New York,1984.
2.	Nathabdndu, T., Kottegoda, and Renzo Rosso, Statistics, "Probability and reliability for Civil and Environmental Engineers"- Mc Graw Hill international edition, Singapore, 1998
3.	Thoft-christensen, P., and Baker, M., J, "Structural reliability theory and its applications"- Springer-Verlag, Berlin, NewYork,1982
4.	Achintya Haldar and Sankaran Mahadevan "Probability, Reliability and Statistical methods in Engineering design"- John Wiley and Sons. Inc, 2000

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester: II	
DESIGN OF PRECAST & COMPOSITE STRUCTURES (Theory)	
Course Code: MVJCSE2063	**CIE Marks: 50**
Credits: L:T:P: 3:0:0	**SEE Marks: 50**
Hours: 40L	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	Learn principles of precast materials preparation
2	Implement the Design of Precast Concepts.
3	Evaluate different methods of Analysis of precast materials.
4	Evaluate the behavior of precast columns and walls under different loading conditions.

Module-1	
Concepts, components, Structural Systems and Design of precast concrete floors: Need and types of precast construction, Modular coordination, Precast elements- Floor, Beams, Columns and walls. Structural Systems and connections. Design of precast Concrete Floors: Theoretical and Design Examples of Hollow core slabs. Precast Concrete Planks, floor with composite toppings with and without props.	**8 Hrs**
Module-2	
Design of precast reinforced and prestressed Concrete beams: Theoretical and Design Examples of ITB –Full section precast, Semi Precast, propped and un propped conditions. Design of RC Nibs.	**8 Hrs**
Module-3	
Design of precast concrete columns and walls: Design of braced and unbraced columns with corbels subjected to pattern and full loading. Design of Corbels. Design of RC walls subjected to Vertical, Horizontal loads and moments, Design of vertical ties and horizontal joints.	**8 Hrs**
Module-4	
Design of Precast Connections and Structural Integrity: Beam bearing, Socket Connection, Structural integrity, Avoidance of progressive collapse, Design of Structural Ties.	**8 Hrs**
Module-5	
Design of Steel Concrete Composite Floors and Beams Composite Floors: Profiled Sheeting with concrete topping, Design method, Bending and Shear Resistance of Composite Slabs, Serviceability Criteria, Design Example	**8 Hrs**

Composite Beams: Elastic Behavior, Ultimate Load behavior of Composite beams, Stresses and deflection in service and vibration, Design Example of Simply Supported beams.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Achieve knowledge of design and development of problem solving skills.
CO2	Understand the principles of precasted elements.
CO3	Design and develop analytical skills.
CO4	Summarize the Probability distributions
CO5	Understand the concepts of precasted elements.

Reference Books	
1.	Structural Precast Concrete Handbook, CIDB, Singapore, 7th Edition 2017.
2.	INSDAG Teaching Resource Chapter 21 to 24: www.steel-insdag.org
3.	IS 15916 (2011): Building Design and Erection Using Prefabricated Concrete -Code of Practice [CED 51: Planning, Housing and pre-fabricated construction]
4.	IS 1343-2012, IS 456-2000, IS 800-20075.
5.	IS 11384 (1985):Code of Practice for Composite Construction in Structural Steel and Concrete [CED 38: Special Structures]

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester: II	
DESIGN OF CONCRETE BRIDGES (Theory)	
Course Code: MVJCSE2064	**CIE Marks: 50**
Credits: L:T:P: 3:0:0	**SEE Marks: 50**
Hours: 40L	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	Make students to learn principles of bridge design
2	Illustrate the various loads to be considered in bridge design.
3	Design different types of bridge structures and to detail them using Limit State method of design.
4	Evaluate performance of the Bridge structure.
5.	Design and understand bridge substructures.

