Semester: III		
Strength of Materials (Theory)		
Course Code: MVJ22CV31		**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 simple stresses, strains, and compound stresses in various structural components.
2	Understand the bending moments and shear forces in different types of beams under various loading conditions
3	Know the bending stress, shear stress, and torsional stress in beams and shafts with different cross sections
4	Understand the deflection in beams and the stability of columns under different loading conditions.
5	Understand the behaviour and strength of structural elements subjected to compound stresses and stresses in thin and thick cylinders.

UNIT-I	**L1,L2,L3**
Simple Stresses and Strains: Introduction, Properties of Materials, Stress, Strain, Hooke's law, Poisson's Ratio, Stress – Strain Diagram for structural steel, Principles of superposition, Total elongation of tapering bars of circular and rectangular cross sections. Composite section, Volumetric strain, expression for volumetric strain, Elastic constants, relationship among elastic constants. Thermal stresses and strains, Compound bars subjected to thermal stresses, state of simple shear. Video link / Additional online information: (Self Learning) • Masonry materials: https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-II	**L1,L2,L3**
Bending moment and shear force diagrams in beams: Introduction to types of beams, supports and loadings. Definition of shear force and bending moment, sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, development of Shear Force Diagram(SFD) and Bending Moment Diagram (BMD) with salient values for cantilever, simply supported and overhanging beams for point loads, UDL (Uniformly Distributed Load), UVL (Uniformly Varying Load), Couple and their combinations Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-III	**L1,L2,L3**
Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. **Torsion in Circular Shaft:** Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-IV	**L1,L2,L3,L4**
Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment- curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple. **Columns and Struts:** Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's	**8 Hrs**

theory. Rankine-Gordon's formula for columns Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	
UNIT-V	**L1,L2,L3,L4**
Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses **Thin and Thick Cylinders:** Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Evaluate the simple stresses, strains and compound stresses
CO2	Calculate the Bending moments, shear force and draw BMD, SFD for various types of beams and loadings
CO3	Analyse the bending stress, shear stress and torsional stress in beams and shafts with different cross sections
CO4	Evaluate the deflection in beams and determine the stability of the columns.
CO5	Evaluate the behaviour and strength of structural elements under the action of compound stresses and stresses in thin and thick cylinders.

Reference Books	
1.	B.C Punmia Ashok Jain, Arun Jain, "Strength of Materials", Laxmi - 2018-22 Publications, 10th Edition-2018
2.	R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
3.	S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013).
4.	Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.
5.	R.K. Rajput, "Strength of materials" S. Chand Publishing (6th Edition)
6.	S S Bhavikatti, "Strength of Materials" Vikas Publishing (5th Edition)
7.	B.S. Basavarajaiah, P. Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition,2010

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks

adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1												
CO2												
CO3												
CO4												
CO5												

Semester: III		
Engineering Survey **(Theory and Practice)**		
Course Code: MVJ22CV32		**CIE Marks: 50**
Credits: L:T:P: 3:0:2		**SEE Marks: 50**
Hours: 40L + 26P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Ability to understand principles of both traditional and modern surveying applying knowledge of mathematics.	
2	Ability to handle surveying equipment's and software tools to carry out field surveying, plot topographical Drawings and construction drawing	
3	Ability to use Total station for data capture, data storage, data transfer.	
4	Ability to prepare construction drawing and setting out	

UNIT-I	L1,L2,L3
Engineering surveying – Definition & importance of surveying for Civil Engineers. Surveying types- Control survey, Topographical surveying, Construction Survey, Cadastral survey, Hydrographic survey and Underground Survey. Surveying through the ages- Chain surveying, Compass surveying and Plane Table Surveying (concepts and limitations only). **Measurement of Distance-** Various types of tapes, Laser distance meter, Distance measuring wheel, Electronic Distance measurement, GPS. Video link / Additional online information: (Self Learning) • Masonry materials: https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-II	**L1,L2,L3**
Vertical Control- Concepts of various types of Datum – Mean Sea level, Bench marks – Temporary and Permanent. Levelling- Terms used in levelling, Setting up of Dumpy level. Differential levelling by plane of collimation method using Dumpy level. **Theodolite Surveying –** Terms used in Theodolite surveying. Setting up a Theodolite. Measurement of horizontal and vertical angles with Theodolite. **Total Station Surveying** – Features, parts, accessories and advantages of Total Station. Surveying with total station – Measurement of Horizontal angle, vertical angle, distance, slope, vertical distance, multiple angles with Total station. Using Total station for Area measurement and Volume calculation Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-III	**L1,L2,L3**
Contours - Definition, terms used, characteristics of contours and applications of contours in civil engineering practice. Contouring using level, theodolite and total station. Plotting of contours in CAD. **Longitudinal and cross sectioning –** Definition, importance of L/S & C/S.	**8 Hrs**

L/S & C/S using level, theodolite and Total station. Plotting of L/S & C/S in CAD. **Coordinate survey with Total station** - Measurement of coordinates using total station. Creating Job files, importance of back sight data, coordinate data recording. Data transferring, data refinement and plotting in CAD. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	
UNIT-IV	**L1,L2,L3,L4**
Curves –Types of Curves- Application of curves in civil engineering. Setting out of Horizontal curve by Theodolite (Rankine's method) and using Total Station. Components of Compound, Reverse curve. Transition Curve and Combined curve. Various types of vertical curves and its applications. **Areas and Volumes**- Methods of determining areas by trapezoidal and Simpsons' rule. Measurement of volume by prismoidal and trapezoidal formula. Earthwork volume calculations from spot levels and from contour maps; Earthwork calculation in Embankments. **Construction Surveying** - Setting out works using Total Station, Setting out buildings by Centre line method Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-V	**L1,L2,L3,L4**
GPS Surveying – Introduction. Overview of GPS system- space, control and user segments. Reference co- ordinate systems. Absolute and Differential positioning with GPS. Gagan system in India. Types of GPS Receivers. Engineering survey using Differential GPS. **Surveying with Drone** – Introduction, applications and advantages. Features of photogrammetric mapping method. Drone surveying requirements- Drone platform, Flight planning software, Sensor DGPS equipment and Image processing software. Types of drones and sensors. Process of drone surveying – flight planning, DGPS markers, capturing images, post processing of images using photogrammetry software and output maps. Application and uses of Remote sensing and GIS in engineering surveying. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**

Sl.NO	Experiments
1	Use of Various types of tapes, Laser distance meter, Distance measuring wheel.
2	Differential levelling by Dumpy level by plane of collimation method
3	Measurement of horizontal and vertical angles by Theodolite. Method of repetition

4	Setting out simple curve using Rankine's method using Theodolite
5	Setting out central line of a small residential building.
6	Setting up of Total station. Features and components of Total station
7	Measurement of Distance, slope, vertical distance, horizontal and vertical angles using Total station
8	Coordinate measurement with Total station
9	Longitudinal sectioning and cross sectioning using Total station
10	Contouring and plotting with Total station
11	Demonstration of Equipment's used for chain, compass and plane table surveying
12	Visit to railway station/ large construction site to understand the importance of datum and benchmark.

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize various types of surveying and carry out distance measurement using various equipment's
CO2	Illustrate the use and applications of levelling and theodolite
CO3	Plot contours, longitudinal and cross sections for construction projects.
CO4	Set curves for construction works and carry out estimation of areas and volumes.
CO5	Demonstrate the necessary skills to carry out GPS and DRONE Surveying

Reference Books	
3.	Punmia BC, & Jain Ashok Kumar. (2016). Surveying (17th ed., Vol. 1). Laxmi Publications.
4.	Dr. K.R. Arora. (2019). Surveying (17th ed., Vol. 1). Standard Book House.
3.	Charles D. Ghilani. (2012) (13 th ed.). Prentice Hall

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer

five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1												
CO2												
CO3												
CO4												
CO5												

Semester: III		
Fluid Mechanics and Hydraulics (Theory and Practice)		
Course Code: MVJ22CV33		**CIE Marks: 50**
Credits: L:T:P: 3:0:2		**SEE Marks: 50**
Hours: 40L + 26P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Understand the Fundamentals of properties of fluids, fluid pressure measurement and hydrostatic law	
2	Learn the Principles of kinematics, hydrodynamics and its applications	
3	Study the Flow measurements and design of pipes	
4	Understand the design of open channels and energy concepts	
5	Understand the Working principles of hydraulic turbines and pumps	

UNIT-I	**L2,L3**
Fluids and their properties – compressibility, surface tension, capillarity, Pascal's law, hydrostatic law, fluid pressure measurement using simple and differential manometers, Total pressure and center of pressure on vertical and inclined plane surfaces. Video link / Additional online information: (Self Learning) • Masonry materials: https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-II	**L2,L4**
Kinematics- Types of flow, continuity equation in Cartesian coordinates, velocity potential, stream function, flow nets, Dynamics-Euler's equation of motion, Bernoulli's equation, Application Venturimeter, Orifice meter, Pitot tube. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-III	**L2,L4**
Classification of orifice and mouthpiece, hydraulic coefficients, discharge over rectangular, triangular and Cipoletti notch, Flow through pipes- major and minor losses, pipes in series and parallel, equivalent pipe, concept of water hammer and surge tanks. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-IV	**L2,L4**
Open channel hydraulics- classification of flow, Most economical channel sections-rectangular, triangular, trapezoidal, circular, Uniform flow, specific energy-rectangular channels, on-uniform flow, hydraulic jump-equation and applications, GVF equation-types. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-V	**L2,L4**
Momentum equation, impact of jet on stationary and moving curved vanes Turbines-types, Pelton wheel-working proportions, velocity triangles Francis turbine- working proportions, velocity triangles Centrifugal pumps-work done, efficiency, multi-stage pumps.	**8 Hrs**

Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	

Sl.NO	Experiments
1	Verification of Bernoulli's equation
2	Calibration of Venturimeter/Orifice meter
3	Determination of hydraulic coefficients of small vertical orifice
4	Calibration of triangular notch
5	Determination of minor losses (Sudden Enlargement, Bends and Contraction Only) in pipes
6	Determination of major losses in pipes
7	Determination of Cd for ogee/broad crested weir
8	Determination of efficiency of jet on flat and curved vanes
9	Determination of Cd of Venturiflume
10	Demo of determination of efficiency of centrifugal pump
11	Demo of determination of efficiency of Francis/Kaplan turbine
12	Demo of determination of efficiency of Pelton wheel

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the fundamental properties of fluids and solve problems on fluid pressure and hydrostatics.
CO2	Apply the principles of kinematics and dynamics of fluid flow to solve problems on velocity and pressure.
CO3	Compute the discharge through pipes, notches and weirs.
CO4	Design the turbines and open channels of different sections and to estimate the energy loss in hydraulic jump.
CO5	Able to interpret the experimental results of discharge, efficiency based on the test conducted in the laboratory.

Reference Books	
1.	P.N. Modi and S.M. Seth-Hydraulics and Fluid Mechanics, including Hydraulic machines, standard Book House, New Delhi
2.	K Subramanya- Fluid Mechanics and Hydraulic Machines, Tata McGraw-Hill, New Delhi
3.	R.K. Bansal- A text book of Fluid Mechanics and Hydraulic Machines- Laxmi Publications, New Delhi
4.	Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford- Fluid Mechanics, Tata McGraw Hill publishing Co Ltd, New Delhi
5.	J.F. Douglas. M. Gastric, John Warfield, Lynne Jack – Fluid Mechanics, Pearson, Fifth edition.
6.	K. Subramanya- Fluid Mechanics and Hydraulic Machines, Problems and Solutions, Tata McGrawhill, New Delhi.
7.	S K SOM and G.Bis was – " introduction to Fluid Mechanics and Fluid Machines, Tata Mcg raw Hill, New Delhi.

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: III		
TRANSPORTATION ENGINEERING (Theory)		
Course Code: MVJ22CV34		**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	Gain knowledge of different modes of transportation systems and to learn the introductory concepts on Highway Engineering.	
2	Get insight to different highway materials and pavement design elements of a highway network.	
3	Realize the significance of road safety by incorporating the concepts of Traffic Engineering.	
4	Understand to different aspects of geometric elements of railway system and evaluate the material quantity required for track laying	
5	Gain knowledge about various components of an Airport and its runway design.	

UNIT-I	L1,L2
TRANSPORTATION ENGINEERING: Introduction, Different Modes of Transportation, M R Jayakar Committee recommendations, Road Classifications and Road Patterns. Highway Alignment: Factors affecting highway alignment, Engineering surveys for alignment-conventional and modern methods. Highway Geometric Design: Factors affecting geometric design of roads, Cross Sectional Elements, Sight distances, Horizontal alignment- Transition curve, superelevation, Extra widening, Vertical alignment–gradients, summit and valley curves. (No derivations) Problems on Sight distance, Super elevation, extra widening of curves, Length of transition curve, Length of summit and valley curve**.**	**8 Hrs**
UNIT-II	**L1,L2,L3**
Highway Materials and Pavements: Desirable properties of aggregates, soil subgrade & Bitumen, Application of bituminous emulsion, Desirable properties of Bituminous Mixes Pavement Design: Factors Controlling design of highway pavements, Pavement types, component parts of pavements and their functions; types of joints used in rigid pavement. Critical stresses in flexible and rigid pavement. **Highway Drainage:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, Types of cross drainage structures their choice and location. **Problems on design of Longitudinal drain.**	**8 Hrs**
UNIT-III	**L1,L2,L3**
Traffic Engineering: Objectives and scope of Traffic Engineering. Traffic Characteristics: Road user characteristics, vehicular characteristics – static and dynamic characteristics, Reaction time of driver and PIEV theory, Types of traffic engineering studies-volume, spot speed, speed and delay, parking, accident, origin & destination, objectives of studies and data collection, method of study, analysis. PCU concept, factors affecting and PCU at different locations and applications. Traffic signs, Signal design by IRC method; Types of intersections.	**8 Hrs**

Problems on Spot speed studies, Speed and delay studies, accident studies, Signal design by IRC method.	
UNIT-IV	**L1,L2**
Railway Engineering: Permanent way and its requirements, Gauges and types, Typical cross sections single and double-line BG track, Coning of wheels and tilting of rails, Rails-Functions-requirements, types and defects of rails. Sleepers and Ballast: Functions, requirements, Track fitting and fasteners, Calculation of quantity of materials required for laying a track, Points & crossings, Railway Station and Yards. Metro train & highspeed train-Design factors considered. **Problem on Quantity calculation for laying railway track. Super-elevation**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Airport Engineering: Layout of an airport with component parts and functions, Site selection for airport, Aircraft characteristics affecting the design and planning of airport, Airport classification, Runway orientation using wind rose with examples. RUNWAY-Basic runway length-Corrections and examples, Runway geometrics, Taxiway-Factors affecting the layout - geometrics of taxiway-Comparison between Runway and Highway, Design of exit taxiway with examples. **Problems on Runway orientation, Basic Runway length, Exit taxiway design.**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the basic principles of geometric design in the context of transportation engineering and planning.
CO2	Select the appropriate pavement materials for construction and design the pavement as per standard practices.
CO3	Conduct traffic studies and analyse traffic data for practical applications.
CO4	Identify the Components parts of Railway Track and design the suitable runway for an Airport.
CO5	Able to interpret the experimental results of highway materials based on laboratory tests and design the pavement as per IRC guidelines.

Reference Books	
5.	S K Khanna and C E G Justo, “Highway Engineering”, Nem Chand Bros, Roorkee.
6.	L R Kadiyali, “Highway Engineering”, Khanna Publishers, New Delhi.
3.	“A Text Book of Railway Engineering" by S C Saxena and S P Arora
4.	“Airport Engineering” by S C Rangwala
5.	“Airport Planning and Design” by Khanna Arora and Jain, Nem Chand Bros, Roorke.
6.	“Roads, Railways, Bridges, Tunnels and Harbour Dock Engineering by B L Gupta, Amit Gupta.
7.	S K Khanna, C E G Justo and A Veeraragavan, “Highway Materials Testing Laboratory Manual”, Nem Chand Bros, Roorkee.

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: III		
Computer Aided Building Planning And Drawing (Practice)		
Course Code: MVJ22CVL35		**CIE Marks: 50**
Credits: L:T:P: 0:0:2		**SEE Marks: 50**
Hours: 26P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Gain skill set to prepare Computer Aided Engineering Drawings using a software	
2	Understanding the details of construction of different building elements	
3	Visualize the completed form of the building and the intricacies of construction based on the engineering drawings	
4	Get familiarization of practices used in Industry	

Sl.NO	Experiments	L3,L4
1	**Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS:962.	
2	**Drawing Tools:** Lines Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet,	
3	**Using Text:** Single line text, Multiline text, Spelling, Edit text	
4	**Special Features:** View tools, Layers concept, Dimension tools, Hatching, Customizing Toolbars, Working with multiple drawings.	
5	**Drawings of Different Building Elements:** Refer NBC before practice • Footing/ Foundation – Foundation dimension for Isolated, combined footing, Standard dimension and cross section of footing • Size stone Masonry – Size of single and double bond stone, Sections at wall foundation • Brick Masonry – Size of standard Burnt Brick, Solid Cement Block, Hollow Cement block, Other bricks used in current practice	
6	Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.	
7	Draw a building plan for single and double bed room accommodation for a given site dimension. Students have to go through Building Bye Laws and regulations	
8	Prepare the centre line drawing for marking the single and double bedroom house as in in exercise 6	
9	Prepare a complete sanction plan for the exercise 6 as per the bye law. Also study the requirements to plan Residential Building, School building, Hospital Building, Offices	
10	Drawing of plan with electrical, plumbing and sanitary services using CAD software	
11	Drawing standard sections for Lintel and chajja, RCC Slabs, Columns and beams.	
12	Drawing different types of staircases – Dog legged, Open well – plan and section	

Course Outcomes: After completing the course, the students will be able to	
CO1	Prepare, read and interpret the drawings in a professional set up.
CO2	Know the procedures of submission of drawings and Develop working and submission drawings for building
CO3	Plan of residential or public building as per the given requirements..

Reference Books	
1.	MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata McGraw Hill Publishing co. Ltd, New Delhi.
2.	Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3.	Malik RS and a Meo GS, "Civil Engineering Drawing", Asian Publishers/Computech Publication Pvt Ltd

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: III		
Rural, Urban Planning and Architecture (Theory)		
Course Code: MVJ22CV361		**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	To make the student understand about the past and present architecture of different parts of the world	
2	Rural and urban planning and growth and circulation of patterns and effect of increase in urbanization	
3	The basic planning required for urban and rural centres with respect to physical and social aspects	
4	Student s to visit the different place of architecture monuments to understand the concept	
5	To understand different types of architecture and planning	

UNIT-I	L1,L2,L3
Introduction: Aim and importance of Architecture, Architecture as a fine art. Role of an architect and an engineer. Essential principles and qualities of architecture with examples **Factors of architecture:** Mass, Form, Colour, Solids, and Voids, Uniformity, Balance and Symmetry, Painting with examples. Laboratory Sessions/ Experimental learning: (Self Learning) • Verification of dimensions of different types of brick • Determination of water absorption of brick • Determination of efflorescence of brick • Find the soundness and hardness of brick Applications: (Self Learning) • Assess quality of bricks Video link / Additional online information: (Self Learning) • Masonry materials: https://nptel.ac.in/courses/105102088/	**10 Hrs**
UNIT-II	**L1,L2,L3**
Architectural influence of the following: Association, Tradition, Climate, Materials, Topography, Religion social customs and aspiration of time. **Architectural characteristics of the following** architecture with examples. 1. Egyptian, 2. Greek, 3. Roman, 4. Buddhist, 5. Hindu, 6. Jain, 7. Chalukyan, 8. Modern architecture Factors that have influence present day Modern Architecture, Aesthetic difference between the past and present Architecture. Laboratory Sessions/ Experimental learning: (Self Learning) • Arrange bricks according to different bonds- Header, stretcher, English and Flemish. Identify various types of stone masonry in the campus. Applications: (Self Learning) • Select suitable masonry for a structure. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**10 Hrs**

UNIT-III	L1,L2
Human settlements, Rural and urban pattern of growth, Factors that promote growth and development of Rural and urban areas Ancient Town Planning in India: Principles of town planning and circulation pattern with examples Laboratory Sessions/ Experimental learning: (Self Learning) • Identify the defects in plastering Applications: (Self Learning) • Measure the condition of painting against water proofing Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**10 Hrs**
UNIT-IV	**L1,L2,L3**
Industrialisation: Impact on town planning, Urbanisation causes, its effect on town and cities, remedial measures both in urban and rural planning Circulation pattern in cities: Urban roads and streets, their fuctional classification, traffic survey data and its use in town planning Laboratory Sessions/ Experimental learning: (Self Learning) • Diagnose causes of dampness in a building Applications:(SelfLearning) • Take suitable measures to improve functional performance and durability of structure. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**10 Hrs**
UNIT-V	**L1,L2,L3**
Contemporary objectives and methods of planning of town: Development plans for cities, objectives and stages involved in their preparation and implementation, space standards for planning. Laboratory Sessions/ Experimental learning: (Self Learning) • Identify various materials used in the residential building and institutional building. Applications: (Self Learning) • Select sustainable and alternative materials according to the requirement. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**10 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand importance of architecture in rural and urban planning
CO2	Understand Influence of architecture
CO3	Design infrastructure for rural and urban region
CO4	Plan and design rural and urban roads
CO5	

Reference Books	
7.	History of Architecture – Fletcher
8.	Urban pattern – Galliaon

3.	Indian architecture – Vol. I & II – Perey Brown
4.	Principle of town and country planning – Lewis Keeble
5.	Urbanization and Urban Syatems in India, Ramachandran R, Oxford University Press, New Delhi.
6.	Town planning – Rangwala, Charothar Publication

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 for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	1	-	-	-	-	1	-	1	1
CO2	3	-	-	1	-	-	-	-	1	-	1	1
CO3	3	2	-	1	-	-	-	-	1	-	1	1
CO4	3	2	2	1	-	-	-	-	1	-	1	1
CO5	3	-	-	1	-	-	1	1	1	-	1	1

Semester: III		
Geospatial Techniques in Practice (Theory)		
Course Code: MVJ22CV362		**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	Introduce the concept of various geospatial technologies used in the industry
2	Help to acquire basic idea about the processing and mapping with modern surveying equipment.
3	Elaborate proven concepts, business practices and applications of geospatial technology.
4	Explain learners understand how geospatial concepts are leveraged in handling real world business challenges of engineering and construction industry.

