Semester: III		
BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY (Theory)		
Course Code: MVJ21CV32		CIE Marks: 50
Credits: L:T:P: 4:0:0		SEE Marks: 50
Hours: 50L		SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	Recognize the good materials for the building construction
2	Supervise different types of masonry
3	Select type of materials, design and supervise suitable types of walls, floor and roof.
4	Gain knowledge about damp proofing, formwork, scaffolding, shoring and underpinning with suitable engineering measures.
5	Select the suitable sustainable materials for building construction

UNIT-I	
Functions of buildings and structure in general - Various components of a building (Online mode) - Loads on buildings as per IS 875, IS 1893 and NBC. **Building Materials:** Bricks-Composition, Classification, Manufacturing Process, Tests. Stones- Requirements and Classification. Timber- Classification, Defects, Qualities, Seasoning, Industrial Timber, Concrete – Ingredients, Cement – Types. 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	
Masonry: Definition and terms used in masonry. Strength of masonry. Brick masonry- characteristics and requirements of good brick masonry , Bonds in brick work, Header, Stretcher, English, Flemish bond- Stone masonry- Requirements of good stone masonry, Classification- Ashlar, Rubble- coursed, uncoursed. 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)	10 Hrs

• https://nptel.ac.in/courses/105102088/	
UNIT-III	
Plastering and Pointing: Mortar for masonry (Types and Uses), Purpose, Materials, method of plastering and pointing. Defects in Plastering. **Painting**: Purpose, Types, Technical terms, Ingredients and defects. Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces. **Varnish**: Characteristics and types 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	
Formwork: Introduction to formwork, mivan shuttering, **Scaffolding** – Types, Shoring and under Pinning. **Roof** – Functions, Flat roof, pitched roof, roofing materials **Damp proofing in ground floor** **Floor** – Flooring materials Thermal Performance, Fire resistance and acoustic of buildings 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	
Sustainable materials and alternatives- Cement concrete blocks, stabilized mud blocks, AAC blocks **Steel in construction**- Factors affecting physical properties, uses, market forms of steel **Plastics**- classification, properties, FRP **Glass**- Composition, manufacturing, varieties of glass 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	Identify various components and requirement needed for building construction.
CO2	Assess strength and stability of masonry.
CO3	Select suitable materials for Plastering, Painting and pointing
CO4	Restate the different types of roofing and flooring materials
CO5	Select the sustainable materials for construction

Reference Books	
1.	"Building Materials", S.K.Duggal, (Fourth Edition) 2012, New Age International Publishers
2.	"Building Construction", Dr. B.C.Punmia, Er. Ashok Kumar Jain, Dr. Arun Kumar Jain, (Elevent Edition) 2016, Laxmi Publications (P) ltd.,2016, New Delhi.
3.	"Fundamentals of Building Construction: Materials and Methods", Edward Allen, Joseph Iano, (Seventh Edition) 2019,Wiley Publishers
4.	"Building and Construction Materials: Testing and Quality Control", M. L. Gambhir, 2014, McGraw Hill Education Pvt. Ltd

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		
GEOLOGY AND GEOINFORMATICS (Theory)		
Course Code: MVJ21CV33		CIE Marks: 50
Credits: L:T:P: 2:1:0		SEE Marks: 50
Hours: 30L+10T		SEE Duration: 3 Hrs.

Course Learning Objectives: The students will be able to	
1	To outline the internal structure and composition of the earth and learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects by the application of Topographic maps
2	To illustrate the various properties, occurrence, uses of minerals and rocks in various industries
3	To assess knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways
4	To understand the basic concepts of Remote Sensing
5	To recognize various Geographical Information System (GIS) method

UNIT-I	
Introduction to Geology, Geomorphology and Seismology: **Introduction:** Geology in civil engineering, branches of geology; Understanding the earth, internal structure and composition and Introduction to Plate tectonics. Landforms – Classification, Rock weathering, types and its effects on Civil Engineering Projects. Watershed management, Floods and their control, River valley, Drainage pattern – parameters and development; Coastlines and their engineering considerations. Earthquake – Causes and Effects, Seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, Richter Scale, Seismograph, Seismic zones- World and India, Tsunami – causes and effects. Early warning system. Reservoir Induced Seismicity; Landslides – causes and their control. Video link / Additional online information: Geology - Introduction: http://nptel.iitm.ac.in/video.php?subjectId=105105106 http://nptel.iitm.ac.in/courses.php?branch=Civil	8 Hrs
UNIT-II	
Mineralogy and Petrology: **Minerals:** Properties that affect the strength of minerals. Physical properties and chemical composition of following minerals - ***Quartz***, ***Feldspars*** (orthoclase and plagioclase), ***Micas*** (biotite and muscovite), A***mphibole*** (hornblende), ***Pyroxene*** (augite and hypersthene), ***Gypsum, Calcite, Clay minerals*** (kaolinite) and their chemical formulae.	8 Hrs.