Module-1	
Introduction: Historical Developments, Site Selection for Bridges, Classification of Bridges Forces on Bridges. Bridge substructures: Abutments, piers and wing walls. Economic span length-Types of loading-Dead load live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.	**8 Hrs**
Module-2	
Box Culvert and Slab Culvert: Different Loading Cases IRC Class AA Tracked, Wheeled and Class A Loading, working out the worst combination of loading, Moment Distribution, Calculation of BM & SF, Structural Design of Slab Culvert, with Reinforcement Details. Specification for culverts as per MORTH Specifications for Road and Bridge Works, IRC Publication.	**8 Hrs**
Module-3	
Analysis and design of T-beam bridge: Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F, Structural design of main girder. Guidelines per MORTH Specifications for Road and Bridge Works, IRC Publication	**8 Hrs**
Module-4	
PSC Bridges: Introduction to Pre and Post Tensioning, Proportioning of Components, Analysis and Structural Design of Slab, Analysis of Main Girder using COURBON's Method for IRC Class AA tracked vehicle, Calculation of pre-stressing force, cable profile and calculation of stresses, Design of End block and detailing of main girder Guidelines per MORTH Specifications for Road and Bridge Works, IRC Publication	**8 Hrs**
Module-5	
Substructures and Balanced Cantilever Bridge: Substructures - Design of Piers and abutments, Introduction to Bridge bearings, Hinges and Expansion joints. Specification for bearings as per MORTH	**8 Hrs**

Specifications for Road and Bridge Works, IRC Publication. Balanced Cantilever Bridge: Introduction and proportioning of components, Design of simply supported portion and design of cantilever portion, design of articulation	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand and explain the historical development of bridge engineering, the various forces acting on bridges, and the criteria for selecting an ideal site for a bridge.
CO2	Apply the Limit State Method to analyze and design box and slab culverts for different loading conditions.
CO3	Analyze and design T-beam bridges using the Limit State Method of design.
CO4	Analyze and design Post-Tensioned Concrete (PSC) slab bridges and T-beam bridges using the Limit State Method of design.
CO5	Design piers and abutments for bridges and describe the proportioning of components of a balanced cantilever bridge.

Reference Books	
1	"Design of Bridges, N Krishna Raju, 5th edition, 2019.Oxford and IBH publishing company,
2	"Design of bridge structures", T R Jagadeesh and M A Jayaram, 2nd Edition, 2009, Prentice Hall of India,.
3	Design of Concrete Bridges, M.G. Aswani, V.N. Vazirani and M.M. Ratwani, 8th Edition, 2014.
4	"Essentials of Bridge Engineering", Johnson Victor. D, 6th Edition, 2019.Oxford Publishing Company,
5	IRC:6-2017 : "Standard Specifications and Code of Practice for Road Bridges".
6	IRC 21:2000 is a standard specification and code of practice for road bridges, focusing on cement concrete (plain and reinforced).

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE is executed by way of tests (T) and assignments. Test portion is evaluated for 50 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the average of all the tests are calculated for 50. The marks for the assignments are 20 (2 assignments for 10 marks each). The marks obtained in test and assignment are added to get marks out of 100 and report CIE for 50 marks

Semester End Examination (SEE):
Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper consists of five questions one from each unit for 20 marks adding up to 100 marks. Each main question may have a maximum of three subdivisions. Each unit will have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

SEMESTER II		
STRUCTURAL ENGINEERING LAB-II (LAB)		
Course Code: MVJCSEL207		**CIE Marks: 50**
Credits: L:T:P: 0:0:2		**SEE Marks: 50**
Hours: 12P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	The objective of this course is to make students to learn principles of design of experiments	
2	To investigate the performance of structural elements	
3	To evaluate the different testing methods and equipment's	

Sl. No	Modules	
1.	Static and Dynamic analysis and design of Multistory Building structures using software (ETABS / STAADPRO)	**3 Hrs**
2.	Design of RCC and Steel Tall structures using software (ETABS / STAADPRO)	**3 Hrs**
3.	Analysis of folded plates and shells using software.	**3 Hrs**
4.	Preparation of EXCEL sheets for structural design (Design of beam, Design of Slab, Design of column, Design of footing as per IS 456:2016)	**3 Hrs**

Course outcomes: On completion of the course, students would be able to	
CO1	Achieve Knowledge of design and development of programming skills.
CO2	Understand the principles of structural analysis and design
CO3	Design and develop analytical skills.
CO4	Summarize the performance of structures for static and dynamic forces

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

The laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of the marks over number of weeks is considered for 30 marks. At the end of the semester a test is conducted for 10 marks. The students are encouraged to implement additional innovative experiments in the lab and are awarded 10 marks. Total marks for the laboratory is 50.

Semester End Examination (SEE):

Total marks: 50

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.