UNIT-I	**L1,L2,L3**
Need of Geospatial technology in Industry: Geospatial in Day to Day Life, Spatial thinking, Evolution of location technology and importance of geography and maps. Need for spatial information, Terminologies, logic, language and formats of spatial technology. Location perspective of construction industry, Overview of Geospatial technology in tenders, Design and execution and Construction lifecycle management. Fundamentals and components of Geospatial Engineering, Surveying and Conventional survey equipment Vs Modern surveying equipment Components. Digital Land Surveying Needs. Laboratory Sessions/ Experimental learning: (Self Learning) • Verification of dimensions of different types of brick • Determination of water absorption of brick • Determination of efflorescence of brick • Find the soundness and hardness of brick Applications: (Self Learning) • Assess quality of bricks Video link / Additional online information: (Self Learning) • Masonry materials: https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-II	**L1,L2,L3**
Total Station and Global Navigation Satellite System (GNSS): Basics of Surveying, Introduction to Survey and Mapping, Geospatial Surveying Equipment, Demo of Total Station Equipment, Setting out and mapping, Advanced geospatial solutions, GNSS Overview of components, working and signal structure of Global navigation System. Laboratory Sessions/ Experimental learning: (Self Learning) • Arrange bricks according to different bonds- Header, stretcher, English and Flemish. Identify various types of stone masonry in the campus. Applications: (Self Learning) • Select suitable masonry for a structure. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-III	**L1,L2**
Geospatial Engineering and technology: Remote Sensing Technologies, Types of	**8 Hrs**

remote sensing, Sensors and its types, Application of sensors & platforms, Image Acquisition, Applications of Remote Sensing. 3D scanning, Principles and the science behind photogrammetry, LiDAR, RADAR and SONAR. Introduction to Platforms and working. Laboratory Sessions/ Experimental learning: (Self Learning) • Identify the defects in plastering Applications: (Self Learning) • Measure the condition of painting against water proofing Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	
UNIT-IV	**L1,L2,L3**
Geographical Information System: Basics of GIS, Vector & Raster data models, Types and components of a Map. Hardware for GIS, DEM and TIN Data products, Attribute Data Types. Basic GIS data conversions, conversions from non-spatial formats to spatial formats. Demo of Conversion of Excel to GIS, Demo of Conversion of CAD TO GIS, Demo of Downloading and Geo-referencing Topo sheets and Raster files. Laboratory Sessions/ Experimental learning: (Self Learning) • Diagnose causes of dampness in a building Applications:(SelfLearning) • Take suitable measures to improve functional performance and durability of structure. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-V	**L1,L2,L3**
Applications and Future trends of Geospatial Technologies: Application of GIS - Spatial Analysis, Catchment Area delineation, Overlay Analysis, Cluster Analysis, Hotspot Analysis and View shed Analysis. Future Trends of Geospatial Technologies. Case Study 1 -Benefit Realization - Case Study 2 Advancements in Modern Survey & Mapping Technologies, Advancements in Spatial Analytics – Geo Intelligence, Future Trends, Geospatial Technology - Way Forward. Laboratory Sessions/ Experimental learning: (Self Learning) • Identify various materials used in the residential building and institutional building. Applications: (Self Learning) • Select sustainable and alternative materials according to the requirement. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend different geospatial techniques in the Construction Industry
CO2	Understand the application of geospatial equipment like Total Station, GNSS, LIDAR, UAV (Drones), etc.,
CO3	Evaluate the various spatial analysis operations by using GIS Environment

CO4	Create a map layout with all essential cartographic elements in GIS Environment.
CO5	Illustrate the various geospatial emerging trends of GIS in Industry.

Reference Books	
9.	T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2010, 24th edition.
10.	James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001
3.	Satheesh Gopi, R. Sathikumar, N. Madhu, — Advanced Surveying, Total Station GPS and Remote Sensing — Pearson education, 2nd Edition,2017.
4.	George Joseph and C. Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018
5.	M. Anij Reddy. Textbook of Remote Sensing and Geographical Information systems. BS Publications, 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 for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	1	-	-	-	-	1	-	1	1
CO2	3	-	-	1	-	-	-	-	1	-	1	1
CO3	3	2	-	1	-	-	-	-	1	-	1	1
CO4	3	2	2	1	-	-	-	-	1	-	1	1
CO5	3	-	-	1	-	-	1	1	1	-	1	1

Semester: III		
Sustainable Design Concept for Building Services (Theory)		
Course Code: MVJ22CV363		**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	To facilitate learners to understand sustainable building designs and its parameters such as energy and water efficiency, Comfort in buildings, and waste management.	
2	To expose the learners to shading systems, thermal and visual comfort	
3	To impart fundamental knowledge on Life cycle assessment and Green ratings and certifications.	

UNIT-I	L1,L2,L3
Introduction to Sustainability and Climatology: Overview of Sustainability – Global energy scenario, carbon footprint and climate action, Net zero in carbon offsetting, Water neutral, Sustainable construction and resource management. Green buildings - Selection of site – preservation and planning, Influence of climate on buildings, Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems. Laboratory Sessions/ Experimental learning: (Self Learning) • Verification of dimensions of different types of brick • Determination of water absorption of brick • Determination of efflorescence of brick • Find the soundness and hardness of brick Applications: (Self Learning) • Assess quality of bricks Video link / Additional online information: (Self Learning) • Masonry materials: https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-II	**L1,L2,L3**
Comfort in Buildings: Thermal comfort – Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies Acoustics – Building acoustics, measures, defects and prevention of sound transmission Indoor Air Quality – Effects, design consideration and integrated approach for IAQ management Visual comfort – Enhancement strategies for Daylighting and Artificial lighting. Laboratory Sessions/ Experimental learning: (Self Learning) • Arrange bricks according to different bonds- Header, stretcher, English and Flemish. Identify various types of stone masonry in the campus. Applications: (Self Learning) • Select suitable masonry for a structure. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-III	**L1,L2**
Energy, water efficiency and waste management in buildings: Energy	**8 Hrs**

efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system. Laboratory Sessions/ Experimental learning: (Self Learning) • Identify the defects in plastering Applications: (Self Learning) • Measure the condition of painting against water proofing Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	
UNIT-IV	**L1,L2,L3**
Life Cycle Assessment of Buildings and Green project management: Materials – Green product certifications, features of sustainable building materials and sustainable alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle assessment and its types – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management. Laboratory Sessions/ Experimental learning: (Self Learning) • Diagnose causes of dampness in a building Applications:(SelfLea rning) • Take suitable measures to improve functional performance and durability of structure. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-V	**L1,L2,L3**
Sustainable rating systems: Green building rating systems- LEED, BREEAM and others, Indian Green building rating systems – IGBC & GRIHA. IGBC criteria for certification -site selection credits, pre-design credits, detailed design credits, pre-construction credits, construction credits, post construction credits. Laboratory Sessions/ Experimental learning: (Self Learning) • Identify various materials used in the residential building and institutional building. Applications: (Self Learning) • Select sustainable and alternative materials according to the requirement. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend sustainable design, climatology, shading system and analyze heat transfer

	mechanism in buildings.
CO2	Assess the design considerations and parameters for thermal comfort, visual comfort, indoor air quality and acoustics
CO3	Develop solutions for energy efficiency, water efficiency and waste management in buildings
CO4	Adopt green project management methodology and evaluate building life cycle assessment
CO5	Implement green practices during construction and operation phase of the buildings for achieving green rating.

Reference Books	
11.	HarharaIyer G, Green Building Fundamentals, Notion Press
12.	Dr. Adv. HarshulSavla, Green Building: Principles & Practices
3.	IGBC Green new building rating system - version 3.0 - Abridged reference guide
4.	The Sustainable Habitat Handbook (6 Volume Set), GRIHA Version 2019
5.	National Building Code – 2016, Volume 1&2, Bureau of Indian Standards

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 for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	-	-	1	-	-	-	-	1	-	1	1
CO2	3	-	-	1	-	-	-	-	1	-	1	1
CO3	3	2	-	1	-	-	-	-	1	-	1	1
CO4	3	2	2	1	-	-	-	-	1	-	1	1
CO5	3	-	-	1	-	-	1	1	1	-	1	1

Semester: III		
Fire Safety in Buildings (Theory)		
Course Code: MVJ22CV364		**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	To understand the importance fire safety
2	To understand various techniques involved in fire safety
3	To design fire resistant buildings using proper materials and methods
4	To understand components of electrical system
5	To understand non-destructive testing

UNIT-I	**L1,L2,L3**
Fire: Introduction, Basic concepts of fire protection, Fire as a process of combustion, planning for fire protection, fire resistance Ventilation and fuel controlled fire, process of combustion: flash over condition, effect of fire on construction material, design of fire resistance steel structure, concrete structure	**8Hrs**
UNIT-II	**L1,L2,L3**
Fire safety: urban planning, escape and refuge, internal planning, detection and suppression Introduction to lift design, design of lift system, expected stop and floor of reversal, different cases, simulation, arrangements and escalators	**8 Hrs**
UNIT-III	**L1,L2,L3**
Introduction to flow system: water supply, constant demand, variable demand and diversity factor, control systems Flow in pipe networks and fixture units, design of water supply distribution system, flow in waste water pipes	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Introduction to HVAC: governing equations to HVAC process, numerical problem on HVAC system, psychometric chart, equation based approach Electrical systems: design of electrical systems, intelligent building, life cycle cost and basics of building maintenance, stages of maintenance management, planning for building maintenance, periodicity of maintenance management, estimation of repair cycle, cost profile of maintenance, lamp replacement, building inspection, planned and Ad-hoc maintenance	**8 Hrs**
UNIT-V	**L1,L2,L3**
Condition survey and health evaluation of buildings: diagnosis of building by visual survey, case studies of visual survey, effect of corrosion and alkali aggregate reaction, sampling and choice of test location Non-destructive testing, core strength test, carbonation and chloride measurement, electrical method of progress measurement Repair, rehabilitation, retrofit, periodicity and economics of condition survey, interpretation of test results	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand types of fire, combustion process and fire resistance

CO2	Plan for fire safety and design of lifts
CO3	Design flow network in buildings
CO4	Design of electrical systems and maintenance
CO5	Perform health evaluation of buildings and suggest remedies

Reference Books	
13.	J A Purkiss, Fire Safety Engineering: Design of Structures, ISBN 13 978-8131220085, Elsevier, 2009
14.	V K Jain, Fire Safety in Buildings, ISBN-13 978-938980219, New Age International Private Limited; Third edition, 2020
3.	Fire protection, services and maintenance management of building, NPTEL video lecture, IIT, Delhi
4.	Bureau of Indian Standards, " HAND BOOK OF FUNCTIONAL REQUIREMENTS OF BUILDINGS, (SP-41 & SP- 32)", BIS 1987 and 1989.
5.	Markus,T.A. & Morris, E.N., "BUILDING CLIMATE AND ENERGY" Pitman publishing limited. 1980.
6.	Croome,J.D .& Roberts,B.M.,"AIR CONDITIONING AND VENTILATION OF BUILDINGS, VOL-1".Pergamon press.
7.	Building Services Design - T.W.MEVER

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 marksare executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1												
CO2												
CO3												
CO4												

CO5												

SOCIAL CONNECT & RESPONSIBILITIES			
Course Code	**21SCR36**	**CIE Marks**	**50**
Teaching Hours week (L:T:P:S)	1: 0: 0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	03
Department	Management Studies / Engineering Department		
Offered for	3rd Semester		
Prerequisite	Nil		

Objectives: The Course will

- Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
- Provide a formal platform for students to communicate and connect with their surroundings.
- Enable to create of a responsible connection with society.

Learning Outcomes: The students are expected to have the ability to :

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Contents:

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage studentsinr interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed :

Module-I

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

Module-II

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

Module-III

Organic farming and waste management: usefulness of organic farming, wet waste managementin neighboring villages, and implementation in the campus.

Module-IV

Water Conservation: knowing the present practices in the surrounding villages and

implementation in the campus, documentary or photo blog presenting the current practices.

Module-V

Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Activities

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. **Share the experience of Social Connect**. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

A total of 14-20 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into 10 groups of 35 each. Each group will be handled by two **faculty mentors**. Faculty mentors will design the activities (particularly Jammingsessions open mic ,and poetry)

Faculty mentors has to design the evaluation system.

Continuous Internal Evaluation (CIE)

After completion of, the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

Marks allotted for the diary are out of 50.

Planning and scheduling the social connect

Information/Data collected during the social connect

Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below-

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59
Unsatisfactory and fail	<39

Semester End Examination (SEE)

This Jamming session will be conducted at the end of the course for **50 marks**

Jamming session includes -Platform to connect to others. Share the stories with others. **Share the experience of Social Connect**. Exhibit the talent like playing instruments, singing, one-act play, art painting, and fine art.

Faculty mentor has to design the evaluation system for the Jamming session.

Semester: III		
Additional Mathematics-I **(Common to all branches)**		
Course Code:	**MVJ22MATDIP-1**	**CIE Marks:50**
Credits:	**L:T:P:S: 3:0:0:0**	**SEE Marks: 50**
Hours:	**30L**	**SEE Duration: 3 Hrs**

Course Learning Objectives: The students will be able to	
1	To familiarize the important and introductory concepts of Differential calculus
2	Aims to provide essential concepts integral calculus.
3	To gain knowledge of vector differentiation
4	To learn basic study of probability.
5	Ordinary differential equations of first order and analyze the engineering problems.

UNIT-I	
Differential calculus: Recapitulation of successive differentiation -nth derivative -Leibnitz theorem (without proof) and Problems, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation, Taylor's and Maclaurin's series expansions- Illustrative examples.	**8 Hrs**
UNIT-II	
Integral Calculus: Statement of reduction formulae for the integrals of $\sin^n(x)$, $\cos^n(x)$, $\sin^n(x)\cos^n(n)$ and evaluation of these integrals with standard limits-problems. Double and triple integrals-Simple examples.	**8 Hrs**
UNIT-III	
Vector Differentiation: Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields. **Vector identities** - $div(\phi\vec{A})$, $curl(\phi\vec{A})$, $curl(grad(\phi))$, $div(curl\,\vec{A})$.	**8Hrs**
UNIT-IV	
Probability: Basic terminology, Sample space and events. Axioms of probability. Conditional probability – illustrative examples. Bayes theorem-examples.	**8Hrs**
UNIT-V	
Ordinary Differential Equations of First Order: Introduction – Formation of differential equation, solutions of first order and first degree differential equations: variable separable form, homogeneous, exact, linear differential equations.	**8Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of calculus to solve problems related to polar curves and its applications
CO2	Apply the concept of integration and variables to evaluate multiple integrals and their usage in computing the area and volumes.
CO3	Illustrate the applications of multivariate calculus to understand the solenoidal and irrotational vectors and also exhibit the inter dependence of line, surface and volume integrals.
CO4	Understand the basic Concepts of Probability
CO5	Recognize and solve first-order ordinary differential equations occurring in different branches of engineering.

Reference Books	
15.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.

16.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10t edition,2014.
3.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
4.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxn Publications, 8th Edition.

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 for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	0	2	0	0	0	0	0	0	0	1
CO2	3	3	0	2	0	0	0	0	0	0	0	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	3	2	0	3	0	0	0	0	0	0	0	1
CO5	3	2	0	2	0	0	0	0	0	0	0	1

Semester: IV		
Analysis of Structures (Theory)		
Course Code: MVJ22CV41		**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 Different Forms of Structural Systems.	
2	Determine the Strain Energy and Slope and Deflection of Beams, Trusses and Frames.	
3	Analyse arches and cable structures.	
4	Analyse different types of beams and frames using slope deflection method.	
5	Analyse different types of beams and frames using moment distribution method.	

UNIT-I	L1,L2,L3
Equilibrium: Conditions of equilibrium, Compatibility conditions, Degree of freedom, Static and kinematic indeterminacies of structural systems **Deflection of beams:** Moment area method: Derivation, Mohr's theorems, sign convention; Application of moment area method to determinate prismatic beams, beams of varying cross section; Use of moment diagram by parts. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-II	**L1,L2,L3**
Slope Deflection Method: Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-III	**L1,L2,L3**
Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Matrix Method of Analysis (Stiffness Method): Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤3. Video link / Additional online information: (Self-Learning) • https://archive.nptel.ac.in/courses/105/105/105105109/ • https://www.vssut.ac.in/lecture_notes/lecture1428730889.pdf	**8 Hrs**

UNIT-V	L1,L2,L3
Matrix Method of Analysis (Flexibility Method): Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤3. Laboratory Sessions/ Experimental learning: (Self-Learning) • Modelling and software analysis of multi-storey frames with lateral loads. Applications: (Self-Learning) • Analysis of continuous beams and plane trusses using system approach by stiffness method. • Analysis of continuous beams using system approach by flexibility method. Video link / Additional online information: (Self-Learning) • https://archive.nptel.ac.in/courses/105/105/105105109/ • https://www.vssut.ac.in/lecture_notes/lecture1428730889.pdf	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the different forms of structural systems and analyse the trusses.
CO2	Evaluate the slope and deflections in beams, frames and trusses by using moment area method and energy principle.
CO3	Analyse and determine the stress resultants in arches and cables.
CO4	Analyse the indeterminate structures and construct BMD AND SFD using slope deflection methods.
CO5	Analyse the indeterminate structures and construct BMD AND SFD using moment distribution method.

Reference Books	
1.	Reddy, C.S., Basic Structural Analysis, 3 rd. ed., Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2011.
2.	Hibbeler, R.C., Structural Analysis, 9 th edition., Pearson publications., New Delhi, 2012.
3.	Thandavamoorthy, T.S., Structural Analysis, 6 th edition., Oxford University press., New Delhi,2015.
4.	L S Negi and R S Jangid, “Structural Analysis”, Tata McGraw-Hill Publishing Company Ltd.
5.	D S Prakash Rao, “Structural Analysis: A Unified Approach”, Universities Press 4
6.	K.U. Muthu and H. Narendra, “Indeterminate Structural Analysis”, IK International Publishing Pvt. Ltd.
7.	Gupta S P, G S Pundit and R Gupta, “Theory of Structures”, Vol II, Tata McGraw Hill Publications company
8.	V N Vazirani and M M Ratwani, “Analysis of Structures”, Vol. 2, Khanna Publishers
9.	Wang C K, “Intermediate Structural Analysis”, McGraw Hill, International Students Edition. S. Rajashekhara and G. Sankarasubramanian, “Computational Structural Mechanics”, PHI Learning Pvt. Ltd.,
10.	S S Bhavikatti, structural analysis, vikas publishing house pvt.ltd., new Delhi

11.	S Ramamrutham and R Narayanan,Theory of structures , Dhanpat Rai Publishing Company.

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
Water Supply and Waste water Engineering (Theory)		
Course Code: MVJ22CV42		**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	Analyze the variation of water demand and to estimate water requirement for a community.	
2	Study drinking water quality standards and to illustrate qualitative analysis of water.	
3	Analysis of physical and chemical characteristics of water and wastewater.	
4	Understand and design of different unit operations and unit process involved in water and wastewater treatment process	
5	Design various oxidation processes.	

UNIT-I	**L1,L2**
INTRODUCTION: Water: Need for protected water supply, Demand of Water: Types of water demands - domestic demand, industrial, institutional and commercial demand, public use and fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor. Design period and factors governing design period. Methods of population forecasting and numerical problems. Physico chemical characteristics of water Sampling. ● Video link / Additional online information: (Self Learning) https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-II	**L1,L2,L3**
WATER TREATMENT: Objectives, Unit flow diagrams – Significance of each unit, Aeration process Limitations and types. **SEDIMENTATION:** Theory, settling tanks, types and design with numerical, Coagulation and flocculation, types of coagulants. **FILTRATION:** Mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation and cleaning. Design of slow and rapid sand filter without under drainage system, Numericals. ● Video link / Additional online information: (Self Learning) https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-III	**L1,L2,L3**
DISINFECTION: Methods of disinfection with merits and demerits. Breakpoint chlorination, Softening: Lime soda and Zeolite process. **WASTEWATER:** Need for sanitation, methods of sewage disposal, types of	**8 Hrs**

sewerage systems, Treatment of municipal waste water: Waste water characteristics sampling, significance and techniques, physical, chemical and biological characteristics, Numerical on BOD. ● Video link / Additional online information: (Self Learning) https://nptel.ac.in/courses/105102088/	
UNIT-IV	**L1,L2**
TREATMENT PROCESS: flow diagram for municipal waste water Treatment unit operations and process Screens: types, disposal. Grit chamber, oil and grease removal. Primary and secondary settling tanks, **SUSPENDED GROWTH SYSTEM**-conventional activated sludge process and its modifications, numerical. ● Video link / Additional online information: (Self Learning) https://nptel.ac.in/courses/105102088/	**8 Hrs**
UNIT-V	**L1,L2,L3**
ATTACHED GROWTH SYSTEM – Trickling filter, numerical on Trickling filters, bio-towers and rotating biological contactors. Principle of stabilization ponds, oxidation ditch. Sludge digesters (aerobic and anaerobic), Equalization. Thickeners and drying beds. ● Video link / Additional online information: (Self Learning) https://nptel.ac.in/courses/105102088/	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Estimate the average and peak water demand for a community.
CO2	Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
CO3	Design the different units of water treatment plant.
CO4	Design the various units of wastewater treatment plant.
CO5	Design of various AOPs and low cost treatment units.

Reference Books	
1.	Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
2.	S. K. Garg, Environmental Engineering Volume-I, Water supply Engineering – M/s Khanna Publishers, New Delhi2010
3.	B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi2010.
4.	S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
Geotechnical Engineering (Theory and Practice)		
Course Code: MVJ22CV43		**CIE Marks: 50**
Credits: L:T:P: 3:0:2		**SEE Marks: 50**
Hours: 40L + 26P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Appreciate basic concepts of soil mechanics as an integral part in civil engineering.	
2	Comprehend basic engineering and mechanical properties of different types of soil.	
3	Become broadly familiar with geotechnical engineering requirements, such as, flow of water through soil medium and compaction characteristics.	
4	Model and measure strength & settlement characteristics and bearing capacity of soils.	

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UNIT-I	L2,L3
INDEX PROPERTIES AND IS CLASSIFICATION **Index Properties:** Phase Diagram, definitions, and their interrelationships. Determination of Index properties, Types of soil structures and Clay Minerals, IS soil classification of Soil.	**8 Hrs**
UNIT-II	**L2,L4**
SOIL WATER-EFFECTIVE STRESS ANALYSIS **Soil Water:** Permeability, Darcy's law-assumption and validity, coefficient of permeability and its determination (only laboratory method), permeability of stratified soils. Capillary phenomenon, Flow net characteristics and applications Effective Stress Analysis: Effective stress concept-total stress, effective stress and Neutral stress.	**8 Hrs**
UNIT-III	**L2,L4**
COMPACTION AND CONSOLIDATION **Compaction:** Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control Mass-spring analogy, Terzaghi's one dimensional consolidation theory (No derivation). Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test, Pre-consolidation pressure and its determination by Casagrande's method.	**8 Hrs**
UNIT-IV	**L2,L4**
SHEAR STRENGTH Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Factors affecting shear strength of soils.	**8 Hrs**
UNIT-V	**L2,L4**
BEARING CAPACITY AND SETTLEMENT	**8 Hrs**

Bearing Capacity: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS methods (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and load eccentricity on bearing capacity of soil, Field methods of determining bearing capacity of soil (SPT and plate load test). **Settlement:** Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 Part 1).	

Sl.NO	**Experiments**
1	Water content determination by oven drying, Rapid moisture meter method
2	Grain size analysis (Sieve analysis of soil)
3	In-situ density tests i) Core-cutter method ii) Sand replacement method
4	Consistency limits i) Liquid limit test (by Casagrande's and cone penetration method) & ii) Plastic limit test
5	Co-efficient of permeability test i) Constant head test ii). Variable head test
6	Standard compaction test (light compaction only)
7	Direct shear test
8	Unconfined compression test & Laboratory vane shear test
9	Triaxial test (unconsolidated undrained test only)
10	Demonstration of Standard penetration test & Boring equipment
11	Demonstration of Proctors Needle
12	Demonstration of Vane shear test

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the fundamentals of Soil mechanics and identify and classify the soil
CO2	Apply the knowledge to determine MDD and OMC and compute consolidation properties and shear parameters of soil and compute the settlement and bearing capacity of soil

CO3	Apply the knowledge to determine shear parameters of soil and compute the settlement and bearing capacity of soil
CO4	Carry out experiments to assess the index properties of soil and determine Compaction, Permeability and Shear Strength characteristics of soil.