Introduction to petrology: Rock Cycle, broad classification of rocks. ***Igneous Petrology***: Plutonic, Hypabyssal and Volcanic rocks, Structure, Texture and Classification of Igneous rocks. Study of common rock types prescribed in practical work and their engineering applications. ***Sedimentary Petrology:*** Rock weathering, Genetic classification of secondary rocks and grain size classification and Textures, Sedimentary Structures, Digenesis Process. Study of common rock types prescribed in practical work and their engineering applications. ***Metamorphic Petrology:*** Agents, Types of metamorphism, Texture and structures. Study of common rock types prescribed in practical work and their engineering applications. Video link / Additional online information: Mineralogy & Petrology: http://nptel.iitm.ac.in/video.php?courseId=1055&p=1 http://nptel.iitm.ac.in/video.php?courseId=1055&p=3	
UNIT-III	
Structural and Engineering Geology: ***Structural Geology:*** Outcrop, stratification, dip and strike relation, Unconformity, joints their types and genesis Faults and folds with their types and causes, Engineering consideration of joints, folds and faults Geotechnical investigations for civil engineering projects: Study of toposheets and geological maps, importance of lithological and structural features studies for the construction of Dams, Reservoirs, Tunnels, Bridges and Highways ***Stratigraphy:*** Principles of Stratigraphy – Fundamentals of Litho-stratigraphy, Bio-Stratigraphy and Chrono-stratigraphy; Introduction to the physiographic and tectonic subdivisions of India; Geotechnical site characterization, Geotechnical and land use mapping, Decision making in regional land use, Geological problems in construction of underground structures in Karnataka Regional Geology. Video link / Additional online information: Structural Geology & Engineering importance: http://nptel.iitm.ac.in/video.php?courseId=1055&p=4	8 Hrs.
UNIT-IV	
Introduction to Remote Sensing: **Introduction**: Introduction to Remote Sensing: Definition - History & Concepts - Electromagnetic Radiation (Source, Mode of Energy transfer, Radiation Principles, Black body radiation); Electro Magnetic Radiation (EMR): EMR Spectrum - EMR Interaction with Atmosphere (Absorption, Scattering & Atmospheric windows) - EMR Interaction with Earth surface (Absorption & reflection) - Spectral Response pattern - Energy budgeting in Remote Sensing.	8 Hrs.

Video link / Additional online information: Introduction to Remote Sensing: www.youtube.com/watch?v=YU9XphJqi6k&list=PLnts6bz5xbzEjSVZP40SUiWxOu0IFNp9c www.youtube.com/watch?v=4KWsbsJW9pU&list=PLnts6bz5xbzEjSVZP40SUiWxOu0IFNp9c&index=2	
UNIT-V	
Introduction to Geographical Information System (GIS): Definition - Usefulness of GIS - Components of GIS - Computer Hardware, Software Modules and Organizational Context of GIS. Data Structure: Data Structure in GIS - Types of Data (Points, Lines and Polygons) - Data Base Structures (Raster Data Structures and Vector data Structures) - Data Conversion (Vector to Raster and Raster to Vector). Video link / Additional online information: Introduction to GIS & Method of Georeferencing: www.youtube.com/watch?v=wi6CxCqVgaI&list=PLnts6bz5xbzEjSVZP40SUiWxOu0IFNp9c&index=12 www.youtube.com/watch?v=ebXzHp7HNQg&list=PLnts6bz5xbzEjSVZP40SUiWxOu0IFNp9c&index=13	**8 Hrs.**

Course Outcomes: After completing the course, the students will be able to	
CO1	Students will able to find and relate the knowledge of geology and its role in Civil Engineering
CO2	Students will recommend the various earth's materials such as mineral, rocks and water in civil engineering practices
CO3	The students will investigate the significance of geological investigations for civil engineering projects and site selection as well as for the preparation of feasibility reports and others
CO4	Collect data and delineate various elements from the satellite imagery using their spectral signature
CO5	Analyze different features of ground information to create raster or vector data

Reference Books	
1.	Basudeb Bhatta, "Remote Sensing and GIS", OUP India, 2021, Pages.752
2.	Bangar, K.M, "Principles of Engineering Geology", Standard Publishers Distributors, New Delhi, 2020, Pages.451
3.	M.P Billings, "Structural Geology", Pearson Education, 2016, Pages.624
4.	S Kumar, "Basics of remote sensing & GIS", Laxmi Publication, 2016, Pages.140
5.	Parbin Singh, "Text Book of Engineering and General Geology", Published by S.K. Kataria & Sons, New Delhi, 2013, Pages.600

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):

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.

