SEMESTER I		
NUMERICAL METHODS AND OPTIMIZATION TECHNIQUES (Theory and Practice)		
Course Code: MVJCSE11		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

Course Outcomes: After completing the course, the students will be able to	
CO 1	Formulate Linear programming for obtaining solution for real world problems
CO 2	Solve Non-linear, geometric and dynamic programming problems of civil engineering.
CO 3	Analyze the data and characterize with regression equations and test its efficacy.
CO 4	Solving differential equations using numerical methods
CO 5	Solve the project management problems using CPM and PERT

Text 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.

Reference Books	
1.	Johnson, R.A. and Bhattacharya, G.K. Statistics-Principles and Methods, 4th ed., John Wiley and Sons, New York, 2001.
2.	Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", 4th ed., 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: MVJCSE12	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.	

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
CO3	Design and develop analytical skills
CO4	Describe the continuum in land 3-dimensions
CO5	Describe the continuum in land 3-dimensions

Text 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.

Reference Books	
1.	Verma P.D.S, "Theory of Elasticity", Vikas Publishing Pvt. Ltd, 2nd Edition, 2012.
2.	

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 EARTHQUAKE ENGINEERING (Theory)		
Course Code: MVJCSE13		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

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 Structural Dynamics
CO3	Summarize the Solution techniques for dynamics of Multi-degree freedom systems
CO4	Analyse earthquake characteristics and associated effects on structures, including linear responses
CO5	Understand the concepts of Seismic response control.

Text 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,.

Reference Books	
1.	Clough Er Penzi "Structural Dynamics", 2nd Edition, TMH, 2018.
2.	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: MVJCSE14		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

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 Structural Design
CO3	Design and develop analytical skills.
CO4	Summarize the principles of Structural Design and detailing
CO5	Understands the structural performance.

Text 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.

Reference Books	
1.	Varghese P.C., "Advanced Reinforced Concrete Design II Ed", 2nd Edition, Prentice-Hall of India, New Delhi, 2005.
2.	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: MVJCSE15		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 for 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, Fiber reinforced concrete. 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.		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

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 cause of deterioration of concrete structures.
CO3	Design and develop analytical skills.
CO4	Summarize the principles of repair and rehabilitation of structures
CO5	Achieve knowledge of design and development of problem solving skills.

Text 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.

Reference Books	
1.	R.T.Allen and S.C. Edwards , "Repair of ConcreteStructures", 9th Edition, Blakie and Sons, 2015.
2.	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: MVJCSEL16	CIE Marks: 50
Credits: L: T: P: 1:0:2	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

Course Outcomes: After completing the course, the students will be able to	
CO1	Assess the properties of fresh concrete both normal and Self compacting Concrete
CO2	Assess the properties of Hardened concrete both normal and Self compacting Concrete
CO3	Assess the structural behavior of beams, columns and slabs

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.