Reference Books	
1.	T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons. 1991
2.	Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-Tata McGraw Hill Publications. 2010
3.	Bowles J E, Foundation analysis and design, McGraw- Hill Publications 5th edition 2001
4.	Malcolm D Bolton, "A Guide to soil mechanics", Universities Press., 2003
5.	Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi. 2010
6.	Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol. I, II, III, Princeton Press, London 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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B

Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
BUILDING MATERIALS LABORATORY (Practice)		
Course Code: MVJ22CVL44		**CIE Marks: 50**
Credits: L:T:P: 0:0:2		**SEE Marks: 50**
Hours: 26P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.	
2	Ability to function on multi-disciplinary teams in the area of materials testing.	
3	Ability to use the techniques, skills and modern engineering tools necessary for engineering.	
4	Understanding of professional and ethical responsibility in the areas of material testing.	
5	Ability to communicate effectively the mechanical properties of materials.	

Sl.NO	Experiments	L3,L4
1	Tests on Bricks, Tiles, Cement Concrete blocks (Weight &Dimensionality, Water Absorption, Strength)	
2	Tests on Fine aggregates - Sieve Analysis, Moisture content, Specific gravity, Bulk density, Bulking and Silt Content	
3	Tests on Coarse aggregates- Sieve Analysis, Water absorption, Moisture content, specific gravity and Bulk density	
4	Tests on Coarse aggregates- Crushing Strength Test, Los Angeles abrasion test, Impact test and Shape tests (combined index and angularity number)	
5	Compression test on mild steel, cast iron and wood.	
6	Tension test on mild steel and HYSD bars	
7	Bending Test on Wood Under two-point loading.	
8	Shear Test on Mild steel- single and double shear.	
9	Impact test on Mild Steel (Charpy & Izod).	
10	Demonstration of Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's.	
11	Demonstration of Strain gauges and Strain indicators.	
NOTE: All tests to be carried out as per relevant latest BIS Codes		

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the physical characteristics, and behavior of common building materials.
CO2	Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion for steel
CO3	Recognize the importance of ethical conduct, integrity, and accuracy in materials testing and reporting.

Video Link	
1.	https://sm-nitk.vlabs.ac.in/exp/tensile-test-mild-steel/
2.	https://eerc01-iiith.vlabs.ac.in/List%20of%20experiments.html
3.	https://archive.nptel.ac.in/courses/105/104/105104030/

Reference Books	
1.	Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
2.	M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education (India)Pvt. Ltd.,2014.
3.	Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors1996.

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: IV		
Building Information Modelling in Civil Engineering (Theory)		
Course Code: MVJ22CV451		**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 concept of Building Information Modelling	
2	Create the workflow followed in industry during creation of BIM 3D model which includes	

3	Building the discipline-based model and create the federated models
4	Design the process of creating the 4D & 5D BIM model

UNIT-I	**L1,L2**
Evolution of Engineering, Introduction to BIM Concepts and Design Authoring: Evolution of Engineering from 2D drawings to BIM Model, Isometric View, Limitation of Isometric views and concept of 3D-Modeling, Building Information Modelling – Introduction & Process, Design Authoring – Concepts and workflow, Fundamentals of Discipline Based Modelling, Introduction to stages of BIM Modelling process as per ISO 19650, Federated model- concepts and demonstrations, workflow of design coordination, Engineering Analysis – Concept and types of analysis, Process and workflow of Design Review in BIM.	**8 Hrs**
UNIT-II	**L1,L2**
Visualization and Interference/Clash check: Views in BIM Model, Visualization Modes, Walkthrough of the Model, Fly through the model, Layers & Properties, Concept of viewpoints, Sectioning and Visualization through Tablet and Mobile, Concept of BIM Kiosk & BIM Rooms, Visualization through Augment Reality (AR), Virtual Reality (VR) & Mixed Reality (MR) Clash Check – Types, Clash avoidance process, Clash Detection Process, Clash Detection Priority Matrix and Report generation, Clash Detection Rules, Report, Grouping, Clash Detection Process – Demo.	**8 Hrs**
UNIT-III	**L1,L2**
Documentation & CDE & Level of Development: Documentation and CDE (Common Data Environment) -2D drawings generation from BIM Model, Computer Network types, Concept of Cloud Computing, Concept and Application of CDE: Traditional Information Sharing, Definition, Reference, and Concept, Setting up the workflow and process for CDE- File naming convention, Roles and Responsibilities, Request for Information and Review Process Concept of LOD (Level of Development), preparation of LOD matrix and Progression matrixDefinition of LOD, Level of Detail and Information, LOD- Wall foundation, Precast Structural Inverted T-Beam, Domestic Water Piping, Plumbing Fixture, Packaged Generator Assembly, LOD- Chart, Matrix and Model Progression Matrix	**8 Hrs**
UNIT-IV	**L1,L2**
4D / Field BIM & Its Applications: Introduction to 4D / Field BIM: Concept of 4D, Introduction to construction sequence and project schedule, Project scheduling using Gantt Chart and its limitation, 4D BIM ModelingProject demo and workflow, Synchronization of 4D BIM Model with project schedule, Reviewing project progress w.r.t planned dates and actual dates, Generation of Reports Application of Field BIM/ 4D BIM: Understanding concept and usage of BIM in field for coordination- 3D Coordination and Visual Communication, Site utilization planning and Construction analysis, Application of wearables in coordination. 3D Control and planning Other Applications of Field BIM/ 4D BIM: Concept and usages of BIM in field for safety, disaster and risk analysis, digital fabrication and scan to BIM, Existing Condition Modeling, Phase Planning, As-built/ Record Models	**8 Hrs**

UNIT-V	L1,L2
5D BIM, AIM & Beyond BIM - Emerging Trends: 5D BIM: Introduction concepts of 5D BIM, Quantity take off with UoM, Concept of QTO with UoM, 5D BIM with UoM with cost, Quantity take off exercise, Demo of Quantity take off: Understanding QTO for Wall, Plaster & Tile, BIM Maturity LOD and General Practice of QTO, Cost Breakup structures, 5D BIM and cost control AIM: Introduction to Asset Information Model (AIM), COBie structures and Asset Information Deliverables, Space Attributes and Asset Attributes- Examples with data, Asset requirementDiscipline wise Infrastructure System, Classification code and Information Exchange, Information Exchange with Facility Management Beyond BIM: Emerging Trends- Concepts of Industrialisation, IoT, Big Data, Data Analytics and their applications in BIM: Industrialisation of Construction through BIM- DfMA, IoT in BIM, BIM and Big data, Data Analytics using AI & ML Future scope of BIM Applications: Smart Infrastructure and the need for connected infrastructure, Digital twins- Concepts and benefits, National Digital Twin or a City level Digital Twin in a Smart City, Fundamental requirements for the success of a Digital Twin and its uses, Digital Twin applications in diverse industries.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the basic principles of BIM evolution and concept of BIM in lifecycle of project
CO2	Understand the workflows of Design authoring followed in industry during creation of 3D model
CO3	Analyze the engineering analysis and the process followed in industry to check and resolve clashes
CO4	Evaluate the integration of schedule and cost in 3D model using 4D and 5D BIM
CO5	Illustrate the various emerging trends of BIM & concept of digital twin

Reference Books	
1.	ISO 19650 - Building Information Modelling (BIM)
2.	BIM Handbook – Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
Construction Equipment, Plants and Machinery (Theory)		
Course Code:MVJ22CV452		**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	To provide insight on the different functions and operations of different equipment and techniques during construction
2	To impart knowledge on the various maintenance and safety to be considered during construction
3	To acquire knowledge on the life cycle of a construction equipment
4	To adopt mechanization in the Construction industry

UNIT-I	**L1,L2**
Basics and Hydraulics of Construction Equipment: Introduction to Construction Equipment- Functions, Operations of Construction Equipment-Introduction to Four & Two Stroke Engine and their components- Introduction and Components to Automobiles. Introduction to Principles of Hydraulic- Calculation of Pressure, Force & Flow- Components of a Hydraulic System- Basic layout of Hydraulic System- Applications of Hydraulics- Strand Jack Operation Video link / Additional online information: (Self Learning) • Construction methods and equipment management: https://nptel.ac.in/courses/105103206/	**8Hrs**
UNIT-II	**L1,L2**
Concreting, Earth Moving, Road Making and Quarry/Mining Equipment: Operations of a Batching Plant - Introduction and Components of Concrete Pump & Placer- Concrete Pipeline- Laying and Cleaning- Bulldozer- Classification and Components- Classification, Components and Attachments of Excavator- Backhoe Loader- Classification & components- Introduction and classification to Hot mix Plant Process of Asphalt Paver-PQC Paver- Classification & Components- Motor Grader Classification & Components- Horizontal Movement Vehicles- Quarry/Mining	**8 Hrs**
UNIT-III	**L1,L2**
Equipment Life Cycle Management: Life Cycle of an Equipment- Equipment Performance Parameters - Introduction to Maintenance- Types of Maintenance- Maintenance Practices	**8 Hrs**
UNIT-IV	**L1,L2**
Tunnelling Equipment / Piling Equipment: Introduction to Tunnel Boring Machines- Details and Operation of a Hard-Rock TBM Details of Earth Pressure Balance (EPB) TBM- Details and operation of Slurry TBM & Components- Hydraulic Grabs- Piling Rig	**8 Hrs**
UNIT-V	**L1,L2**
Mechanization and Digitalization in Construction and Safety in Construction	**8 Hrs**

Equipment: Importance of Digital Analytics- Digital Solution in Construction Projects- Importance of Mechanization - Railway Track Construction- Rebar Processing Machine- Operation of Mechanized Equipment- Introduction to 3D Concrete Printer- Importance of Safety- Various PPE & Purpose- Safety of Men & Machines at Work- Safety During Construction Activities Safety with Tools & Tackles	

Course Outcomes: After completing the course, the students will be able to	
CO1	Evaluate equipment and techniques required during construction
CO2	Understand the operation of a batching plant.
CO3	Analyze the equipment life cycle management.
CO4	Demonstrate basic knowledge about Construction equipment and machinery.
CO5	Comprehend mechanization and digitalization in construction

Reference Books	
1.	Velumani. P, "Construction Techniques and Practices", SIA Publishers & Distributers Pvt Ltd, 2020.
2.	Dr. Manoranjan Samal, "Advanced Construction Techniques and Equipment" S.K. Kataria & Sons
3.	S.C.Sharma, "Construction Equipment and management" E-Book .2019
4.	Mahesh varma, , "Construction Equipment and its Palnningand Applications", 5th edition, Metroplolitan Book Co. Publishers,, 2005.
5.	S.Seetharaman, "Construction Engineering and Management", 4 th Edition , Umesh publications, New Delhi, 1999.

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 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
CONCRETING TECHNIQUES AND PRACTICES (Theory)		
Course Code: MVJ22CV453		**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	To present the basics of concrete and different materials used in it.
2	To impart knowledge on materials used in concrete, relevant Indian standard codes, and practical aspects on concreting activities at projects.
3	To explain the importance of making good quality concrete to build durable structures.
4	To introduce the Design of concrete mixes from the Industrial experiences at Sites and optimization of higher grades of Concrete.
5	To learn the best practices in concrete construction from industry's decades of experiences, thumb rules, mitigation of concreting issues at Sites

UNIT-I	**L1,L2**
Introduction to concrete, overview of materials- cement, low carbon cement, coarse aggregate and fine aggregate, and mineral admixture:- fly ash, GGBS, micro silica / silica fume, metakaolin / rice husk ash, composite cement and ultrafine materials, lab test - fineness of fly ash, recycled aggregate	**8 Hrs**
UNIT-II	**L1,L2,L3**
Water and chemical admixture: source, requirements, limits and testing Blending of aggregate -: Blending of fine and coarse aggregate, gradation for optimization and practical aspects.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Mix design - Volumetric mix design, mix design by absolute volume method, worked out practical examples based on industries experience at project sites over several decades, higher grades of concrete, high performance concrete, test on concrete: workability of concrete, flexural and compressive strength tests.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Production of concrete-: batching plant, calibration, mixing and transportation of concrete handling of concrete at construction, ready-mix concrete, pumping, placing of concrete with boom placers, levelling, vibration and compaction, cold joints, finishing and curing and protection of concrete	**8 Hrs**
UNIT-V	**L1,L2,L3**
Special types of concrete: self-compacting concrete, mass concrete, dry lean concrete, geopolymer concrete, pavement quality concrete, fiber reinforced concrete, composite concrete, lightweight concrete, ferrocement, shotcreteing, guniting, grouting, challenges faced at sites: plastic shrinkage cracks, plastic settlement, honey comb, bug holes, cover to concrete, do's and don'ts in concrete construction, site shoot, introduction on 3D printing.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to

CO1	Evaluate the properties of concrete by conducting test on cement, aggregate and concrete (with & without admixtures) for using the data for Mix design procedures
CO2	Understand to Select and proportionate different materials used in a concrete mix including admixtures
CO3	Design a concrete mix as per requirement of construction project
CO4	Apply the best practices in concrete construction from industry's requirement, thumb rules, mitigation of concreting issues at Sites.

Reference Books	
1.	Concrete Technology by M. S. Shetty, S Chand, New Delhi-110055.
2.	Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.
3.	IS 456, IS 269, IS 516, IS 1786, IS 1893, IS 12269, IS 9103, IS 8112

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
Watershed Management (Theory)		
Course Code: MVJ22CV454		**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	To understand Watershed Hydrology
2	To estimate water demand and learn, water conservation methods
3	To estimate water demand and learn, water conservation methods
4	To estimate water demand and learn, water conservation methods

UNIT-I	**L1,L2**
Principles of Watershed Management: Basics concepts, hydrology and water availability, surface water, ground water, conjunctive use, human influences in the water resources system.	**8 Hrs**
UNIT-II	**L1,L2**
Conservation of Water: Perspective on recycle and reuse, wastewater reclamation, social aspects of watershed management and community participation, private sector participation, institutional issues, socio-economy, integrated development, water legislation and implementations, case studies.	**8 Hrs**
UNIT-III	**L1,L2**
Water Harvesting: Rainwater management, conservation, storage and effective utilization of rainwater, structures for rainwater harvesting, roof catchments system, check dams, aquifer storage.	**8 Hrs**
UNIT-IV	**L1,L2**
Sustainable Watershed Approach: Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, soil erosion and conservation	**8 Hrs**
UNIT-V	**L1,L2**
Applications of RS and GIS in Watershed management: Role of decision support system in watershed management, watershed characteristics of coastal regions, coastal aquifer tor management, uniqueness of coastal water resources.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Discuss surface and ground water resources system and, human influences
CO2	Integrate water resources system in arid and semi-arid regions and explain watershed aquifer for management.
CO3	Analyze water resources related issues for conservation and synthesize augmentation of water resources
CO4	Design integrated watershed management system
CO5	Apply modern tools in watershed management

Reference Books

1.	Murthy, J. V. S., "Watershed Management in India", New Age Publishers, New Delhi. 2nd Edition, 2017.
2.	Singh Vir, Raj., "Watershed Planning and Management", Yash Publishing House, Bikaner.3rd Revised Edition, 2016
3.	"Decision Support System for Integrated Watershed Management", Colorad State University. 2012.
4.	"Decision Support System for Integrated Watershed Management", Colorad State University. 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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
Universal human values course **(Theory)**		
Course Code: MVJ22UHV48		**CIE Marks: 50**
Credits: L:T:P: 1:0:0		**SEE Marks: 50**
Hours: 15L		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.	
2	Facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.	
3	Highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.	

UNIT-I	**L1,L2**
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations. **Practical Sessions**: (1) Sharing about Oneself (2) Exploring Human Consciousness (3) Exploring Natural Acceptance. Video link: • https://www.youtube.com/watch?v=85XCw8SU084 • https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3p Z3yA7g_OAQz • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**3 Hrs**
UNIT-II	**L1,L2**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health. **Practical Sessions**: (4) Exploring the difference of Needs of Self and Body (5) Exploring Sources of Imagination in the Self (6) Exploring Harmony of Self with the Body Video link: • https://www.youtube.com/watch?v=GpuZo495F24 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**3 Hrs**
UNIT-III	**L1,L2**
Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order. **Practical Sessions**: (7) Exploring the Feeling of Trust (8) Exploring the Feeling of	**3 Hrs**

Respect (9) Exploring Systems to fulfill Human Goal Video link: • https://www.youtube.com/watch?v=F2KVW4WNnS • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	
UNIT-IV	**L1,L2**
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence. **Practical Sessions**: (10) Exploring the Four Orders of Nature (11) Exploring Co-existence in Existence Video link: • https://www.youtube.com/watch?v=1HR-QB2mCF0 • https://www.youtube.com/watch?v=lfN8q0xUSpw • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**3 Hrs**
UNIT-V	**L1,L2**
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession **Practical Sessions**: (12) Exploring Ethical Human Conduct (13) Exploring Humanistic Models in Education (14) Exploring Steps of Transition towards Universal Human Order Video link: • https://www.youtube.com/watch?v=BikdYub6RY0 • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**3 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Explore themselves, get comfortable with each other and with the teacher
CO2	Enlist their desires and the desires are not vague.
CO3	Restate that the natural acceptance (intention) is always for living in harmony, only competence is lacking
CO4	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them
CO5	Present sustainable solutions to the problems in society and nature

Reference Books	
1.	AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AicteSipUHV _download.php
2.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P

	Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
3.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
4.	Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: IV		
Additional Mathematics-II (Common to all branches)		
Course Code:	**MVJ22MATDIP-2**	**CIE Marks:50**
Credits: L:T:P:S: 3:0:0:0		**SEE Marks: 50**
Hours: 30L		**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To familiarize the important concepts of linear algebra.	
2	Aims to provide essential concepts differential calculus, beta and gamma functions.	
3	Introductory concepts of three-dimensional geometry along with methods to solve them.	
4	Linear differential equations	
5	Formation of partial differential equations.	

UNIT-I	
Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and eigen vectors of a square matrix. Diagonalization of a square matrix of order two.	**8 Hrs**

UNIT-II	
Differential calculus: Indeterminate forms: L-Hospital rule (without proof), Total derivatives, and Composite functions. Maxima and minima for a function of two variables. Beta and Gamma functions: Beta and Gamma functions, Relation between Beta and Gamma function-simple problems.	**8Hrs**
UNIT-III	
Analytical solid geometry : Introduction –Directional cosine and Directional ratio of a line, Equation of line in space- different forms, Angle between two line, shortest distance between two line, plane and equation of plane in different forms and problems.	**8Hrs**
UNIT-IV	
Differential Equations of higher order: Linear differential equations of second and higher order equations with constant coefficients. Inverse Differential operator, Operators methods for finding particular integrals , and Euler – Cauchy equation.	**8 Hrs**
UNIT-V	
Partial differential equation: Introduction- Classification of partial differential equations, formation of partial differential equations. Method of elimination of arbitrary constants and functions. Solutions of non-homogeneous partial differential equations by direct integration. Solution of Lagrange's linear PDE.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Make use of matrix theory for solving system of linear equations and compute eigenvalues and eigen vectors required for matrix diagonalization process.
CO2	Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.
CO3	Understand the Three-Dimensional geometry basic, Equation of line in space-different forms, Angle between two line and studying the shortest distance .
CO4	Demonstrate various physical models through higher order differential equations and solve such linear ordinary differential equations.
CO5	Construct a variety of partial differential equations and solution by exact methods.

Reference Books	
1	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 43rd Edition, 2013.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition,2014.
3.	Ramana B. V., "Higher Engineering Mathematics", Tata Mc Graw-Hill, 2006.
4.	Bali N. P. & Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 8th Edition.

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 for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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.

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Semester: V		
Construction Management and Entrepreneurship (Theory)		
Course Code:MVJ22CV51		**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	**To understand the concept of Scheduling and cost management in construction project**
2	**To go through the Statutory and regulatory requirements in construction**
3	**To explain the concept of procurement and contract management**
4	**To understand Quality and Safety during construction.**
5	**To identify the risks and its management.**

UNIT-I	**L1,L2**
Planning and Scheduling: Construction project formulation – construction management, define scope – scope management, types of project planning and its management, Statutory and regulatory requirements- layout and building plan approval, contract, Fire and Safety, Quality, Environmental, commencement certificate, legal and public policies. **Schedule management – WBS, Bar Charts, Sequencing and Dependency, Network Diagram, Activity Duration, Critical Path Method, PERT, Case study.** **Cost Management - Creating schedules, Assigning Resources, Cost, Evaluation, Optimization and**	**8Hrs**

Tracking. **Video link / Additional online information: (Self Learning)** • **Construction planning and management: nptel.ac.in/courses/105/103/105103093/**	
UNIT-II	**L1,L2**
Resource management: Basic concepts of resource management, class of labour, Wages & statutory requirement, Labor Production rate or Productivity, Factors affecting labour output or productivity. Construction Equipment - classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders, and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipment. Selection of construction equipment and basic concept on equipment maintenance **Video link / Additional online information: (Self Learning)** • **Principles of construction management: nptel.ac.in/courses/105/103/105103093/**	**8 Hrs**
UNIT-III	**L1,L2**
Contract and Procurement management : Procurement – procurement types, planning, stages – procurement execution – sustainable procurement management **Construction contract –formation, types, essential elements, contract law – tendering process- contract award – Documentation – contractor and sub-contractor management –**	**8 Hrs**

claims – disputes- compensation – breach of contract – project completion and project closure	
UNIT-IV	**L1,L2**
Quality, Safety and Risk Management: Quality Management - Occupational Health, Safety and Environment, Barriers, Quality Management System – Chart and tools. **Safety management - safety requirements, Safety and Health codes.** **Risk management - Process, Terminology, Identification, Analysis and Response Strategy Completion certificate, occupancy certificate, Facilities management**	**8 Hrs**
UNIT-V	**L1,L2**
Introduction to Entrepreneurship: Characteristics of a Successful Entrepreneur, Understand the entrepreneurial journey, different entrepreneurial styles, personality traits, strengths, and weaknesses. 5M Model, Communication skills: communication breakdown-miscommunication and poor listening, rectification. **Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.** **Video link / Additional online**	**8 Hrs**

information: (Self Learning) • **Entrepreneurship: nptel.ac.in/courses/110/106/110106141/**	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Develop WBS and estimate the resource requirements**
CO2	**Analyse the cost control monitoring and accounting methods for a project**
CO3	**Understand the Statutory and legal requirements for a construction**
CO4	**Prepare the plan for procurement management and Risk mitigation.**
CO5	**Understand the concept of entrepreneurship and business planning.**

Reference Books	
1.	**Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw Hill Publishing Company, New Delhi.**
2.	**Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia Publications Pvt. Ltd. New Delhi**
3.	**Engineering Economics, R Panneerselvam, Eastern Economy Edition 2001, PHI, ISBN – 81- 203-1743-2.**
4.	**Cost Accounting, Khan M Y, 2nd Edition, 2000, Tata McGraw-Hill, ISBN 0070402248**
5.	**Mechanical Estimating & Costing, T.R.Banga, S.C.Sharma, 16th Edition, 2011, Khanna Publishers, ISBN 8174091009**
6.	**Poornima M. Charantimath, "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson education.**

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksare executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V	
Engineering Geology and Geo-Informatics (Theory and Practice)	
Course Code: MVJ22CV52	CIE Marks: 50
Credits: L:T:P: 3:0:2	SEE Marks: 50
Hours: 40L + 26P	SEE Duration: 3 Hrs.
Course Learning Objectives: The students will be able to	
1	To inculcate the importance of earth's interior and application of Geology in civil engineering in Geo Hazard mitigation and management
2	To create awareness among Civil engineers regarding the resources of earth
3	To provide knowledge on dynamic Geology and its importance in modifying the physical character of rocks which cause rocks suitable or unsuitable in different civil engineering projects such as Dams, bridges, tunnels and highways.
4	To educate the ground water management regarding diversified geological formations, . To highlight the concept of rain water harvesting.
5	To understand the application of Remote Sensing and GIS, Natural disaster and management and environmental awareness. To understand the subsurface using geospatial data
6	To provide decision support on the nature of the basic raw materials used in construction. To provide decision support on Lithological characters and subsurface conditions
7	To describe various geological maps and interpretation of geological data for mining and subsurface investigations.

UNIT-I	L1,L2,L3
Introduction, the scope of earth	8 Hrs

science in Engineering. Earth's internal structure and composition, internal dynamics and Plate tectonics, Earthquakes - types, causes, so-seismic lines, seismic zonation, seismic proof structures. Volcanic eruption - types, causes. Landslides-causes types, preventive measures; Tsunami – causes, consequences, mitigation. Cyclones - causes and management.	
UNIT-II	**L1,L2,L3**
Earth Materials in Construction Minerals -Industrial, rock-forming and ore minerals. Physical properties, composition. Rocks Types, structure/Texture, mineral composition occurrence, properties. Decorative (facing/polishing), railway ballast, rocks for masonry work, monumental/architecture, Dressing of stones, Requirement of good building stones.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Earth Surface process and Resources Weathering, type, causes, soil insitu, drifted soil, soil profile, soil mineralogy, structure, types of soil, Black cotton soil v/s Lateritic soil; effects of weathering on monumental rocks. Soil Horizon, Soil Classification by Grain Size.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Surface and sub investigation for deep foundation, Dip and strike, and outcrop problems (numerical problem geometrical/ simple trigonometry based), Borehole data(and problems), Faults, folds, unconformity, joints, types, recognition and their significance in Civil engineering	**8 Hrs**

projects like tunnel project, dam project, Reservoir site.	
UNIT-V	**L1,L2,L3**
Surface and sub investigation for deep foundation Dip and strike, and outcrop problems(numerical problem geometrical/ simple trigonometry based), Borehole data(and problems), Faults, folds, unconformity, joints, types, recognition and their significance in Civil engineering projects like tunnel project, dam project, Reservoir site,.	**8 Hrs**

Sl.NO	Experiments
1	Identification of common minerals based on Physical Properties
2	Identification of rocks used in building construction based on Physical properties
3	Solving Geological maps for suitability for aqua duct
4	Geological maps with inclined beds, suitability for tunnels/ Dams
5	5 Geological maps with folds, in tunnels/ Dams
6	Geological maps with unconformity , in tunnel/dam project
7	Geological maps with faults in Dams/tunnels project
8	One Day Nearest Field Visit Investigation.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply geological knowledge in different civil engineering practice.
CO2	Acquire knowledge on durability and competence of foundation rocks, and will be able to use the best building materials.
CO3	Students will become competent enough for the safety, stability, economy and life of the structures that they construct
CO4	Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems

CO5	**Students will become Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering for safe and solid construction.**

Reference Books	
3.	**Engineering Geology, by Parthasarathy et al, Wiley publications**
4.	**A textbook of Engineering Geology by ChennaKesavulu, Mac Millan India Ltd**
3.	**Principle of Engineering Geology, by K.M. Bangar, Standard publishers**
4.	**Physical and Engineering Geology, by S.K. Garg, Khanna publishers**
5.	**Principles of Engineering Geology, by KVGK Gokhale, BS Publications**
6.	**Introduction to Environmental Geology by Edward A Keller, Pearson publications.**
7.	**Engineering Geology and Rock Mechanics B. P. Verma, Khanna publishers**
8.	**Principles of Engineering Geology and Geotechnics, Krynine and Judd, CBS Publications**

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V	
Concrete Technology **(Theory and Practice)**	
Course Code: MVJ22CV53	**CIE Marks: 50**
Credits: L:T:P: 3:0:2	**SEE Marks: 50**
Hours: 40L + 26P	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	**To recognize material characterization of ingredients of concrete and its influence on properties of concrete**
2	**To study the properties of fresh concrete and hardened concrete**
3	**Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.**
4	**Ascertain various types of special concrete with their properties.**

UNIT-I	L1,L2,L3
Concrete Ingredients **Cement manufacturing process, chemical composition and their importance, hydration of cement, types of cement. Testing of cement, steps to reduce carbon footprint. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction, and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders, and air entraining agents. Mineral admixtures – Pozzolanic and cementitious materials, Fly ash, GGBS, silica**	**8 Hrs**

fumes, Metakaolin and rice husk ash. **https://nptel.ac.in/courses/105102012**	
UNIT-II	**L1,L2,L3**
Fresh Concrete **Factors affecting workability. Measurement of workability– slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.**	**8 Hrs**
UNIT-III	**L1,L2,L3**
Hardened Concrete **Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull-out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations**	**8 Hrs**
UNIT-IV	**L1,L2,L**

	3
Concrete Mix Design **Principles of concrete mix design, Parameters and factors influencing mix design, Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Special Concretes **RMC-manufacture and requirement as per QCI-RMCPCS, properties, advantages, and disadvantages. Self-Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - types of fibres, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix proportion and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High-Performance Concrete.**	**8 Hrs**

Sl.NO	**Experiments**
1	**Testing of cement: Consistency, fineness, setting time,**
2	**Specific Gravity, Soundness and strength of cement**
3	**Testing of fine aggregate: Specific Gravity, sieve analysis and zoning, bulking of fine**
4	**aggregate, bulk density, silt content.**

5	Testing of coarse aggregate: Specific Gravity, sieve analysis, bulk density, flakiness index,
6	elongation index, water absorption & moisture content, soundness of aggregate.
7	Concrete Mix design by IS code method as per 10262- 2019 & 456-2000, DOE method.
8	Demonstration of Testing of concrete cube of specified strength
9	Demonstration of Testing of concrete beam for pure bending

Course Outcomes: After completing the course, the students will be able to	
CO1	Relate material characteristics and their influence on microstructure of concrete.
CO2	Distinguish concrete behaviour based on its fresh and hardened properties.
CO3	Illustrate proportioning of different types of concrete mixes for required fresh and hardened properties using professional codes.
CO4	Select a suitable type of concrete based on specific application.

Reference Books	
1.	M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.
2.	A.R. Santha Kumar, "Concrete Technology", Oxford Un iversity Press, New Delhi (NewEdition).
3.	Neville A.M. "Properties of Concrete"-4th Ed., Longman.
4.	Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V	
Environmental Engineering Lab (Practice)	
Course Code: MVJ22CVL54	**CIE Marks: 50**
Credits: L:T:P: 0:0:2	**SEE Marks: 50**
Hours: 26P	**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to	
1	To learn different methods of water & waste water quality
2	To conduct experiments to determine the concentrations of water and waste water
3	To determine the degree and type of treatment
4	To understand the environmental significance and application in environmental engineering practice.

Sl.NO	Experiments	L3,L4
1	Determination of Ph and Turbidity.	
2	Determination of Acidity and Alkalinity	
3	Determination of Calcium, Magnesium and Total Hardness	
4	Determination of Dissolved Oxygen	
5	Determination of BOD.	
6	Determination of Chlorides	
7	Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.	
8	Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids, iv) Volatile Solids, Fixed Solids v) Settleable Solids.	
9	Determination of optimum coagulant dosage using Jar test apparatus	
10	Determination Nitrates and Iron by spectrophotometer	
11	Determination of	

	COD (Demonstration)
12	**Air Quality Monitoring (Demonstration)**
13	**Determination of Sound by Sound level meter at different locations (Demonstration)**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Acquire capability to conduct experiments and estimate the concentration of different parameters.**
CO2	**Compare the result with standards and discuss based on the purpose of analysis.**
CO3	**Determine type of treatment, degree of treatment for water and waste water.**
CO4	**Identify the parameter to be analysed for the student project work in environmental stream.**

Reference Books	
1.	**Garg, S.K., Sewage Disposal and Air Pollution Engineering, Khanna Publishers, 2008.**
2.	**Wastewater Engineering Treatment and reuse, Metcalf and Eddy, Fourth edition, 2007, Tata McGraw-Hill Edition,**
3.	**Environmental Engineering, Peavy, H.S., Rowe, D.R. and Tchobanoglous, G, 2013 McGraw Hill.**

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: V		
Numerical Methods in Civil Engineering (Theory)		
Course Code: MVJ21CV551		**CIE Marks:50**
Credits: L:T:P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 03 Hrs**
Course Learning Objectives: The students will be able to		
1	**To learn various numerical techniques.**	
2	**To solve Numerical differentiation and integration problems.**	
3	**Apply numerical techniques to solve civil engineering problems.**	

UNIT-I	L1,L2,L3
Historical development of Numerical techniques: **Role in investigations, research and design in the field of civil engineering development of algorithm/ flow charts for following methods for the solution of linear simultaneous equation- Gaussian elimination method, Gauss-Jordan matrix inversion method, Gauss-Siedel method and Factorization method.**	**8 Hrs**
UNIT-II	**L1,L2,L3**
Development of algorithm for Bisection method: Newton-Raphson method and its applications for solution of nonlinear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Numerical differentiation and integration:	**8Hrs**

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method – Two-point and three-point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules. Trapezoidal rule, Simpson's one-third and their application for computation of area of BMD drawn for statically determinate beams. 1/3rules.	
UNIT-IV	**L1,L2,L3**
Development of algorithms and differential equations: **New Marks method for computation of slopes and deflections in statically determinate beams. Development of algorithm and application of solution of ordinary differential equation to civil engineering problems by Euler's method, Runge Kutta 4th order method**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Expression of derivatives by finite difference: **Introduction, backward differences, forward differences, and central differences. Application of finite difference method for analysis of statically determinate beams, statically indeterminate beams, Buckling of columns, Beams on elastic foundation.**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**To learn various numerical techniques.**
CO2	**To solve Numerical differentiation and integration problems.**
CO3	**Apply numerical techniques to solve civil engineering problems.**
CO4	**To develop algorithms and differential equations to civil engineering problems.**

CO5	**Apply finite difference method for analysis of statically determinate structures.**

Reference Books	
1.	**Grewal. B.S. and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi**
2.	**Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi.**
3.	**Chapra. S.C. and Canale. R. P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi.**
4.	**Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi.**
5.	**Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi.**

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 for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions

for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V		
Occupational Safety and Health Monitoring (Theory)		
Course Code: MVJ22CV552		**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	**To Identify hazards in the workplace that pose a danger or threat to their safety or health.**
2	**To Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.**
3	**To analysis a potential safety or health hazard**
4	**To Discuss role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.**
5	**To Identify decisions required to maintain protection of the environment, workplace as well as personal health and safety**

UNIT-I	**L1,L2,L3**
Occupational Hazard and Control Principles: **Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation.**	**8Hrs**
UNIT-II	**L1,L2,L3**
Ergonomics at Work Place: **Ergonomics Task analysis,**	**8 Hrs**

Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.	
UNIT-III	**L1,L2,L3**
Fire Prevention and Protection: **Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.** **Electrical Safety, Product Safety: Technical Requirements of Product safety.**	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Health Considerations at Work Place: **Types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability.**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Occupational Health and Safety Considerations: **Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants, and construction sites. Policies, roles and**	**8 Hrs**

responsibilities of workers, managers and supervisors.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify hazards in the workplace that pose a danger or threat to their safety or health.
CO2	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
CO3	Present a coherent analysis of a potential safety or health hazard
CO4	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
CO5	Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Reference Books	
1.	Goetsch D. L.,(1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
2.	Heinrich H.W.,(2007),"Industrial Accident Prevention-A Scientific Approach",McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3.	"Industrial Safety and Pollution Control Handbook.
4.	Colling D.A.,(1990),"Industrial Safety Management and Technology", Prentice Hall,New Delhi.
5.	Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

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 marksare executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V		
Solid Waste Management (Theory)		
Course Code: MVJ22CV553		**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	**To facilitate the learners to understand fundamentals of key elements in solid waste management and governance.**	
2	**To impart knowledge to arrive strategies for waste management and selection of technologies for processing, treatment, and disposal**	
3	**To examine and plan designs for material recovery facility, micro composting units, incinerators, biodigesters, and landfills**	

UNIT-I	L1,L2
Introduction to Solid waste management **Definition, Classification, need and Global perspective of solid waste management. Policies and legislative frameworks, Government initiatives on Solid waste management. Integrated solid waste management and concept of 3R's, Role of stakeholders.**	**8 Hrs**
UNIT-II	**L1,L2**
Waste generation and characterization **Factors affecting waste generation and methods to estimate the quantity of waste generated. Physical, chemical, and biological methods of waste characterization.**	**8 Hrs**
UNIT-III	**L1,L2**
Storage, collection, and Transportation of waste	**8 Hrs**

Methods of storage, Storage container types and materials, onsite processing. Methods of collection and collection vehicles, Analysis, and design of Hauled and Stationary container systems with case studies. Transfer stations – feasibility and economic analysis.	
UNIT-IV	**L1,L2**
Waste processing and Disposal **Waste processing facilities- MRFs Landfills – Selection of liners, Design, Closure and Leachate management, Composting, Waste to Energy concepts – Incineration, Biogas recovery and Refuse derived fuels RDFs.**	**8 Hrs**
UNIT-V	**L1,L2**
Special Waste and Smart Solid Waste Management **Definition, Classification, Effects, treatment, disposal, Legislation and case studies of Hazardous waste, Construction and demolition waste, Electronic waste, Plastic, Biomedical waste and Radioactive waste. Life cycle assessment of solid waste management, Automation and IOT in storage, collection and treatment of solid waste. Case studies.**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Articulate the elements of solid waste management and categorize the waste based on physical, chemical, and biological characteristics.**
CO2	**Design a waste collection system for onsite collection, storage and demonstrate waste transfer and transport operations.**
CO3	**Evaluate and develop waste processing and treatment methods for solid and hazardous waste with sustainable practices.**

CO4	**Select appropriate disposal methods such as landfills, waste to energy plants and its handling in an efficient way.**
CO5	**Develop reduce, reuse, and recycling methods for special waste and prepare smart solutions for solid waste management.**

Reference Books	
1.	**Handbook of Solid Waste Management by Frank Kreith, George Tchobanoglous 1994**
2.	**Management of Municipal Solid waste by T.V. Ramachandra 2009**
3.	**Hazardous Waste management by Michael D LaGrega, Philip. L. Buckingham, Jeffery C. Evans 2001**

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20

marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V		
Remote Sensing and GIS (Theory)		
Course Code: MVJ22CV554		**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 concept of using photographic data to determine relative positions of points.**
2	**Study the methods of collection of land data using Terrestrial and Aerial camera.**
3	**Analyze the data gathered from various sensors and interpret for various applications.**
4	**Apply the principles of RS, GIS and GPS in various scopes of Civil Engineering**

UNIT-I	**L1,L2,L3**
Remote Sensing - Definition, types of remote sensing, components of remote sensing, electromagnetic spectrum, Black body, Atmospheric windows, energy interaction with earth surface features. Spectral reflectance curve. Platforms and sensors. Sensor resolutions. Types of satellites Indian and other remote sensing satellites (IRS, IKONS and Landsat). Principle of visual interpretation - key elements. **Video link / Additional online information: (Self Learning)** • **NPTEL lecture videos**	**8 Hrs**
UNIT-II	**L1,L2,L3**
Photogrammetry: Introduction types of Photogrammetry, Advantages Photogrammetry, Introduction to digital	**8 Hrs**

Photogrammetry. Aerial Photogrammetry: Advantages over ground survey methods- geometry of vertical photographs, scales of vertical photograph. Ground coordination relief displacement, scale ground coordinates – flight planning	
UNIT-III	**L1,L2,L3**
Geographic Information System - Introduction, Functions and advantages, sources of data for GIS. Database – Types, advantages, and disadvantages. Data Analysis - overlay operations, network analysis, spatial analysis. Outputs and map generation. GPS- components and working principles.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Applications of GIS, Remote Sensing and GPS: (1) Water Resources engineering and management- prioritization of river basins, water perspective zones and its mapping, Highway, and transportation -highway alignment, Optimization of routes, accident analysis, Environmental Engineering- Geostatistical analysis of water quality, rainfall	**8 Hrs**
UNIT-V	**L1,L2,L3**
Applications of GIS, Remote Sensing and GPS: (2) Urban Planning & Management, urban sprawl, Change detection studies, forests and urban area, agriculture, Disaster Management. Layouts: Dead end, Radial, Grid iron, Circular system.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Understand and remember the**

	principle of Remote Sensing (RS) and Geographical Information Systems (GIS) data acquisition and its applications
CO2	Apply RS and GIS technologies in various fields of engineering and social needs
CO3	Analyze and evaluate the information obtained by applying RS and GIS technologies.
CO4	Create a feasible solution in the different fields of application of RS and GIS

Reference Books	
1.	Higher Surveying, Chandra A.M, 2015, 3rd Edition, New age international (P) Ltd, ISBN: 81224381 21
2.	Remote Sensing and GIS, Bhatta B, 2011, Oxford University Press, New Delhi, ISBN - 0198072392
3.	Principles of Remote sensing and Image Interpretation, Lillesand and Kiefer, 2011, 6th Edition, John Wiley Publishers, New Delhi, ISBN – 8126532238.
4.	Geographic Information System-An Introduction, Tor Bernharadsen, 2009, 3rd Edition, Wiley India Pvt. Ltd. New Delhi, ISBN - 9788126511389
5.	Remote Sensing, Robert A. Schowengerdt, 2009, 3rd Edition, Elsevier India Pvt Ltd, New Delhi

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V		
Research Methodology and IPR (Theory)		
Course Code: MVJ22RM157		**CIE Marks: 50**
Credits: L:T:P: 2:2:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to	
1	To Understand the knowledge on basics of research and its types.
2	To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
3	To learn Ethics in Engineering Research.
4	To Discuss the concepts of Intellectual Property Rights in engineering.

UNIT-I	L1,L2,L3
Introduction: Meaning of Research, Objectives of Engineering Research, and	8 Hrs

Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	
UNIT-II	**L1,L2,L3**
Literature Review and Technical Reading **New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet.** **Attributions and Citations: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged,** **Acknowledgments in, Books Dissertations, Dedication or Acknowledgments**	**8 Hrs**
UNIT-III	**L1,L2,L3**
Building Intellectual Property Rights, Law of Patents, Fundamentals of Patent Law - Evolution of the patent system, Patentability Requirements; Patentable Subject Matter; Industrial Applicability/Utility;	**8 Hrs**

Novelty; Anticipation by publication; Anticipation by public knowledge and public use; Anticipation by public display; Anticipation by sale; Inventive Step/Non-Obviousness; Novelty Assessment; Inventive Step Assessment; Specification, Drafting of A Patent Specification - Introduction Patent Specification; Provisional Specification Complete Specification, Parts of the complete specification; Patent Procedure in India - PATENT PROCEDURE; Registration and Renewal fee payment; Patent Infringement - Infringement of a patent; Literal Infringement; Equivalence Infringement; Indirect Infringement; Defenses - Experiment - Research or Education - Bolar Exemption- Government use- Patent Exhaustion Patent Misuse- Inequitable Conduct - Remedies- Injunction- Account of profits- Costs; International Patent Regimes - International Instruments; Paris Convention; TRIPS AGREEMENT; PCT; BUDAPEST TREATY, Patenting Biotechnology Inventions - Unique nature of Biotechnology; Patentability Requirements and Biotechnology Inventions; Patentable Subject Matter- USA- Europe- India; Patentability of Software Inventions - Patentability of Software Inventions in USA; Patentability of software inventions in Europe; Patentability of Software Inventions in India.	
UNIT-IV	**L1,L2,L3**

Law of Copyright and Designs, Understanding Copyright Law - Historical Overview – Justification For Copyright Law - The Natural Law Justification - The Economic Rationale of Copyright Clause, Basic Concepts Underlying copyright Law - Idea – Expression Dichotomy Originality / Creativity – Fixation Term of Protection, Subject - Matter of Copyright - Literary Works - Dramatic Works - Musical Work - Artistic Works - Cinematograph Films and Sound recordings, Acquisition of Copyright in India, Rights of the Copyright Owner - Economic Rights - Moral Right or Droid Moral Right of Authorship or Paternity Rights - Rights against Distortion or Mutilation of the Original Works or Integrity Rights - Limitations -Limitations set under International Regime – Berne Convention - Rome Convention - Trips Agreement - Three Step Test, Infringement of Copyright -Transfer of copyright - License and Assignment – License and consent -Duration of a License Form and Content - Disputes in Respect of Licence - Types of Licenses- Exclusive and Non-Exclusive Licenses.	**8 Hrs**
UNIT-V	**L1,L2,L3**
Basic Principles of Design Rights - Justification for Protecting Designs - Historical Perspective -Features of Shape, configuration, Pattern or Ornament - or Composition of lines or colour - New or Original - Applied to an Article, Excluded Subject - Matter - Method or Principle of Construction -	**8 Hrs**

Features Dictated Solely by Function - Mechanical Device - Trademark, or Property Mark, or Artistic Work - immoral Designs and Designs Contrary to Public order–Rights of the Owner of Designs and Tests for Infringement. Assignment of Design Rights, Infringement of Designs.	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Know the meaning of engineering research.**
CO2	**Know the procedure of Literature Review and Technical Reading.**
CO3	**Know the fundamentals of patent law and drafting procedure.**
CO4	**Understanding the copyright laws and subject matters of copyrights and designs rights**

Reference Books	
1.	**"Research Methodology Methods and Techniques", C.R Kothari, New Age International Publishers,2004, 2nd Edition, ISBN (13) : 978-81-224-2488-1**
2.	**Dipankar Deb · Rajeeb Dey, Valentina E. Balas "Engineering Research Methodology", ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library**
3.	**David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4.**

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: V		
Environmental Studies (Theory)		
Course Code: MVJ22ENV58		**CIE Marks: 50**
Credits: L:T:P: 2:0:0		**SEE Marks: 50**
Hours: 30L		**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to	
1	**Relate interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences including geo-systems, biology, chemistry, economics, political science and international processes**
2	**Study drinking water quality standards and to illustrate qualitative analysis of water.**
3	**Critically evaluate the science and policy ramifications of diverse energy portfolios on air and water quality, climate, weapons proliferation and societal stability.**

UNIT-I	**L1, L2**
Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. **Ecosystems (Structure and Function): Forest, Desert, Rivers, Ocean Biodiversity: Types, Hot spots; Threats and Conservation of biodiversity, Deforestation.** **Video link: https://nptel.ac.in/courses/127/106/127106004/**	**6 Hrs**
UNIT-II	**L1, L2**
Advances in Energy Systems (Merits, Demerits, Global Status and	**6 Hrs**

Applications): Hydrogen, Solar, Tidal and Wind. **Natural Resource Management (Concept and case-study): Disaster Management, Sustainable Mining and Carbon Trading.** **Video link: https://nptel.ac.in/courses/121/106/121106014/**	
UNIT-III	**L1, L2**
Environmental Pollution: Surface and Ground Water Pollution, Noise pollution, Soil Pollution and Air Pollution. **Waste Management & Public Health Aspects: Bio-medical Waste, Solid waste, Hazardous waste and E-waste.** **Video link:** • **https://nptel.ac.in/courses/122/106/122106030/** • **https://nptel.ac.in/courses/105/103/105103205/** • **https://nptel.ac.in/courses/120/108/120108005/** • **https://nptel.ac.in/courses/105/105/105105160/**	**6 Hrs**
UNIT-IV	**L1, L2**
Global Environmental Concerns (Concept, policies, and case-studies): Global Warming, Climate Change, Acid Rain, Ozone Depletion and Fluoride problem in drinking water. **Video link:** • **https://nptel.ac.in/courses/122/106/122106030/** • **https://nptel.ac.in/courses/120108004/** • **https://onlinecourses.nptel.ac.in/noc19_ge23/preview**	**6 Hrs**
UNIT-V	**L1, L2**

Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems. **Video link:** • **https://nptel.ac.in/courses/105/102/105102015/** • **https://nptel.ac.in/courses/120/108/120108004/**	**6 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Describe the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.**
CO2	**Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.**
CO3	**Demonstrate ecology knowledge of a complex relationship between biotic and Abiotic components.**
CO4	**Apply their ecological knowledge to illustrate and graph a problem**
CO5	**Describe the realities that managers face when dealing with complex issues.**

Reference Books	
1.	**Principals of Environmental Science and Engineering, Raman Siva kumar, Cengage learning, Singapur, 2nd Edition, 2005.**
2.	**Environmental Science – working with the Earth G.Tyler Miller Jr. Thomson Brooks /Cole, 11th Edition, 2006**
3	**Textbook of Environmental and Ecology, Pratiba Singh, Anoop Singh & Piyush Malaviya , ACME Learning Pvt. Ltd. New Delhi, 1st Edition.**

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI	
Design of RCC Structures **(Theory and Practice)**	
Course Code: MVJ22CV61	**CIE Marks: 50**
Credits: L:T:P: 3:0:2	**SEE Marks: 50**
Hours: 40L + 26P	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2	Follow a procedural knowledge in designing various structural RC elements.
3	Impart the usage of codes for strength, serviceability and durability.
4	Acquire knowledge in analysis and design of RC elements.

UNIT-I	L1,L2,L3
Introduction to working stress and limit State Design: Introduction to working stress method, Difference between Working stress and Limit State Method of design. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section. Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Limit State Analysis of Beams: Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Limit State Design of Beams: Design of singly reinforced beams with check for shear, check for development length and other checks. Design of doubly reinforced beams and flanged sections without checks.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of Cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases	**8 Hrs**
UNIT-V	**L1,L2,L3**
Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load.	**8 Hrs**

Sl.NO	Experiments
1	Calculation of deflection of singly reinforced beam using Excel
2	Design of a simply supported RCC singly reinforced beam using Excel and draw the reinforcement details
3	Design of a simply supported RCC doubly reinforced beam using Excel and draw the reinforcement details
4	Design of singly reinforced beams with check for shear, check for development length and other checks using Excel.
5	Design of a cantilever beam using Excel and draw the reinforcement

6	Design a simply supported RCC one way slab with intermediate support and draw the reinforcement details
7	Design a two-way slab for the given data and prepare Bar bending schedule
8	Design a short axially loaded RC column using Excel
9	Design the reinforcement for RCC square column with isolated square footing
10	Design the reinforcement for RCC circular column with isolated square footing
11	Creation of models related to RC Structural elements. (Demonstration)
12	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the design philosophy and principles.
CO2	Solve problems of RC elements subjected to flexure, shear and torsion.
CO3	Demonstrate the procedure in designs of RC structural elements such as slabs, columns and footings
CO4	Owns professional and ethical responsibility.

Reference Books	
1.	N Subramanian, " Design of Concrete Structures" , Oxford university Press
2.	Unnikrishnan Pillai and Devdas Menon, " Reinforced Concrete Design" , McGraw Hill, New Delhi
3.	H J Shah, "Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)" , Charotar Publishing House Pvt. Ltd.
4	P C Varghese, "Limit State design of reinforced concrete", PHI, New Delhi

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Irrigation Engineering and Hydraulic Structures **(Theory)**		
Course Code: MVJ22CV62		**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	Analyse and design gravity dams.
2	Find the cross-section of earth dam and estimate the seepage loss
3	Design spillways and aprons for diversion works.
4	Design CD works and chose appropriate canal regulation works.

UNIT-I	**L1,L2,L3**
Storage Works- Reservoirs – Types of reservoirs, selection of site for reservoir, zones of storage of a reservoir, reservoir yield, estimation of capacity of reservoir using mass curve- Reservoir Sedimentation Life of Reservoir. Types of dams, factors affecting selection of type of dam, factors governing selection of site for a dam.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile, and practical profile of a gravity dam, limiting height of a low gravity dam, Factors of Safety – Stability Analysis, Foundation for a Gravity Dam, drainage and inspection galleries.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Earth dams: Types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, seepage through earth dam-graphical method, measures for control of seepage. Spillways: types of spillways, Design principles of Ogee spillways – Spillway gates. Energy Dissipaters and Stilling Basins Significance of Jump Height Curve and Tail Water Rating Curve – USBR and Indian types of Stilling Basins.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Diversion Head works: Types of Diversion head works- weirs and barrages, layout of diversion head work – components. Causes and failure of Weirs and Barrages on permeable foundations, -Silt Ejectors and Silt Excluders, Weirs on Permeable Foundations – Creep Theories – Bligh's, Lane's and Khosla's theories, Determination of uplift pressure- Various Correction Factors – Design principles of weirs on permeable foundations using Creep theories – exit gradient, U/s and D/s Sheet Piles – Launching Apron.	**8 Hrs**
UNIT-V	**L1,L2,L3**
Canal Falls : Types of falls and their location, Design principles of Notch Fall and Sarada type Fall. Canal regulation works, principles of design of cross and distributary head regulators, types of Canal escapes – types of canal modules, proportionality, sensitivity, setting and flexibility. Cross Drainage works: types, selection of suitable type, various types, design considerations for	**8 Hrs**

cross drainage works.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Know types of water retaining structures for multiple purposes and its key parameters considered for planning and designing
CO2	Understand details in any Irrigation System and its requirements
CO3	Analyse and Design of a irrigation system components

Reference Books	
1.	Irrigation Engineering and Hydraulic structures by Santhosh kumar Garg, Khanna Publishers
2.	Irrigation engineering by K. R. Arora Standard Publishers
3.	Irrigation and water power engineering by Punmia & Lal, Laxmi publications Pvt. Ltd., New Delhi
4.	Theory and Design of Hydraulic structures by Varshney, Gupta & Gupta

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Design of Bridges **(Theory)**		
Course Code: MVJ22CV631		**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	Introduce students to various aspects of Bridge structures, its components.
2	Understand the hydraulic design concepts of Bridges, various IRC loading standards.
3	Design small span bridges like culverts, slab decks, and T-beam decks and post tensioned slab
4	Understand various types of bearings, analysis of substructures, and foundations.
5	Understand super structure construction methods and practices

UNIT-I	**L1,L2,L3**
Introduction and Conceptual Design of Bridges Introduction, components of a bridge and their functions, Site investigations prior to bridge construction, classification of bridges, IRC loading standards, IRC A, AA, and 70 R. Hydraulic design of bridges, natural and artificial water ways, afflux, Economical span, problems.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Pipe culverts. Hydraulic design and structural design, IRC standards. Design problems. Design of Box culverts, general procedure of design for all the conditions of culvert , reinforcement details, Design example (students should be given to design the culvert for any one condition of loading)	**8 Hrs**
UNIT-III	**L1,L2,L3**
Design of Deck slab (Limit state method): Introduction, Design of deck slab. Effective dispersion of wheel load along the span and effective width concept, Arrangement of wheel loads of IRC A for obtaining maximum bending moment and shear force. Design example, Arrangement of IRC class AA obtaining maximum bending moment and shear force. Design example. Arrangement of IRC 70R loading for obtaining maximum bending moment and shear force. Design example.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Introduction to T-beam bridges: Code provisions, typical arrangement of longitudinal and cross girders, Pigeaud's method, design of interior panel (for IRC class AA & 70R), methods for finding load distribution among longitudinal girders (Courbon's, Hednry Jaguer's method), general steps of design (only design concepts).	**8 Hrs**
UNIT-V	**L1,L2,L3**
Bridge substructures, abutments and Piers: Types of abutments and piers, stability analysis of piers and abutments, base pressure distribution. Bridge bearings, types and their suitability.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Select the type of the bridge based on the site investigation inputs and be able to compute design discharge, linear water way , economic span and depth of scour
CO2	Design pipe culverts.

CO3	Design deck slabs for critical loads
CO4	Analyse the stability of bridge piers and abutments.
CO5	Recommend suitable bearings for the given type of bridge and support condition

Reference Books	
1.	Krishna Raju N, Design of Bridges, Oxford-IBH publishing, 5 th edition, New Delhi
2.	Rajagopalan, Bridge Super Structures, Narosa Publishing House, 2013, ISBN :817-31-964-78
3.	D. Johmson Victor, Essentials of Bridge Engineering, 6 th edition, Oxford IBH publications, New Delhi, 2019 ,ISBN:978-81-204-1717-5
4.	T.R.Jagadeesh & M A Jayaram, Design of Bridge Structures, 3 rd edition, PHI, New Delhi, 2020, ISBN:978-81-203-3385-29
5.	IRC : 112- 2020: Code of Practice for Concrete Bridges, July 2020, New Delhi

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Design of Formwork and Scaffolding (Theory)		
Course Code: MVJ22CV632		**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	To select the appropriate formwork system	
2	To design the formwork system	
3	To compute the bill of quantity for the formwork system	
4	To incorporate safer design and construction aspects including assembling and dismantling to prevent formwork failures	
5	To comprehend plan, layout and detailed drawing for formwork systems	

UNIT-I	L1,L2,L3
Introduction to Formwork Classification, benefits, objectives, areas of competitiveness, selection of Formwork, formwork materials, accessories and consumables, application of Tools. Formwork for Foundation, Wall, Columns, Slab and Beam. Conventional drawings. Vertical Application of Conventional Foundation Formwork, Formwork components, Components, assembly and de-shuttering of formwork System, Flex System, Heavy Duty Tower System, safety of work, Formwork for stairs, Load Bearing Tower.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Planning and Design of formwork Formwork planning and monitoring, basics of formwork design, design assumptions and design methods. Design of wall formwork, slab formwork and checks. Formwork drawing Concept and Preparation Guidelines, BOQ Calculation and Checklist.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Formwork cost estimation and optimization Schedule of formwork, Mobilization distribution, BOQ, Quantity Calculation, Cost optimization	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Modular and Special formwork, scaffolding Modular and Special formwork: Advantages and Limitations, Shuttering and de-shuttering, applications, Aluminium formwork - Drawings & Components, Activities, High rise construction, Table lifting system. Scaffolding: Modular scaffold Installation sequence, Tie and material specification, Ladder safety, Loading Classification, application, Components of L&T Modular Scaffolding system, Access scaffold Do's and Don'ts. Innovation and Global practices.	**8 Hrs**
UNIT-V	**L1,L2,L3**
Formwork building and erection, Formwork Failures Formwork assembly for Wall & Column Panels, Equipment and Layout, Plant and Machinery, Formwork erection and safety, Inspection and Corrections, Plant and Machinery, Code and Contractual Requirements. Formwork Failures: Causes, design deficiency, safety in formwork, prevention of formwork failures.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyse the project, and decide appropriate formwork materials and suitable formwork system
CO2	Design formwork systems as per Industrial requirement
CO3	Estimate the bill of quantity and optimize the formwork cost
CO4	Prepare the layout and detailed drawing for the formwork system

Reference Books	
1.	Jha, K.N., Formwork for Concrete Structures, First Edition, McGraw Hill. 2012
2.	Robert L. Peurifoy and Garold D. Oberiender, Formwork for Concrete Structures, McGraw-Hill, 1996
3.	IS 14687 -Guidelines for falsework for concrete structures

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Applied Geotechnical Engineering **(Theory)**		
Course Code: MVJ22CV633		**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	Appreciate basic concepts of soil mechanics applied in the design of foundations
2	Learn concepts of Geotechnical investigations required for civil engineering projects emphasizing in situ investigations
3	Conceptually learn various theories related to bearing capacity of soil and their application in the design of shallow foundations and estimation of load carrying capacity of pile foundation
4	Estimate internal stresses in the soil mass and application of this knowledge in proportioning of shallow and deep foundation fulfilling settlement criteria
5	Study about assessing stability of slopes and earth pressure on rigid retaining structures.

UNIT-I	**L1,L2,L3**
Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, sample disturbance and Bore hole log.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Drainage and Dewatering: Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method). Flownets: Importance, properties and applications, Phreatic Lines, Seepage in earth dams (with and without	**8 Hrs**
UNIT-III	**L1,L2,L3**
Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Factors influencing lateral earth pressure, Geotechnical design of gravity and cantilever retaining walls.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Stability of Slopes: Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts. Causes for slope instability, Methods of stabilisation of slopes	**8 Hrs**
UNIT-V	**L1,L2,L3**
Stresses in Soil: Geodesic stress and Stress due to structures, Boussinesq's Stress distribution in ground for point load, line load and uniformly distributed loads, Newmark's Chart, Contact Pressure, Pressure bulbs. Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to

CO1	Ability to plan and execute geotechnical site investigation program for different civil engineering projects
CO2	Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
CO3	Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
CO4	Ability to determine settlement in footing.

Reference Books	
1.	Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering,UBS PublishersandDistribu tors, NewDelhi.
2.	K.R.Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, NewDelhi.
3.	PC Varghese, Foundation Engineering, PHI India Learning Private Limited, NewDelhi.
4.	Punmia BC, Soil Mechanics and Foundation Engineering (2017), 16th edition, LaxmiPublicationsco., New Delhi.

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 are executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Design and Construction of Highway Pavements **(Theory)**		
Course Code: MVJ22CV634		**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	To impart a fundamental understanding to the basics of highway geometric design features	
2	To introduce the evaluation of pavement material characteristics to identify their suitability for construction	
3	To study the principles and design of flexible and rigid pavements according to IRC specifications	
4	To skill up for executing pavement construction with quality control and assurance along with Plants and Machinery selection	

UNIT-I	L1,L2,L3
Introduction and Subgrade materials: Overview of highway - Classification of roads, Pavement Layers – Components and Functions, Highway alignment and Survey, road development in India, Components and Geometric Standards of Highway Design **Pavement subgrade material:** Soils, Soil Characteristic Evaluation, desirable properties, tests (Virtual) - Liquid Limit, Plastic limit, Shrinkage Limit, Grain size analysis - Wet sieve and Hydrometer analysis, Water Content, Specific gravity, Free swell index, Relative density, Heavy compaction, California Bearing Ratio.	**8 Hrs**
UNIT-II	**L1,L2**
Pavement Materials **Stone aggregates:** Desirable properties, tests (Virtual) - Sieve analysis, Specific gravity, Water absorption, Bulk density, Wet Sieve analysis, Aggregate crushing value, Aggregate impact value, Combined Flakiness and Elongation index, Aggregate abrasion value, Soundness of aggregate, Characteristic evaluation **Bituminous binders:** Desirable properties, tests (Virtual) - Specific gravity, Penetration, Softening Point, Ductility, Elastic recovery, Flash point, Separation, Loss on heating, Matter soluble in trichloro ethylene, Absolute, Kinematic and Rotational Viscosity, Aging of Bitumen, Characteristic evaluation. **Bituminous paving mix:** Desirable properties, tests (Virtual) - Stripping value of coarse aggregate, Stone polishing value of coarse aggregate, Maximum specific gravity of bituminous mix, Marshall stability & flow, Binder content, Bulk specific gravity and density, Indirect tensile strength, Resilient Modulus (indirect tension test), Resistance of compacted asphalt mixtures to moisture-induced damage, Characteristic evaluation Cement: Desirable properties, tests (Virtual) - Consistency, Initial Setting Time, Final Setting Time, Mortar Cube compressive strength, Fineness of cement, Specific gravity of cement, Soundness of cement, Characteristic evaluation **Concrete:** Desirable properties, requirements, tests (Virtual) - Workability,	**8 Hrs**

Compressive Strength, Flexural strength, Characteristic evaluation	
UNIT-III	**L1,L2,L3**
Principles and Design of Pavements **Flexible Pavement:** Introduction, composition, factors governing design, design of flexible pavements as per IRC; Bituminous mix design (Marshall method), IIT Pave Software; Case study - Design Problem **Rigid pavement:** Introduction, composition, factors governing design, DLC and PQC mix design; design of concrete pavements as per IRC; Joints; Case study – Design Problem	**8 Hrs**
UNIT-IV	**L1,L2**
Plants and Machinery: Introduction; Asphalt Hot Mix Plant, Concrete Batching Plant, Wet Mix Macadam Plant, Earthmoving and Excavation Equipment, Paving Equipment, Slipform Paver, Paver Milling and Road Marking Equipment; Factors affecting output of Plant & Equipment; Initiatives to improve quality. **Construction Planning:** Concept of Highways, Planning; Schedules in Planning; Monitoring; Software in Planning	**8 Hrs**
UNIT-V	**L1,L2,L3**
Subgrade and Base Layer: Construction Practices and Quality Control; Granular Sub-base Construction Activities; Cement Treated Sub-base Construction Activities **Flexible Layers:** Wet Mix Macadam; Construction Practices of Wet Mix Macadam; Hot Mix Asphalt; Construction Practices of Hot Mix Asphalt Layer, Quality Control of Flexible Layers **Rigid Layers:** Dry Lean Concrete; Construction Practices of Dry Lean Concrete; Pavement Quality Concrete; Construction Practices of Pavement Quality Concrete, Quality Control of Rigid Layers **Pavement Evaluation:** Introduction, Pavement Condition Survey, Pavement Evaluation Functional and Structural, Distresses - Flexible and Rigid Pavement, Overlay Design of Flexible Pavement.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop an understanding of the fundamentals of pavement layer behaviour.
CO2	Comprehend the material specifications by interpreting the relationship between material properties and pavement behaviour.
CO3	Conduct different tests on road construction materials to evaluate their characteristics
CO4	Carry out the design of flexible and rigid pavements
CO5	Acquire skillful knowledge of pavement construction practices, plant and machinery selection and quality control

Reference Books	
1.	Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2.	Partha Chakraborty, “Principles of Transportation Engineering”, PHI Learning,
3.	Principles and Practices of Highway Engineering by Kadiyali L.R and Dr.Lal N.B., Khanna Publishers, New Delhi, 2003

4.	Relevant IRC and IS Codes of Practices, MoRTH Specification

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students must answer five questions, one from each unit for 16 marks adding up to 80 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: VI		
Water conservation and Rainwater Harvesting (Theory)		
Course Code: MVJ22CV641		**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	Appreciate basic concepts of Water and its importance.
2	Learn elementary knowledge of ground water.
3	Conceptually learn various theories related to Groundwater recharge and Groundwater recharge
4	Study about Subsurface investigation of Ground water

UNIT-I	**L1,L2,L3**
Water and its importance. Monsoon– types and behavior in India, rainfall – characteristics and distribution, onset and withdrawal of effective rains, dry spells and wet spells, critical dry spells, water loss from the soil, measurement and factors, hydrological cycle, Importance and issues relating water status Scenario of water in Karnataka: sources, geographical distribution, quality. Water (hydrological) cycle, influence of human activity on the water cycle, Surface water resources.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Elementary knowledge of ground water: general aquifer. Water quality and its impact on human beings. Water harvesting: need, principles of water harvesting, general water harvesting methods - rain water harvesting - methods, classes, benefits, approach, rooftop rainwater harvesting , subsurface barrier/dykes, farm ponding, etc mostly used in rural areas.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Groundwater recharge. Factors affecting groundwater recharge, Revival of traditional techniques for water harvesting. Calculation of available rain water for harvesting. Preparation of suitable technical drawing and design of rain water harvesting structure	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Elementary conservation of water: importance, knowledge regarding conservation/saving of water in daily use, in agriculture, in industries. Water Conservation strategies- Limiting the consumption, Reuse and recycling, Elimination of losses, Pollution prevention	**8 Hrs**
UNIT-V	**L1,L2,L3**
Subsurface investigation of Ground water: General, geophysical methods and its importance. Present law regarding water management Water footprints- Blue water footprint, green water footprint, grey water footprint. Sustainability assessment	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Learn Water and its importance
CO2	Analyze and Design of RCC composite Girder

CO3	Design of Substructure and Auxiliary components
CO4	Design of different types of foundations for bridges.
CO5	Concept of different types of execution methods of Bridges and Inspection, Monitoring & Maintenance of Bridges

Reference Books	
1.	Indian Road Congress (IRC) codes and Ministry of Road Transport & Highway (MORT) Specifications
2.	Concrete Bridge practice by V.K. Raina
3.	Essentials of Bridge Engineering by D. Johnson Victor

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Geographic Information System **(Theory)**		
Course Code: MVJ22CV642		**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	To introduce the fundamentals and components of Geographic Information System
2	To provide details of spatial data structures, input and Processes
3	To provide details of spatial data structure management
4	To provide details of spatial data structure Applications

UNIT-I	**L1,L2,L3**
Fundamentals of GIS: **Introduction to GIS** - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions– History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open-source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements Video link / Additional online information: (Self Learning) • NPTEL VIDEOS.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Spatial Data Models; Database Structures – Relational, Object Oriented – Entities – ER diagram - data models - conceptual, logical and physical models - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models- TIN and GRID data models.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Data Input and Topology: Scanner - Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input –Digitizer – Datum Projection and reprojection -Coordinate Transformation – Topology - Adjacency, connectivity, and containment – Topological Consistency – Non topological file formats - Attribute Data linking – Linking External Databases – GPS Data Integration	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Data Quality and Standards: Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy, and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure.	**8 Hrs**
UNIT-V	**L1,L2,L3**
Data Management and Output: Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS distributed GIS.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Have basic idea about the fundamentals of GIS
CO2	Understand the types of data models

CO3	Get knowledge about data input and topology.
CO4	Gain knowledge on data quality and standards.
CO5	Understand data management functions and data output

Reference Books	
1.	Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.
2.	Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction Geographical Information Systems, Pearson Education, 2nd Edition,2007
3.	Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 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.

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Integrated Waste Management for a Smart City (Theory)		
Course Code: MVJ22CV643		**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	To introduce the fundamentals of Solid Waste Management
2	To provide details of Sustainable Cities
3	Understand the Sustainable Development Goals.

UNIT-I	**L1,L2,L3**
Introduction to Solid Waste Management Municipal Solid Waste Characteristics and Quantities generation rates and waste composition; Integrated waste management issues, collection, recovery, reuse, recycling, energy-from-waste, and landfilling;	**8 Hrs**
UNIT-II	**L1,L2,L3**
Biological treatment of the organic waste fraction ; Direct land application, composting, and anaerobic digestion. MSW Rules 2016, Swachh Bharat Mission and Smart Cities Program	**8 Hrs**
UNIT-III	**L1,L2,L3**
Biochemical Processes and Composting Energy Recovery from Municipal Solid Waste. Current Issues in Solid Waste Management and Review of MSW Management Status in First List of 20 Smart Cities in the Country	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Construction and Demolition (C&D) Waste Management - Overview C&D Waste – Regulation, Beneficial Reuse of C&D Waste Materials	**8 Hrs**
UNIT-V	**L1,L2,L3**
Electronic Waste (E-Waste) Management – Issues and Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand basic idea about Sustainable Development.
CO2	Get knowledge about Sustainable Cities.
CO3	Gain knowledge on Saving Biodiversity.
CO4	Understand Sustainable Development Goals.

Reference Books	
1.	George Tchobanoglous, Hilary Theisen and Samuel A Vigil, Integrated Solid Waste management, Tata McGraw Hill
2.	Manual on Solid Waste Management, prepared by The Central Public Health and Environmental Engineering Organization(CPHEEO), India
3.	William A Worrell and P. Aarne Veslind Solid Waste Engineering, 2nd Edition (SI Edition) Cengage Learning, 2012 (ISBN-13: 978-1-4390-6217-3)

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Sustainable Development Goals (Theory)		
Course Code: MVJ22CV644		**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	To introduce the fundamentals and components of Sustainable Development
2	To provide details of Sustainable Cities
3	To Understand the Sustainable Development Goals.
4	To Understand the concept of biodiversity.
5	To explain the Feasibility of Sustainable Development.

UNIT-I	**L1,L2**
Sustainable Development: Introduction to Sustainable Development Economic Growth and Progress, Continuing Poverty, Environmental Threats, Business as Usual Versus Sustainable Development	**8Hrs**
UNIT-II	**L1,L2**
Sustainable Cities: The Patterns of Urbanization Around the World, development of Sustainable city, Smart Infrastructure, Urban Resilience, Planning for Sustainable Development.	**8 Hrs**
UNIT-III	**L1,L2**
urbing Climate Change The Basic Science of Climate Change, Consequences, Mitigation, Adaptation, Mitigation Policies:	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Saving Biodiversity: Concept of Biodiversity, Biodiversity Under Threat, Oceans and Fisheries, Deforestation International Dynamics.	**8 Hrs**
UNIT-V	**L1,L2,L3**
Sustainable Development Goals Introduction to Sustainable Development Goals, Goal-Based Development, Financing for Sustainable Development, Principles of Good Governance, Feasibility of Sustainable Development.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand basic idea about Sustainable Development.
CO2	Get knowledge about Sustainable Cities.
CO3	Gain knowledge on Saving Biodiversity.
CO4	Understand Sustainable Development Goals.
CO5	Understand the feasibility of Sustainable Development.

Reference Books	
1.	Ram Kumar Mishra, Ch Lakshmi Kumari, Sandeep Chachra, P.S. Janaki Krishna “Smart Cities for Sustainable Development” Springer, 2022 Edition

2.	The Sustainable Development Goals Report 2020 Kindle Edition, Department of Economic and Social Affairs
3.	'The Sustainable Development Goals" Hardcover – December 4, 2018 United Nations.

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 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VI		
Software Application Lab (Practice)		
Course Code: MVJ22CVL66		**CIE Marks: 50**
Credits: L:T:P: 0:0:2		**SEE Marks: 50**
Hours: 26P		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	Use industry standard software in a professional set up.	
2	Understand the elements of finite element modelling, specification of loads and boundary condition, performing analysis and interpretation of results for final design.	
3	Develop customized automation tools..	

Sl.NO	Experiments	L3,L4
1	Analysis of plane trusses, continuous beams using software	
2	Analysis of portal frames using software	
3	Understanding basic features of Project management software. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.	
4	Identification of Predecessor and Successor activities with constrain. Constructing Network diagram (AON Diagram) and analyzing for Critical path,	
5	Critical activities and Other non-Critical paths, Project duration, Floats. Study on various View options available	
6	Basic understanding about Resource Creation and allocation g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project	
7	GIS applications using open source software: To create shape files for point, line and polygon features with a map as reference. To create decision maps for specific purpose.	
8	Computation of earthwork, Design of horizontal curve by offset method, Design of super elevation Using Excel	
9	**Demonstration Experiments (For CIE)**	
10	Creating structural model and analysis of high rise structures	
11	Creating a model of building and the effect of earth quake	
12	Create a model of large span roof and analyse	

Course Outcomes: After completing the course, the students will be able to	
CO1	Use software for analysis and design of structural elements.
CO2	Design using excel spread sheet
CO3	Modelling of structural elements of buildings

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: VII	
Design of Steel Structures **(Theory and Practice)**	
Course Code: MVJ22CV71	**CIE Marks: 50**
Credits: L:T:P: 3:0:2	**SEE Marks: 50**
Hours: 40L + 26P	**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to	
1	**Understand the behaviour of structural elements in steel structures and well versed with Steel design principles according to the guidelines of IS: 800-2007.**
2	**Apply their knowledge of Structural mechanics to analyse and design the steel structures.**
3	**Design the steel structural elements of different forms and connections under different stresses.**

UNIT-I	L1,L2,L3
Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification. **Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis**	**8 Hrs**
UNIT-II	**L1,L2,L3**
Bolted Connections: Introduction, Types of Bolts,	**8 Hrs**

Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) and bracket connections both types	
UNIT-III	**L1,L2,L3**
Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and Bracket connections both types. **Advantages and Disadvantages of Bolted and Welded Connections.**	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members with Lug angles. **Design of Column Bases: Design of Simple Slab Base and Gusseted Base.**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battened Systems.	**8 Hrs**

Sl.NO	**Experiments**
1	**Design a Bolted Connections using M S Excel**

2	Design a welded Connections using M S Excel
3	Design of Tension members using M S Excel
4	Design of Compression Members using MS Excel
5	Design of Simple Slab Base using M S excel
6	Design of Gusseted Base using M S Excel
7	Draw the following using AutoCAD. Column bases and Gusseted bases with bolted and welded connections.
8	Draw the following using AutoCAD. Roof Truss – Welded and Bolted
9	Draw the following using AutoCAD. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
10	Draw the following using AutoCAD. Built-up Columns with lacings and battens.
11	Drawing of Gantry Girder for the given data using AutoCAD.
12	Drawing of Welded Plate girder for the given data using Auto CAD.

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain: the engineering properties and the behaviour of steel structural elements according to the guidelines.
CO2	Analyse and design: Structural connection of Steel Elements.
CO3	Analyse and design: the steel structural elements of different forms under different stresses.

Reference Books	
1.	N Subramanian, "Design of Steel Structures", Oxford University Press, New Delhi, India
2.	S K Duggal, "Limit State Design of Steel Structures" McGraw Hill Publications Chennai.

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Estimation and Contract Management (Theory)		
Course Code: MVJ22CV72		**CIE Marks: 50**
Credits: L:T:P: 3:2:0		**SEE Marks: 50**
Hours: 40L + 10 T		**SEE Duration: 3 Hrs.**
Course Learning Objectives: The students will be able to		
1	**Estimate the quantities of work, develop the bill of quantities, and arrive at the Cost of civil engineering Project**	
2	**Understand and apply the concept of Valuation for Properties**	
3	**Understand, Apply and Create the Tender and Contract document**	

UNIT-I	**L1,L2,L3**
Quantity Estimation for Building: study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by Short wall and long wall method - centre line method. • **Estimate of R.C.C structures including Slab, beam, column, footings.**	**8 Hrs**
UNIT-II	**L1,L2,L3**
Estimate of Steel truss, manhole and septic tanks and slab culvert. Quantity Estimation for Roads: Computation of volume of earthwork fully in banking, cutting, partly cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and	**8 Hrs**

detail specifications of different items of works in buildings and roads. **Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost** **Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.**	
UNIT-IV	**L1,L2,L3**
Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). **Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture.** **Contract Forms: FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Contract Management-Post award :Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach	**8 Hrs**

of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism, Contract management and administration. Valuation: Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.**
CO2	**Prepare detailed and abstract estimates for various road works, structural works and water supply and sanitary works.**
CO3	**Prepare the specifications and analyze the rates for various items of work**
CO4	**Assess contract and tender documents for various construction works.**
CO5	**Prepare valuation reports of buildings**

Reference Books	
1.	**Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.**
2.	**B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.**
3.	**M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications.**

4.	MORTH Specification for Roads and Bridge Works – IRC New Delhi
5.	Kohli D.D and Kohli R.C, "Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
6.	Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
7.	Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Prestressed Concrete (Theory)		
Course Code: MVJ22CV73		**CIE Marks: 50**
Credits: L:T:P: 3:2:0		**SEE Marks: 50**
Hours: 40L + 10 T		**SEE Duration: 3 Hrs.**

Course Learning Objectives: The students will be able to	
1	**Use the basics of prestressing to concrete elements.**
2	**Restate the basic principle of prestressing including losses.**
3	**Interpret the deflections in a prestressed concrete member.**
4	**Analyze the section for flexure, shear under limit state of serviceability and design the pre- stressed beam under permissible stress condition.**
5	**Describe the design of anchorage zones.**

UNIT-I	**L1,L2 ,L3**
Introduction to pre-stressed concrete structures: High strength concrete and steel, stress-strain characteristics and properties, fundamentals, load balancing concept, stress concept, center of thrust. Pre-tensioning and post-tensioning systems, tensioning methods, and end anchorages. **Video link / Additional online information: (Self Learning)** • **https://nptel.ac.in/courses/105/106/105106117/**	**8 Hrs**
UNIT-II	**L1,L2 ,L3**
Losses of Prestress: Stresses in concrete due to prestress and loads, stresses in steel due to loads, cable profiles, various losses encountered	**8 Hrs**

in pre-tensioning and post-tensioning methods, determination of jacking force. **Video link / Additional online information: (Self Learning)** • **https://nptel.ac.in/courses/105/106/105106117/**	
UNIT-III	**L1,L2,L3**
Deflection of a pre-stressed member – Short term and long-term deflections, Elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343. Effect of creep on deflection, load verses deflection curve, methods of reducing deflection. **Video link / Additional online information: (Self Learning)** • **https://nptel.ac.in/courses/105/106/105106117/**	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Flexure -Types of flexural failure, IS Code recommendations . Ultimate flexural strength of sections. **Shear - IS Code recommendations, shear resistance of sections, shear reinforcement. Limit state of serviceability – control of deflections and cracking.** **Design of Beams: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections.** **Video link / Additional online information: (Self Learning)** • **https://nptel.ac.in/courses/105/106/105106117/**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Design of End block: Transmission of Prestress in pretension members,	**8 Hrs**

transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force stresses in end blocks-Methods, I.S. code provision for the design of end block reinforcement. **Video link / Additional online information: (Self Learning)** • **https://nptel.ac.in/courses/105/106/105106117/**	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Restate the basic concept of pre-stressing and understand the requirement of PSC members for present scenario.**
CO2	**Examine the stresses encountered in PSC element during transfer and at working.**
CO3	**Interpret the effectiveness of the design of PSC after studying losses.**
CO4	**Investigating the PSC element and finding its efficiency and design PSC beam for different requirements.**
CO5	**Design the end blocks in PSC using codal provisions.**

Reference Books	
1.	**Prestressed Concrete Structure by T.Y. Lin, Ned H. Burns**
2.	**Prestressed Concrete by N. Krishna Raju**
3.	**Prestressed Concrete by G.S.Pandit and S.P.Gupta**
4.	**IRC 112 and IS 1343 codes**

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Intelligent Transportation Systems (Theory)		
Course Code: MVJ22CV741		**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	**To learn the fundamentals of ITS.**	
2	**To study the ITS functional areas**	
3	**To have an overview of ITS implementation in developing countries**	

UNIT-I	L1,L2
Introduction to Intelligent Transport System: Introduction to Intelligent Transportation Systems (ITS) - Definition – Role and Responsibilities – Advanced Traveller Information System – Fleet Oriented ITS Services – Electronic Toll Collection – Critical issues – Security – Safety	**8 Hrs**
UNIT-II	**L1,L2**
ITS Architecture and Hardware: Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection – Techniques – Dynamic Message Sign – GPRS – GPS – Toll Collection	**8 Hrs**
UNIT-III	**L1,L2**
Advanced Transport Management System: Video Detection – Virtual Loop - Cameras - ANPR – IR Lighting – Integrated Traffic Management – Control Centre – Junction Management Strategies- ATMS – Advanced Traveler Information Systems (ATIS)- Route Guidance – Issues - Historical – Current – Predictive Guidance – Data Collection – Analysis – Dynamic	**8 Hrs**

Traffic Assignment (DTA) – Components – Algorithm.	
UNIT-IV	**L1,L2**
Advanced Traveller and Information System: Travel Information – Pre Trip and Enroute Methods- Basic ATIS Concepts – Smart Route System – Data Collection – Process – Dissemination to Travelers – Evaluation of Information – Value of Information – Business Opportunities	**8 Hrs**
UNIT-V	**L1,L2**
Case Studies: Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Understand the sensor and communication technologies.**
CO2	**Apply the various ITS methodologies**
CO3	**Define the significance of ITS under Indian conditions**

Reference Books	
1.	**Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001.**
2.	**Henry F. Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 1992.**
3.	**Turban E.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan, 1998.**
4.	**Sitausu S. Mittra, "Decision Support Systems – Tools and Techniques", John Wiley, New York, 1986.**
5.	**Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems – Theory and Application", Springer Verlog,**

	New York, 1987
6.	ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Precast Members - Systems & Construction (Theory)		
Course Code: MVJ22CV742		**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	**Impart concepts of precast concrete building design**
2	**Comprehend various aspects like selection and planning of structural system and its components, significance, plant and production methods, transportation and erection sequence of precast elements**
3	**Evaluate actual loads, integrating architectural and services requirements, structural modelling & analysis of a precast building**
4	**Design and detailing of precast multi-storeyed building using software.**
5	**Design and detailing of precast multi-storeyed building using software.**

UNIT-I	**L1,L2,L3**
Introduction to Precast and its elements: tractors, end users) and Limitations, Residential, Commercial & Industrial Applications of precast, Materials used, Code provisions and clauses. **Major elements (Beam, slab, wall, column, foundation, staircase, roof elements, façade) : Classification, Types and shapes, selection, application, erection, advantages, Infra works - Pipes & drains, duct bank, baggage handling tunnel, culvert and sleeper, facia element,**	**8 Hrs**

pavement and channel **Video link / Additional online information: (Self Learning)** • **https://youtu.be/eWdxA5L5lOs?si=m5m5a42mH9LsnUAD**	
UNIT-II	**L1,L2,L3**
Precast Structural Systems, Production, Storage, & Logistics: Structural System: Skeletal System, Portal Frame system, Large Panel system, Cell Block system and hollow block system, Guide lines of selection – Residential & office buildings, Industrial Buildings, Commercial buildings, Structural Stability and Structural Behaviour. **Plant and Production: Introduction - Types & Process, Production – Design and shop drawings, check lists, Moulding, Casting and its types, Concreting, Curing, Demoulding and inspection.** **Storage, Delivery, Handling- introduction and types of equipment, lifting devices, Erection and installation - Horizontal components, vertical components, special elements, Quality Inspection and Tolerance** **Video link / Additional online information: (Self Learning)** • **https://youtu.be/9bInahMLTdM?si=aJ1rvCd6OOXpvdri**	**8 Hrs**
UNIT-III	**L1,L2,L3**
Modelling, Analysis and design of Wall system: Design Basis Criteria: Geometric parameters and Occupancy, Location and Associated Parameters, Systems and material specifications, analysis tools, Loads and Load Combinations – gravity	**8 Hrs**

loads, lateral loads (seismic and wind) **ETABS software, Modelling, Analysis and Design of structural elements for RC Wall system: Design of RC wall, beam, slab & staircase, Design for stripping, stacking, transportation and erection for all elements** **Video link / Additional online information: (Self Learning)** • **https://youtu.be/9bInahMLTdM?si=aJ1rvCd6OOXpvdri**	
UNIT-IV	**L1,L2,L3**
Joints Connections for RC Wall system, Modelling, Analysis, Design of the Frame system: Joints connections for RC wall system – Wall to foundation, wall to wall horizontal connection, wall to wall vertical connection, beam to wall connection, beam to beam connection, slab to wall – progressive collapse, diaphragm action & slab to beam connection, staircase to beam or wall connection. **Modelling, Analysis and design for Frame system and its connections: ETABS Modelling, Analysis and Design for frame system (foundation, column, beam, slab etc.)** **Video link / Additional online information: (Self Learning)** • **https://youtu.be/9bInahMLTdM?si=aJ1rvCd6OOXpvdri**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Prestressed concrete and Preventive Measures and case studies: Prestressed Concrete, Various types of slab design and its check, Slab to beam connection Preventive Measures – Testing requirements, water tightness, temporary supports, MEP related preventive measures,	**8 Hrs**

progressive collapse – introduction and design, common defects and remedies. **Case Studies - Residential Project, Commercial Project** **Video link / Additional online information: (Self Learning)** • **https://youtu.be/9bInahMLTdM?si=aJ1rvCd600Xpvdri**	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Comprehend the necessity of precast construction**
CO2	**Adopt the appropriate mould and method for casting, transportation, and erection**
CO3	**Precast Concrete Structures Paperback – 12 June 2019 by Kim S. Elliott**
CO4	**Create and analyze a precast building model using ETABS software**
CO5	**Design of precast building including connections, adhering to the code requirements & functional aspects**

Reference Books	
1.	**IS 15916, Building Design and Erection Using Prefabricated Concrete**
2.	**IS 13920, Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces**
3.	**Precast Concrete Structures – 2018 by Hubert Bachmann and Alfred Steinle Specifications**

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Earthquake Resistant Structures (Theory)		
Course Code: MVJ22CV743		**CIE Marks:50**
Credits: L:T:P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 03 Hrs**
Course Learning Objectives: The students will be able to		
1	**Fundamentals of structural dynamics**	
2	**Fundamentals of engineering seismology**	
3	**Irregularities in building which are detrimental to its earthquake performance**	
4	**Different methods of computation seismic lateral forces for framed and masonry structures.**	
5	**Earthquake resistant design requirements for RCC and Masonry structures and Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures .**	

UNIT-I	**L1,L2,L3**
Introduction to structural dynamics: **Basic Definitions, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles, Types of Vibrations, Damping and its types, Analytical Model of dynamic system, Free vibration of damped and undamped system having single degree of freedom. Concept of equivalent spring, Numerical problems on determining natural period, natural frequency, mass, stiffness, amplitude, and acceleration for undamped free vibration systems.**	**8 Hrs**
UNIT-II	**L1,L2,L3**
Engineering Seismology: Terminologies (Focus, Focal depth,	**8 Hrs**

Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India, Earthquake measuring instruments-Seismoscope, Seismograph and accelerograph.	
UNIT-III	**L1,L2,L3**
Seismic Performance of Buildings and Over View of IS-1893 (Part-1): **Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.**	**8Hrs**
UNIT-IV	**L1,L2,L3**
Determination of Design Lateral Forces: **Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls). Numerical problems.**	**8 Hrs**
UNIT-V	**L1,L2,L3**
Ductility considerations: Factor affecting ductility, ductile detailing of	**8 Hrs**

flexural members, columns and frame members as per IS13920. Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column **Earthquake Resistant Design of Masonry Buildings: Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings**	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Relates to structural idealization studies on properties of real structures**
CO2	**Understand the principal of Seismology.**
CO3	**Analyse earthquake characteristics and associated effects .**
CO4	**Apply the concepts of earthquake design and concept of lateral load distribution on buildings.**
CO5	**Apply the concepts of earthquake design on masonry buildings.**

Reference Books	
1.	**Earthquake Resistant design of Structures, Duggal S K, 5th Edition, 2017, Oxford University Press.**
2.	**Earthquake Resistant Design of Structures, Pakaj Agarwal & Manish Shrikande, 4th Edition, 2016, PHI India.**
3.	**Earthquake resistant design of Building Structures, Vinod Hosur, 3rd Edition, 2016, Wiley(india).**
4.	**Theory and Application to Earthquake Engineering, 7th edition, 2018, Pearson Education.**

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 for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Ground Improvement and Reinforced Earth (Theory)		
Course Code: MVJ22CV744		**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	**State the engineering behavior of natural soils & various methods adopted for Evaluation of soil conditions**
2	**Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification by adopting Mechanical and Geo-synthesis methods for construction of civil engineering structures**
3	**Explain the techniques and methods adopted for dewatering and grouting methods**
4	**Apply the knowledge on stabilization of soils.**
5	**Illustrate the various reinforcement techniques adopted for stabilization of soils.**

UNIT-I	**L1,L2,L3**
Rock cycle: classification of rocks and rocks forming minerals; Weathering process and formation of soil; Role of ground improvement in foundation Engineering; Methods of Ground improvement – Geotechnical Problems in alluvial, lateritic, and black cotton soils. Selection of Suitable ground improvement techniques based on soil conditions- In situ and laboratory tests to characterize problematic soils; Mechanical,	**8 Hrs**

Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications	
UNIT-II	**L1,L2,L3**
Mechanical Modification – Principles of soil densification – Properties of Compacted soil, Compaction control tests, Specification of compaction requirements, Blasting, Vibro-compaction, Dynamic Tamping and Compaction piles. **Geo-synthetics – Types - general applications - types of geotextiles and geo-grids - physical and strength properties of geotextiles and geo-grids - behavior of soils on reinforcing with geotextiles and geo-grids - design aspects with geotextiles and geo-grid.**	**8 Hrs**
UNIT-III	**L1,L2,L3**
Hydraulic Modification – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geo-synthetics, Preloading and vertical drains, Electro-kinetic dewatering, capacity of pumps and pumps design, installation and operation of dewatering systems – single line, two-line, flow to a single well, multiple well systems **Grouting: Introduction, effect on properties of soils, Grouting – types - desirable characteristics of grouts - grouting methods - grouting pressure - grouting materials - grouting technology; - permeation grouting - compaction grouting - soil fracture grouting - jet grouting - application and limitations - slab jacking, grouted columns - application to dams.**	**8 Hrs**

UNIT-IV	L1,L2,L3
Stabilization of soils: Mechanical Stabilization -Soil aggregate mixtures, properties and proportioning techniques, soft aggregate stabilization, compaction, field compaction control; Cement Stabilization-Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques; Lime and Bituminous Stabilization-Type of admixtures, mechanism, factors affecting, design of mixtures, construction methods	8 Hrs
UNIT-V	**L1,L2,L3**
Soil improvement by using Reinforcing Elements - Introduction to Reinforced Earth - Load Transfer Mechanism and Strength Development - Soil Types - Reinforcing Materials - Reinforced Earth Retaining walls - Reinforced Embankments - Soil Nailing. Ground Improvement Techniques for Geotechnical Earthquake Engineering, Case studies on ground improvement techniques	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the natural processes involved in the formation of soil as well as find out the suitable method for stabilization of soils.
CO2	Address the mechanical modifications and geo-synthesis effects on soil
CO3	Implement the various dewatering methods and grouting methods
CO4	Analysis the various chemical methods adopted for Stabilization of soils
CO5	Select the suitable method for

	stabilization of soil by Reinforcement techniques.

Reference Books	
1.	**Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.**
2.	**Manfred Hausmann , "Engineering principles of ground modification", Mc Graw Hill Pub. Co.**
3.	**Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", Mc Graw Hill Pub. Co.**
4.	**Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London**
5.	**Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths**
6.	**Principles and Practice of Ground Improvement, Jie Han (Indian Edition), Wiley Publishers**

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Design and Execution of Pile Foundations (Theory)		
Course Code: MVJ22CV745		**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	**Introduce the concept of Piling works and design requirements for a pile**
2	**Elaborate the construction procedures which are involved in different pile foundations**
3	**Explain the different load test which needs to be conducted on the piles.**
4	**Understand the Environmental, Health and Safety standards which need to be in place for the handling of the pile works**
5	**Elaborate on the bill of quantities of various Pile foundations**

UNIT-I	**L1,L2,L3**
Introduction to piles, Design and construction of Bored Cast insitu piles and Driven Cast insitu piles: Overview of Pile foundations, Selection Criteria, Common Design considerations, General Terminologies and Indian standard codes. Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of Bored cast insitu piles and Driven cast insitu piles	**8 Hrs**
UNIT-II	**L1,L2,L3**
Introduction, design and construction of precast driven and under reamed piles: Materials and Equipment, Construction	**8 Hrs**

procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests, Case Studies of precast driven piles, precast driven piles in pre-bored holes and Under reamed piles	
UNIT-III	**L1,L2,L3**
Grouping and settlement of piles and testing: Introduction to Grouping and Settlement of piles, Pile Group efficiency and Spacing, Capacity of Pile group, Settlement of Pile group, Case studies Introduction & Types of testing on piles and General requirements for testing, Pile Integrity tests - introduction & Equipment Types of Pile Integrity test, Data Recording & Interpretation of results, Introduction to quality assurance of piles, General requirement	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Quality control and Special Types of piles: Quality Control of BCIS, DCIS piles, Quality records and checklists. Materials, Equipment, manufacturing procedure, Design and installation, suitability and application and failure modes of spun piles and helical piles	**8 Hrs**
UNIT-V	**L1,L2,L3**
Software and Bill of quantities, Construction challenges: Introduction to Bill of quantities for Bored cast insitu, Driven Cast insitu, Precast driven and Precast driven piles in pre-bored holes and undreamed piles. Challenges in bored and driven piles, Introduction to types of piling software, Software demonstrations (e.g., PLAXIS) and step-by-step design techniques for deep foundations. Modelling in Plaxis 2D	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend Basic design concepts, of pile foundations
CO2	Compute capacity of piles and select suitable type of pile foundation based on soil conditions
CO3	Apply different construction procedures of pile foundation
CO4	Design and execute different load testing on piles
CO5	Compute bill of quantities for pile foundations

Reference Books	
1.	IS 2911- Indian standard code driven cast insitu, bored cast insitu, Driven precast piles
2.	IS 14593-Indian standard code for bored cast insitu piles founded on rocks – Guidelines

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Retrofitting and Rehabilitation of Structures (Theory)		
Course Code: MVJ22CV746		**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	**To introduce the concept of Retrofitting, Strengthening and rehabilitation**	
2	**To provide details of Damage Assessment.**	
3	**To Understand the concept of influence on Serviceability and Durability**	
4	**To Understand the concept of maintenance and Retrofitting Techniques**	
5	**To explain the details about Artificial fibre reinforced polymer**	

UNIT-I	**L1,L2**
General: Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.	**8Hrs**
UNIT-II	**L1,L2**
Damage Assessment: Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems	**8 Hrs**
UNIT-III	**L1,L2**
Influence on Serviceability and Durability: **Effects due to climate,**	**8 Hrs**

temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.	
UNIT-IV	**L1,L2,L3**
Maintenance and Retrofitting Techniques: Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building	**8 Hrs**
UNIT-V	**L1,L2,L3**
Materials for Repair and Retrofitting: Artificial fibre reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.	**8 Hrs**
Course Outcomes: After completing the course, the students will be able to	
CO1	**Understand concept of Retrofitting,**

	Strengthening and rehabilitation
CO2	Get knowledge about details of Damage Assessment
CO3	Gain knowledge on concept of influence on Serviceability and Durability
CO4	Understand the concept of maintenance and Retrofitting Techniques
CO5	Understand about Artificial fibre reinforced polymer

Reference Books	
1.	"Innovative Bridge Design Handbook: Construction, Rehabilitation and Maintenance" by Alessio Pipinato
2.	"Traditional Details: For Building Restoration, Renovation, and Rehabilitation" by Charles George Ramsey and Harold Reeve Sleeper
3.	"Repair and Rehabilitation of Reinforced Concrete Structures" by Walter F. Silva

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 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Road Safety Engineering (Theory)		
Course Code: MVJ22CV751		**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	**To provide students with a comprehensive understanding of the principles, strategies, and techniques related to ensuring safety on roadways.**	
2	**To equip students with the knowledge and skills necessary to analyze road safety issues**	
3	**To design effective road safety measures and contribute to the improvement of road safety practices.**	

UNIT-I	L1,L2
Accident Investigations and Risk Management: Collection of Accident Data, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction, Condition and Collision Diagram.	**8 Hrs**
UNIT-II	**L1,L2**
Traffic Engineering Studies: Statistical Methods In Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi-Squared Distribution, Statistical Comparisons- Traffic Management Measures And Their Influence On Accident	**8 Hrs**

Prevention.	
UNIT-III	**L1,L2,L3**
Road Safety in Transport Planning and Geometric Design: Vehicle and Human Characteristics, Road Design and Safety Elements, Redesigning Junctions, Cross Section Improvements, Traffic Control, Traffic Calming Measures, Road Safety Furniture.	**8 Hrs**
UNIT-IV	**L1,L2**
Role of Signs and Markings in safety: Types Of Signs – Design Specifications – Guidelines For Installation – Role Of Signs In Safety; Types Of Road Markings – Design Specifications – Role Of Road Markings In Safety.	**8 Hrs**
UNIT-V	**L1,L2**
Traffic Management Systems for safety: Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Road Safety Improvement Strategies, ITS and Safety.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Analyse road safety data, identify hazardous locations, and assess safety risks on roadways.**
CO2	**Evaluate the effectiveness of road safety interventions and conduct post-implementation analysis.**
CO3	**Utilize modelling and simulation techniques to predict and assess the impact of road safety measures.**
CO4	**Demonstrate knowledge of traffic control devices, traffic management strategies, and their role in enhancing road safety.**
CO5	**Comprehend the legal and policy framework related to road safety engineering and contribute to policy**

	development.

Reference Books	
1.	**Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers**
2.	**Fundamentals of Transportation Engineering - C.S. Papacostas, Prentice Hall India.**
3.	**Transportation Engineering – An Introduction, C. Jotin Khisty, B. Kent Lall**
4.	**Fundamentals of Traffic Engineering, Richardo G Sigua**
5.	**Handbook of Road Safety Measures, Second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson**
6.	**Road Safety By NCHRP**
7.	**Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers**

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students must answer five questions, one from each unit for 16 marks adding up to 80 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: VII		
Conservation of Natural Resources (Theory)		
Course Code: MVJ22CV752		**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 types of land forms, soil conservation and sustainable land use planning**
2	**Apprehend water resources, types, distribution, planning and conservation. Water pollution and types of uses.**
3	**Know the types of minerals and rocks.**
4	**Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control**
5	**Apprehend basics of biodiversity and ecosystems.**

UNIT-I	**L1,L2,L3**
Land: Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning. **Video link / Additional online information: (Self Learning)** • **https://youtu.be/gimg8449uaU?si=d5zRKpAbxpriVHex**	**8 Hrs**
UNIT-II	**L1,L2,L3**
Water: Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic,	**8 Hrs**

industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water, its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions. **Video link / Additional online information: (Self Learning)** • **https://youtu.be/gimg8449uaU?si=d5zRKpAbxpriVHex**	
UNIT-III	**L1,L2,L3**
Air: Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Economic effects of air pollution. Control of air pollution by equipment, smoke and its control. Ozone depletion –impacts, photochemical changes. **Video link / Additional online information: (Self Learning)** • **https://youtu.be/gimg8449uaU?si=d5zRKpAbxpriVHex**	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Biodiversity: Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry.	**8 Hrs**

Ecosystem: Definition, Types: forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of ecosystem. **Video link / Additional online information: (Self Learning)** • **https://youtu.be/gimg8449uaU?si=d5zRKpAbxpriVHex**	
UNIT-V	**L1,L2,L3**
Global warming: concept, indicators, factor and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity. .EIA regulations in India, status of EIA in India, list of projects needing environmental clearance under EIA notifications. Case study of hydro power/ thermal power projects **Video link / Additional online information: (Self Learning)** • **https://youtu.be/gimg8449uaU?si=d5zRKpAbxpriVHex**	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Apprehend various components of land as a natural resource and land use planning.**
CO2	**Know availability and demand for water resources as applied to India.**
CO3	**Analyse the components of air as resource and its pollution**
CO4	**Discuss biodiversity & its role in ecosystem functioning.**
CO5	**Critically appreciate the environmental concerns of today.**

Reference Books	
1.	**P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, New Delhi, 2011**

2.	Singh J.S, Singh S.P & Gupta, S.R., "Ecology, environment and resource conservation", Anamaya publications, 2006
3.	Krishnamurthy K.V., "An advanced textbook of Biodiversity- principle & practices." Oxford and IBH publications Co.Pvt ltd, New Delhi. 2004.

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Energy Efficiency, Acoustics and Daylighting In Building (Theory)		
Course Code:MVJ22CV753		**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	**To facilitate learners to understand climatology, heat ingress in building and energy**
2	**To expose the learners to building acoustics, indoor air quality and day lighting.**
3	**To impart fundamental knowledge on Life cycle assessment and Energy efficiency in buildings.**

UNIT-I	**L1,L2**
Introduction to Climatology and heat ingress in building: Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems. Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies.	**8Hrs**
UNIT-II	**L1,L2**
Building acoustics, Indoor air quality and Lighting in buildings: Basics of sound and Building acoustics – Acoustic defects, prevention of sound transmission and acoustic measure for office building. Indoor Air Quality – Effects, control of contaminants and moisture in indoor	**8 Hrs**

environment, Integrated approach for IAQ management. Fundamentals of lighting- Day lighting and its metrics – Strategies for day lighting and its control. Artificial lighting – Design and control strategies – Visual comfort enhancement. **Video link / Additional online information: (Self Learning)** • **Energy efficiency, Acoustics and day lighting in building : nptel.ac.in/courses/105/102/105102175/**	
UNIT-III	**L1,L2**
Energy efficient buildings, Water and Waste management in buildings: Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. (demand control ventilation) Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system. **Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare facilities.**	**8 Hrs**
UNIT-IV	**L1,L2**
Life Cycle Assessment of Buildings and Green project management: Materials – Green product certifications, features of sustainable building materials and sustainable	**8 Hrs**

alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle assessment and its types – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management. Video link / Additional online information: (Self Learning) • Life cycle assessment: nptel/courses/video/105105157/ L01	
UNIT-V	**L1,L2**
Energy Efficient rating: Energy efficiency rating for distribution transformers, diesel generator set, motors, pumps, electrical appliances, lighting fixtures and lifts as per Bureau of Energy Efficiency (BEE). Energy efficiency in HVAC system – Variable Frequency Drive (VFD), Air volume drive. Roof top solar installations and solar water heaters, Heat recovery system in buildings, Building Management System (BMS) – Occupancy sensors and energy efficient lighting controls, Smart Buildings.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend climatology, shading system and analyze heat transfer mechanism in buildings.
CO2	Assess the design considerations and parameters for lighting, acoustics and indoor air quality.
CO3	Develop solutions for energy efficiency, water efficiency and waste management in buildings.
CO4	Adopt green project management methodology and evaluate building life

	cycle assessment
CO5	Understand energy efficiency measures in a building.

Reference Books	
1.	Energy Conservation Building Code – 2017 (with amendments up to 2020), Bureau of Energy Efficiency.
2.	The Sustainable Habitat Handbook (6 Volume Set), GRIHA Version 2019
3.	National Building Code – 2016, Volume 1&2, Bureau of Indian Standards
4.	HarharaIyer G, Green Building Fundamentals, Notion Press
5.	Dr. Adv. HarshulSavla, Green Building: Principles & Practices

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 marksare executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20

marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VII		
Environmental Protection and Management (Theory)		
Course Code:MVJ22CV754		**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	Study the facts of environmental pollution and conservation of natural resources.
2	Study the elements of corporate environmental management systems complying with international standards.
3	Learn to lead the environmental assessment team and implement waste minimization options.
4	Study the application of environmental management systems audit for various organizations.

UNIT-I	L1,L2
Introduction: Importance of Environmental protection and need for Environmental management **Environmental Management Standards:** Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental	8Hrs

Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles – National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.	
UNIT-II	**L1,L2**
Environmental quality: Objectives, Rationale of Environmental standards, Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.	**8 Hrs**
UNIT-III	**L1,L2**
Environmental Management System: EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution	**8 Hrs**

prevention – environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.	
UNIT-IV	**L1,L2**
Environmental Audit: Environmental management system audits as per ISO 19011 – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non-conformance – Corrective and preventive actions –compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.	**8 Hrs**
UNIT-V	**L1,L2**
Applications: Applications of EMS, Waste Audits and Pollution Prevention opportunities in Textile, Sugar, Pulp & Paper, Electroplating, Tanning industry, Dairy, Cement,	**8 Hrs**

Chemical industries, etc. Transboundary movement, disposal, procedures of hazardous wastes.	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Gain the knowledge about environmental issues and an approach to corporate environmental management systems for conservation of resources and environmental protection.**
CO2	**Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards**
CO3	**Lead pollution prevention assessment team and implement waste minimization options**
CO4	**Gain the knowledge about environmental management system audits**
CO5	**Develop, Implement, maintain and Audit Environmental Management systems for industries**

Reference Books	
1.	**Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.**

2.	ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
3.	ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4.	Paul L Bishop „Pollution Prevention: Fundamentals and Practice", McGraw-Hill International, Boston,2000.
5.	Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

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 marksare executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Deep Excavation and Tunnels **(Theory)**		
Course Code: MVJ22CV811		**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	Introduce various underground structures such as tunnels, caverns, shafts, and stations	
2	Explain the construction methodology, support systems and challenges in the construction of Tunnels, caverns, shafts, and stations	
3	Explain design aspects in the field on geotechnical/rock engineering and tunnelling, Instrumentation, and monitoring of tunnels	
4	Impart knowledge on the field challenges to the students through introduction of problem statements in each module and to assess the comprehension of course through case studies as project work	
5	Impart knowledge on the field challenges to the students through introduction of problem statements in each module and to assess the comprehension of course through case studies as project work	

UNIT-I	L1,L2,L3
Introduction to underground constructions and tunnelling: General Description of Various Tunnels and other underground structures, Components of a tunnel, Stress around an underground opening, Methods of excavations, Subsurface investigation Surface investigation, Sampling Techniques, Laboratory and in-situ testing of soil and rock, Indian standard codes Video link / Additional online information: (Self Learning) • https://youtu.be/MfkIm7qBiPk?si=bGahyKtpOzQitxjt	**8 Hrs**
UNIT-II	**L1,L2,L3**
Construction, challenges and solutions for Caverns, shaft and underground stations: Factors affecting the choice of method of tunnel construction, Cut and cover method, Bored method, Drill and blast method, Sequential excavation method and shaft method, Norwegian tunnel boring method (NTM), New Austrian tunnel boring method (NATM), Methods of construction of caverns and shafts and underground stations, Challenges and solutions for execution of these methods, Different types of Tunnel boring machines. Video link / Additional online information: (Self Learning) • https://youtu.be/MfkIm7qBiPk?si=bGahyKtpOzQitxjt	**8 Hrs**
UNIT-III	**L1,L2,L3**
Design methodology, Instrumentation and monitoring for tunnels: Rock mass classification, Geotechnical and geological inputs for design, Empirical, semi empirical and joint set analysis, Numerical 2D modelling and final support	**8 Hrs**

recommendations, Need for Instrumentation and monitoring in tunnels, Types of Instruments - Planning and execution Video link / Additional online information: (Self Learning) • https://youtu.be/MfkIm7qBiPk?si=bGahyKtpOzQitxjt	
UNIT-IV	**L1,L2,L3**
Support systems and design software for tunnels: Need for pre-excavation support system, Fore piling, Bolts and Anchors, Shotcrete, wire meshes, lattice girders and integrated support systems, Different types of retaining structures and their applicability. Secant piles, Sheet piles, contiguous piles and soldier piles and D wall. Requirement of investigation to be carried out for underground structure, Preparation geotechnical interpretation report for design of retaining structure, Numerical analysis to be performed for temporary / permanent retaining system, Introduction to software to be used in embedded retaining system, Case studies. Video link / Additional online information: (Self Learning) • https://youtu.be/MfkIm7qBiPk?si=bGahyKtpOzQitxjt	**8 Hrs**
UNIT-V	**L1,L2,L3**
Indian and International Code provisions: Introduction to interpretation using Rock data, Introduction to Wallap, Introduction to Plaxis Introduction to RS-2, Introduction to CIRIA 143, Wallap and their application Practical application & case studies Video link / Additional online information: (Self Learning) • https://youtu.be/MfkIm7qBiPk?si=bGahyKtpOzQitxjt	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the different soil investigation techniques, rock mass classifications, components of different underground structures and their functions.
CO2	Design and apply different construction methodologies for tunnels, Caverns and shafts in different soil and rock conditions
CO3	Evaluate the suitability of different excavation supports such as sheet piles, soldier piles, diaphragm walls and tunnel support for different soil and rock conditions
CO4	Create an instrumentation monitoring plan for tunnel construction
CO5	Comprehend the use of different software tools in deep excavations and apply code provisions for mitigating water ingress and seepage in excavations and tunnels

Reference Books	
1.	David Chapman, Nicole Metje, Alfred Stark " Introduction to Tunnel Construction "2017 , CRC Press
2.	CIRIA -C760 "Guidance on Embedded retaining wall design"

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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Semester End Examination (SEE):
Total marks: 50+50=100
SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Pre-Engineered Buildings **(Theory)**		
Course Code: MVJ22CV812		**CIE Marks:50**
Credits: L:T:P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 03 Hrs**
Course Learning Objectives: The students will be able to		
1	To describe the specifications of various types of steel members used in Pre-engineered Buildings	
2	To explain the calculation of loads that are applicable for steel buildings, and unique only to PEB like crane loads, mezzanine loads, pipe rack loads, etc.	
3	To understand the various steps for carrying out the analysis & optimized design of an industrial pre-engineered building and its connections	
4	To go through the design procedure of cold-formed elements that constitute the secondary framing of a Pre-engineered building	
5	To get an idea of fabrication and erection aspects in the design and construction of a Pre-Engineered building	

UNIT-I	**L1,L2,L3**
Introduction to PEB, Materials used in PEB and its specifications: Introduction to PEB, Materials used in PEB and its specifications, Built-up Tapered sections – Cold-formed Steel sections – Bracings in PEB – Cladding & Roofing – Additional components in a PEB – Insulation, Ventilation, Drainage, Expansion, Acoustics – Coatings of elements of a PEB – Accessories in a PEB.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Components and Loads on a PEB: Layout of a PEB – Load flow path – Primary framing : Column and Rafter frame – Secondary framing: Purlins and girts – Bracing configurations and selection – Special structural systems – Jack beams and Jack portals – Lattice girders – Soldier columns – Cabletrays and Pipe racks – Types of Crane systems and configurations Mezzanine floors, joists and Decking sheets – Roof sheeting types and variants – Wall cladding and panel types – Openings in PEB in Roofs and walls Loads acting on a PEB – Dead Loads, Live loads, Snow loads, Collateral loads, Wind loads, Seismic loads – Crane loads and Mezzanine loads – Loads due to temperature and its consideration in design.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Connections in PEB and Codes of Practice: Various types of connections in PEB – Rafter to column connections – Beam to Beam/Column connections – Splices – Base connections, Anchor bolts and base plates – Gantry Girder Connections – Optional connections. Codes practiced for the design of a PEB – Indian Standards, IS:800 - American Standards, AISC 360 – MBMA practices – Cold-formed Steel design code, IS:801 & AISI S100	**8Hrs**
UNIT-IV	**L1,L2,L3**
Design of a PEB warehouse and Industrial PEB structure: Study of inputs from the client – Modelling of a PEB warehouse structure – Calculation and application of loads and load combinations into the software –	**8 Hrs**

Analysis and Design parameters for the structure – Design of Primary and Secondary members – Deflection & Drift checks – Design of Connections . Design of Industrial PEB structure – Modelling, Loads, Analysis and Design of the structure using software – Additional scope of Industrial structures in comparison with Warehouse structures – Design of Gantry girders – Special Connections Design	
UNIT-V	**L1,L2,L3**
Design of base connections: Base connection, Drawings in a PEB, Stakeholders of a PEB & Fabrication, Erection and Execution aspects ,Column reactions and Base connection design: Base plates and Anchor Bolts – Overview of Footing, Pedestal, Tie beams and Grade slab, Anchor Bolt (AB) & General Assembly (GA) drawings – Good for Construction (GFC) Drawings – Fabrication & Erection drawings – Bill of Quantities (BOQ) and Material Planning Sheet (MPS) – As-Built drawings ,Stakeholders of a PEB – Role of Design Engineers & Manufacturers responsibilities – Pre-Bid and Post-bid conditions – Shop fabrication – Methods of rolling – Quality tests – Scheme and Sequence of Erection – Good Engineering practices	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the specifications of hot-rolled and coldformed steel members used in Pre-Engineered buildings
CO2	Compute various loads acting on pre-engineered buildings and select the proper framing configuration and lateral load resisting systems
CO3	Carry out the analysis & optimized design of an industrial pre-engineered building and its connections, using a modelling software
CO4	Design cold-formed elements that constitute the secondary framing of a Pre-engineered building Integrate the practical fabrication and erection aspects in the design and construction of a Pre-Engineered building Understand the principal of Seismology.
CO5	Integrate the practical fabrication and erection aspects in the design and construction of a Pre-Engineered building Understand the principal of Seismology.

Reference Books	
1.	IS 800:2007, IS 1893, IS 875 (Part 1-5), SP6, NBC (Part 1 & 2): 2016.
2.	N. Subramanian, Steel Structures: Design and Practice, Oxford Publications.
3.	K S Vivek, P Vyshnavi , Pre - Engineered Steel Building, Lambert publications.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):
Total marks: 50+50=100
SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Advanced RCC Structures **(Theory)**		
Course Code: MVJ22CV813		**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	To make students to learn principles of Structural Design,
2	To design different types of structures and to detail the structures.
3	To evaluate performance of the structures

UNIT-I	**L1,L2,L3**
Design of R C slabs by yield line method. Design of RCC overhead circular and rectangular water tanks with supporting towers	**8 Hrs**
UNIT-II	**L1,L2,L3**
Design of grid or coffered floors. Design of flat slabs	**8 Hrs**
UNIT-III	**L1,L2,L3**
Design of R C Chimneys. Design of continuous beams with redistribution of Moments	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Design of R C bunkers Design of R C silos	**8 Hrs**
UNIT-V	**L1,L2,L3**
Formwork: Introduction, Requirements of good formwork, Materials for forms, choice of formwork, loads on formwork, Permissible stresses for timber, Design of formwork, shuttering for columns, Shuttering for slabs and beams, Erection of Formwork, Action prior to and during concreting, Striking of forms. Recent developments in form work	**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 detailin
CO5	Understands the structural performance

Reference Books	
1.	Krishna Raju. N., “Advanced Reinforced Concrete Design”, CBS Publishers & Distributors
2.	Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, “Comprehensive RCC Design”, Laxmi Publications, New Delhi
3.	Pillai S. U. and Menon D., “Reinforced Concrete Design”, Tata McGraw-Hill,3rd Ed, 1999

4.	Shah.H.J, “Reinforced Concrete”, Vol-1 and Vol-2, Charotar, 8th Edition –2009 and 6th Edition – 2012 respectively. 5. Gambhir.M.L, “Design of Reinforced Concrete Structures”, PHI Pvt. Ltd, NewDelhi, 2008
5.	IS Code Books

Continuous Internal Evaluation (CIE):
Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Project Management and Finance **(Theory)**		
Course Code:MVJ22CV814		**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	To understand what are the objectives of project management	
2	To outline the principles followed in carrying out a project.	
3	To demonstrate knowledge and understanding of engineering and management principles.	
4	To function effectively as an individual, and as a member or leader in diverse teams.	
5	To understand the concepts of finance and accounts carried out in project management.	

UNIT-I	L1,L2
Project Implementation, Monitoring and Control: Project representation- Role of project managers ,relevance with objective of organization, preliminary manipulations ,Basic Scheduling concepts : Resource leveling , Resource allocation ,Setting a base line, Project management information system: Importance of contracts in projects: Team work in Project Management: Formation of Effective terms	**8Hrs**
UNIT-II	**L1,L2**
Project planning and time management: Purpose, Project scheduling, activity definition, activity sequencing, activity duration estimating, schedule development, schedule control, project management using CPM\PERT- Network basics, Network development, PERT analysis, advantages. Computerized network analysis- features of PM software, capabilities of PM software, multi project analysis. Video link / Additional online information: (Self Learning) • Project planning and control: nptel.ac.in/courses/105/106/105106149/	**8 Hrs**
UNIT-III	**L1,L2**
Project Evaluation, Auditing and Other Related Topics in Project: Management Project Evaluation: Project auditing: Phase of project audit Project closure reports, computers, e-markets in Project Management Video link / Additional online information: (Self Learning) • Project management- Planning Execution, Evaluation And Control: https://onlinecourses.nptel.ac.in/noc23_mg124/	**8 Hrs**
UNIT-IV	**L1,L2**
Project appraisal: Objectives, essentials of a project methodology – Market appraisal – Technical appraisal – Financial appraisal – Socio – economic appraisal – Management appraisal	**8 Hrs**
UNIT-V	**L1,L2**

Finance and Accounting: Source of finance- Term Loans - Capital Structure - Financial Institution Accounting Principles - Preparation and Interpretation of balance sheets, profit and loss statements , Fixed Assets, Current assets, Depreciation methods - Break even analysis Video link / Additional online information: (Self Learning) • Financing infrastructure projects: https://nptel.ac.in/courses/105103133	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Ability to prepare project feasibility reports.
CO2	Ability to implement the project effectively meeting government norms and conditions.
CO3	Ability to understand the role and responsibility of the Professional Engineer.
CO4	Be able to assess social, health, safety issues based on the reasoning received from the contextual knowledge.
CO5	Ability to choose projects which benefit the society and organization

Reference Books	
1.	Project Management Institute A Guide to the Project Management Body of Knowledge PMBOK Guide (Sixth Edition), Sept 2017
2.	James C.Van Horne, Fundamentals of Financial Management, Person Education 2004.
3.	Kuster J., Huber, E., Lippmann, R., Schmid, A., Schneider, E., Witschi, U., Wust, R. Project Management Handbook,2015
4.	Prasanna Chandra, Financial Management, Tata McGraw-Hill,2008.
5.	By Carl S. Warren, James M. Reeve, Jonathan Duchac.Financial and Managerial Accounting,2016
6.	PaneerSelvam, R., and Senthilkumar, P., Project Management, PHI, 2011.
7.	Khanna, R.B.,Project Management, PHI 2011.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to

answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Metros and Seaports Engineering **(Theory)**		
Course Code: MVJ22CV815		**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	Elaborate on the salient features and types of Transit oriented development and its significance	
2	Explain the planning, Analysis, design and execution of elevated and underground Metro viaducts, tunnels including monitoring systems and stations	
3	Explain the design and Analysis of Earth retaining structures used in Metro systems	
4	Introduce the future trends and technologies in Transportation systems.	
5	Introduce the salient features of seaports	
6	Explain the different permanent and enabling structures in seaports	

UNIT-I	L1,L2
Introduction to Mass Rapid Transit System (MRTS) and Planning of Metros: Overview of Metro, Transit Oriented Development, Feasibility Study for MRTS Project, Sustainable and Smart Technologies, Recent Advancements & Future Technologies (High Speed Rail Technology, 'Maglev & Ground Effect Trains etc.). Basic Interfacing Principles – Alignment, Urban level planning, constraints and restrictions, Building Information Modelling in Metros, HVAC Systems, Tunnel Ventilation System, Public Health Engineering, Fire Alarm System etc.	**8 Hrs**
UNIT-II	**L1,L2**
Design, Construction and Quality Control: Introduction to Contracts, Overview of FIDIC standards, Introduction to Quality Systems, Precasting Yard Development, Types of Precast Super Structure, Precast Mould development, Formwork System Overview, introduction to Precast Erection, Superstructure launching Methods, Obligatory Spans, substructure and foundation Construction Methodology, Challenges in Foundation Construction Alignment / Span configuration of elevated structures, Soil condition and type of foundations, Substructure system, Choosing type of Pier based on alignment profile, Rail / Over Head Equipment mast, Station overall layout, Pier arm - spine wing / cantilever and Platform- precast/cast-in-situ system. Erection methods and case studies Overview of Elevated station, Analysis and Design, Spine beam method, Design of station components, Loads and introduction to IRC/IRS Codes, 'Analysis and Design of superstructure, Substructure and foundation, 'Introduction to Modelling Software - STAAD Pro.	**8 Hrs**
UNIT-III	**L1,L2**
Earth Retaining systems, Underground Metro Stations, Tunnels and monitoring systems: Underground Stations and its configurations, Shoring Systems, supporting systems, Construction Methodology (Bottom Up method/ Top Down method), Tunnelling methods and monitoring systems, Earth retaining structures, Secant pile wall design, Guide walls, Introduction to	**8 Hrs**

Loads, Load combinations, Fire resistant criteria and Floatation check, 2D & 3D model generation, SOD restrictions & Element sizing for UG Stations, Design of all the components of UG station.	
UNIT-IV	**L1,L2**
Introduction to Seaports: Introduction and evolution of Ports and Harbors, Terminologies, Overview of Marine Structures, Operation and components of Ports, Site investigation and survey, Approach facilities and navigational aids. Design considerations and functional requirements of typical port structures, Breakwater Structures, berthing structures, Piers, Wharfs, Jetties, Quays, Dolphins, Fenders, Dredging facilities, Shipyard structures (dry dock and floating dock), Shore protection and Reclamation	**8 Hrs**
UNIT-V	**L1,L2**
Enabling structures: Cofferdams and Dewatering – Case study, Load Out Jetty (LOJ) – Design of retaining structure, Elevated platform and Hydraulic ramp. Casting Yard Planning and Mould Optimization. Piling Gantry – Layout, Loading. Rock Works – Breakwater construction, Revetment. Floating Stability/Caisson launching – Casting bed, Ballasting. Modular Construction – Modularization, Erection.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Create the basic layout of elevated and underground metro stations as per laid down codes and regulations
CO2	Interpret design recommendations and Codes of Practice for Elevated and Underground Metros and select suitable construction practices
CO3	Design the earth retaining systems for the excavations of underground stations
CO4	Comprehend the different permanent and enabling structures of seaports and harbors
CO5	Design Enabling structures of Ports and Harbors

Reference Books	
1.	Indian Standard code - IS 456, Guidance on embedded retaining wall design CIRIAC760
2.	David Chapman, Nicole Metje, Alfred Stark “Introduction to Tunnel Construction” 2017, CRC Press
3.	M. Ramachandran, “Metro Rail Projects in India- A Study in Project Planning” 2011, Oxford University Press
4.	Srinivasan, R., Harbour, Dock & Tunnel Engineering, Charotar Publishing House
5.	Bindra, S.P., A course in Docks and Harbour Engineering, Dhanpat Rai & Sons
6.	Port Design - Guidelines and recommendations by C. A. Thoresen, Tapir Publications

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 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: VIII		
Advanced Concrete Technology **(Theory)**		
Course Code: MVJ22CV816		**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	To learn the fundamentals of properties of concrete materials, its testing procedures,	
2	To study various types of concretes, NDT of concrete and mix design.	
3	To know the special types of concrete.	
4	To know the Durability & NDT of concrete	
5	To learn the Special Topics in Concrete Technology:	

UNIT-I	L1,L2,L3
Concrete materials: Cement -Review of manufacturing process- chemical composition, Bogue's compounds, mechanism of hydration-heat of hydration, - **Chemical Admixtures**- types, uses, mechanism of action - effects on properties of concrete – Mineral admixtures- types, chemical composition - physical characteristics - effects on properties of concrete - Rheology – basic concepts – Bingham model Video link / Additional online information: (Self Learning) • https://youtu.be/SdWh05agJtg?si=cKPdNJnenGnBS4_	**8 Hrs**
UNIT-II	**L1,L2,L3**
Mix proportioning: **Mix design** - nominal mix- design mix – concept of mix design - variables of proportioning - general considerations -factors considered in the design of concrete mix- various methods of mix design - design of concrete mix as per IS 10262-2019 - Statistical quality control of concrete – mean strength – standard deviation – coefficient of variation –sampling - testing - acceptance criteria Video link / Additional online information: (Self Learning) • https://youtu.be/SdWh05agJtg?si=cKPdNJnenGnBS4_	**8 Hrs**
UNIT-III	**L1,L2,L3**
Properties of fresh and hardened Concrete: Properties of fresh concrete- workability-factors affecting workability - slump test, compaction factor test- Vee Bee consistometer test- Properties of hardened concrete - modulus of elasticity, compressive strength, split tensile strength, flexural strength- effect of water cement ratio – maturity concept- Creep - factors affecting creep - effect of creep Shrinkage- factors affecting shrinkage - plastic shrinkage, drying shrinkage, autogenous shrinkage, carbonation shrinkage Video link / Additional online information: (Self Learning) • https://youtu.be/SdWh05agJtg?si=cKPdNJnenGnBS4_	**8 Hrs**

UNIT-IV	L1,L2,L3
Durability & NDT of concrete: Durability of concrete- Factors affecting durability - permeability- cracking- reinforcement corrosion; carbonation, chloride penetration, sulphate attack, acid attack, fire resistance; frost damage, alkali silica reaction, concrete in sea water - Non- destructive testing of concrete surface hardness test- ultrasonic pulse velocity method - penetration resistance- pull-out test core cutting - measuring reinforcement cover Video link / Additional online information: (Self Learning) • https://youtu.be/SdWh05agJtg?si=cKPdNJnenGnBS4_	**8 Hrs**
UNIT-V	**L1,L2,L3**
Special Topics in Concrete Technology: Special concretes - lightweight concrete-heavy weight concrete - high strength concrete – high performance concrete - self compacting concrete -roller compacted concrete– fibre reinforced concrete - polymer concrete-pumped concrete - ready mix concrete - green concrete. Special processes and technology - sprayed concrete; underwater concrete, mass concrete; slip form construction, prefabrication technology- 3D concrete printing Video link / Additional online information: (Self Learning) • https://youtu.be/SdWh05agJtg?si=cKPdNJnenGnBS4_	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	To understand the properties and testing procedure of concrete materials as per IS cod
CO2	To design concrete mix using IS Code Methods.
CO3	To describe the procedure of determining the properties of fresh and hardened concrete
CO4	To explain non destructive testing of concrete
CO5	To describe the various special types of concretes.

Reference Books	
1.	Neville A. M. and Brooks J. J., Concrete Technology, Pearson Education, 2019
2.	Shetty M. S., Concrete Technology", S. Chand & Co., 2018
3.	R. Santhakumar „ Concrete Technology", Oxford Universities Press, 2018
4.	Mehta and Monteiro, Concrete-Micro structure, Properties and Materials", McGraw Hill Professional 2017
5.	Neville A.M., "Properties of Concrete", Trans-Atlantic Publications, Inc.; 5e, 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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Energy Conservation in Buildings **(Theory)**		
Course Code: MVJ22CV821		**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	To facilitate learners to understand climatology, heat ingress in building and energy efficiency.	
2	To expose the learners to comfort in buildings.	
3	To impart fundamental knowledge on Life cycle assessment and Energy conservation.	
4	To understand the concept of Life Cycle Assessment of Buildings	
5	To understand the concept of Energy conservation	

UNIT-I	L1,L2
Introduction to Climatology and heat ingress in building: Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems. Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies.	**8Hrs**
UNIT-II	**L1,L2**
Building acoustics, Indoor air quality and Lighting in buildings: Basics of sound and Building acoustics – Acoustic defects, prevention of sound transmission and acoustic measure for office building. Indoor Air Quality – Effects, control of contaminants and moisture in indoor environment, Integrated approach for IAQ management. Fundamentals of lighting-Daylighting and its metrics – Strategies for daylighting and its control. Artificial lighting – Design and control strategies – Visual comfort enhancement.	**8 Hrs**
UNIT-III	**L1,L2.L3**
Energy efficient buildings, Water and Waste management in buildings: Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. (demand control ventilation) Water Efficiency – Planning and design of water management system, Rain water harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system. Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, healthcare facilities.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Life Cycle Assessment of Buildings and Green project management: Materials – Green product certifications, features of sustainable building materials and sustainable alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle	**8 Hrs**

assessment and its types – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management.	
UNIT-V	**L1,L2,L3**
Energy conservation: Energy efficiency rating for distribution transformers, diesel generator set, motors, pumps, electrical appliances, lighting fixtures and lifts as per Bureau of Energy Efficiency (BEE). Energy efficiency in HVAC system – Variable Frequency Drive (VFD), Air volume drive. Roof top solar installations and solar water heaters, Heat recovery system in buildings, Building Management System (BMS) – Occupancy sensors and energy efficient lighting controls, Smart Buildings	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend climatology, shading system and analyze heat transfer mechanism in buildings.
CO2	Assess the design considerations and parameters for lighting, acoustics and indoor air quality.
CO3	Develop solutions for energy efficiency, water efficiency and waste management in buildings.
CO4	Adopt green project management methodology and evaluate building life cycle assessment.
CO5	Implement energy conservation measures in buildings.

Reference Books	
1.	HarharaIyer G, Green Building Fundamentals, Notion Press
2.	Dr. Adv. HarshulSavla, Green Building: Principles & Practices
3.	The Sustainable Habitat Handbook (6 Volume Set), GRIHA Version 2019
4.	National Building Code – 2016, Volume 1&2, Bureau of Indian Standards

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 marksare executed by means of an examination.

The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to

answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Occupational Health and Safety **(Theory)**		
Course Code: MVJ22CV822		**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	Gain an historical, economic, and organizational perspective of occupational safety and health	
2	Investigate current occupational safety and health problems and solutions	
3	Identify the forces that influence occupational safety and health	
4	Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice	

UNIT-I	**L1,L2,L3**
Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation	**8 Hrs**
UNIT-II	**L1,L2,L3**
Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis , Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations	**8 Hrs**
UNIT-III	**L1,L2,L3**
Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety.	**8 Hrs**
UNIT-IV	**L1,L2,L3**
Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability	**8 Hrs**
UNIT-V	**L1,L2,L3**
Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
CO2	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
CO3	Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation
CO4	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
CO5	Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Reference Books	
1.	Goetsch D.L., (1999), "Occupational Safety and Heal th for Technologists, Engineers and Managers", Pren tice Hall.
2.	Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Company
3.	National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Poll ution Control Handbook
4.	Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.

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 are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII

Green Buildings (Theory)		
Course Code: MVJ22CV823		**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 Definition, Concept & Objectives of the terms cost effective construction and green building
2	Apply cost effective techniques in construction
3	Apply cost effective Technologies and Methods in Construction
4	Understand the Problems due to Global Warming
5	State the Concept of Green Building 6. Understand Green Buildings

UNIT-I	**L1,L2,L3**
Introduction to the concept of cost effective construction -Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks Lime Poszolana Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials-Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials Video link / Additional online information: (Self Learning) • https://youtu.be/nFBvLIfFFqI?si=vMLjWzELQjGnUF2Q	**8 Hrs**
UNIT-II	**L1,L2,L3**
Environment friendly and cost effective Building Technologies - Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames - Water tanks - Septic Tanks - Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof -Pre-engineered and ready to use building elements - wood products - steel and plastic - Contributions of agencies - Costford - Nirmithi Kendra - Habitat Video link / Additional online information: (Self Learning) • https://youtu.be/nFBvLIfFFqI?si=vMLjWzELQjGnUF2Q	**8 Hrs**
UNIT-III	**L1,L2,L3**
Global Warming – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition – Features Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings. Video link / Additional online information: (Self Learning)	**8 Hrs**

• https://youtu.be/nFBvLIfFFqI?si=vMLjWzELQjGnUF2Q	
UNIT-IV	**L1,L2,L3**
Green Building rating Systems- BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only) Video link / Additional online information: (Self Learning) • https://youtu.be/nFBvLIfFFqI?si=vMLjWzELQjGnUF2Q	**8 Hrs**
UNIT-V	**L1,L2,L3**
Utility of Solar Energy in Buildings Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. **Green Composites for Buildings Concepts of Green Composites**. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment Video link / Additional online information: (Self Learning) • https://youtu.be/nFBvLIfFFqI?si=vMLjWzELQjGnUF2Q	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand cost effective building materials
CO2	Choose environment friendly construction procedure
CO3	Design eco-friendly buildings to reduce global warming
CO4	Understand the different green rating of buildings
CO5	Estimate energy saving in construction

Reference Books	
1	Harhara Iyer G, Green Building Fundamentals, Notion Press 2. Dr. Adv. Harshul Savla, Green Building: Principles & Practices

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks are executed by means of an examination.
The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of three sub divisions. 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: VIII		
Integrated Building Services **(Theory)**		
Course Code: MVJ22CV824		**CIE Marks:50**
Credits: L:T:P: 3:0:0		**SEE Marks: 50**
Hours: 40L		**SEE Duration: 03 Hrs**

Course Learning Objectives: The students will be able to	
1	Understand Electrical System along with substation for a building infrastructure
2	Learn ELV System and its interface with other allied services
3	Design and implement HVAC System
4	Learn and implement Fire Alarm System (PAS)
5	Understand and implement importance of Public Health Services

UNIT-I	**L1,L2,L3**
Advanced Electrical System Design for Buildings: Basics of Electrical System, Electrical terminologies, Major Electrical equipment, Building power distribution and its schemes, Fundamentals of Power& distribution transformers, HT, LT, DG Sets, Cables & Wires, UPS and its importance, Introduction of HT, LT switchgears systems, Importance of Lighting design & different Light fixtures used in buildings – Interior, external, street & offices, RMU, HT consumer, Substation Building in Master plan - Space planning for RMU,HT, DG set, HSD yard, Space provision for Electrical Equipment including Substation, Various equipment clearance requirements, HVAC, PHE, FPS service-electrical load input for designing electrical power distribution, Pedestals & ceiling support requirement for all Electrical equipment.	**8 Hrs**
UNIT-II	**L1,L2,L3**
Extra Low Voltage System for Infrastructure: Introduction & Brief of ELV Systems, Concept of Building Management System (BMS) & Fire Alarm System, Interface with Architecture/ Structure, Access control, CCTV & Public address system - Brief and purpose, BMS - Brief and purpose, BMS interfaces with Electrical, HVAC, Fire & Life Safety and PHE, BMS interfaces with airport systems.	**8 Hrs**
UNIT-III	**L1,L2,L3**
Heating, Ventilation & Air conditioning systems: Basics of HVAC - Psychrometry and its importance - Major Components of Air conditioning System - Fundamental concepts of Heat transfer, Air-conditioning system, Ventilation system, Pressurization Systems and their importance to Life safety, Chilled water system, Cooling towers and major HVAC equipment, Pumping system in HVAC, Importance of Thermal and Acoustic Insulation, Introduction and basics of Variable Refrigerant Flow (VRF) systems, Radiant cooling, Underfloor distribution, Chilled beams – Space planning - Importance of Static weight / Operating weights of mechanical equipment - Importance of Floor slab and Terrace roof slab openings / cut-outs	**8Hrs**
UNIT-IV	**L1,L2,L3**
Fire Protection and Life Safety System:	**8 Hrs**

Basics of Fire Protection System - Active Fire protection system - Passive Fire protection system - Basics of Smoke Control and Fire Stop Systems - Codes & Standards and Statutory Compliance - Fire and its Classes - Hazard Classification based on building occupancy - Means of Egress and its components - Importance of Life Safety - Refuge Area, Fire Tower and Fire Lift - Occupant Load and Capacity factors - Fire Stopping Materials - Compartmentation in a building - Smoke control & management in Fire Zoning - Components of Fire Compartments.	
UNIT-V	**L1,L2,L3**
Public Health Engineering: Scope of works in Public Health Engineering - Sanitary fixtures and types - Water supply and treatment - Rain water drainage system - Landscape irrigation features – Water demand calculation based on building occupancy – Piping for different plumbing systems in buildings – Pump selection – Plant room sizing - Sewage treatment process - External water supply, storm drainage & sewerage system - Solid waste management - Interfacing PHE system with Architect and Structural engineers.	**8 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand Electrical System along with substation for a building infrastructure
CO2	Learn ELV System and its interface with other allied services.
CO3	Design and implement HVAC Systems
CO4	Learn and implement Fire Alarm System (PAS)
CO5	Understand and implement importance of Public Health Services

Reference Books	
1.	P K Barton, Barry G Fryer, David Highfield, Building Services Integration, 1983, SPON Press.
2.	Fred Hall, Roger Greeno , Building Services Handbook, 7th edition, 2017, Routledge Publications.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the entire syllabus. Part – B Students have to answer five questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have a maximum of

three sub divisions. 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.