Total marks: 50+50=100

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

Semester: III		
SOLID MECHANICS & LABORATORY (Theory and Practice)		
Course Code: MVJ21CV34		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours
Course Learning Objectives: The students will be able to		
1	Provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.	
2	Explain the basic concepts of the stresses and strains for different materials	
3	State the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural element.	
4	Evaluate the behaviour of torsional members.	
5	Evaluate the behaviour of columns and struts.	

UNIT-I	
Concepts of Stress and Strain: Properties of materials, Normal stress, Shear stress, Normal strain, Hooke's law, Poisson's ratio. Stress-strain diagram of ductile and brittle materials, Factor of safety. Elongation of uniform bar and tapering bar due to self-weight. Compound bars, Elastic constants and their relationship. Video link / Additional online information:(Self Learning) • https://nptel.ac.in/courses/105105108/ • https://nptel.ac.in/courses/105/102/105102090/	8 Hrs
UNIT-II	
Compound Stresses: Two-Dimensional Stress Problems:Principal stresses, maximum shear stresses, Mohr's circle of stresses and its construction. **Stresses in Pressure Vessels:** Introduction, Thin cylinders subjected to internal pressure, Hoop stresses, Longitudinal stress and change in volume,Lame's Equation. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105105108/ • https://nptel.ac.in/courses/105/102/105102090/	8Hrs
UNIT-III	
Beam Statics: Definition of bending moment and shear force, sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments for determinate beams. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105105108/ • https://nptel.ac.in/courses/105/102/105102090/	8Hrs

UNIT-IV	
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', 'T' and Symmetrical Built-up sections. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105105108/ • https://nptel.ac.in/courses/105/102/105102090/	8Hrs
UNIT-V	
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 theory. **Torsion in Circular Shaft:** Introduction, pure torsion, Assumptions, derivation of pure torsion, derivation for rigidity and polar modulus, Power transmitted by solid and hollow circular shaft. Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105105108/ • https://nptel.ac.in/courses/105/102/105102090/	8Hrs
LABORATORY EXPERIMENTS	
1. Determination of Tensile strength of mild steel by Tension test. 2. Determination of Compressive strength of mild steel by Compression test. 3. Determination of Compressive strength of cast iron by Compression test. 4. Determination of Torsional strength by Torsion test on mild steel circular sections. 5. Bending Test on Wood under Third point loading. 6. Determination of Ultimate Shear Strength Test on Mild steel. 7. Determination of Impact strength by Impact test on Mild Steel (Charpy & Izod). 8. Estimation of surface resistance by Hardness tests on ferrous and non-ferrous metals- Brinell's & Rockwell. 9. Compression Test on Brick 10. Flexure Test on Tiles	

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the concepts of stress and strain at a point as well as the stress-strain relationships for homogeneous, isotropic materials.
CO2	Evaluate the behaviour and strength of structural elements under the action of compound stresses and Analysis of stresses for Thin & Thick Pressure Vessels.
CO3	Compute shear force and bending moment in loaded statically determinate beams
CO4	Compute bending and shear stresses in beams subjected to simple bending
CO5	Describe the critical buckling load of prismatic columns with different end conditions and able to compute torsional stress induced in circular members

Reference Books	
1.	"Strength of Materials",B.S. Basavarajaiah, P.Mahadevappa,3rd Edition, 2010,University Press (India) Pvt. Ltd.
2.	" Elements of Strength of Materials",D.H. Young, S.P. Timoshenko ,5th Edition (Reprint 2014),East West Press Pvt.Ltd.
3.	"A Textbook of Strength of Materials",R K Bansal,4th Edition,Laxmi Publications, 2010.
4.	" Strength of Materials",S.S. Rattan ,2nd Edition (Sixth reprint 2013),McGraw Hill Education (India) Pvt. Ltd.

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	3	3	-	-	-	-	-	-	1	1	-	1
CO2	3	3	-	1	-	-	-	-	1	1	-	1
CO3	3	3	-	1	-	-	-	-	1	1	-	1
CO4	3	3	1	2	1	-	-	-	1	1	-	1
CO5	3	3	1	2	1	-	-	-	1	1	-	1

Semester: III		
GEODETIC INFORMATION & PRACTICES (Theory and Practice)		
Course Code: MVJ21CV35		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours: 40 L+ 26 P		SEE Duration: 03+03 Hours

Course Learning Objectives: The students will be able to	
1	Provide basic knowledge about principles of surveying for location, design and construction of engineering projects
2	Develop skills for using surveying instruments including, leveling instruments, plane tables, theodolite, compass
3	Make students to familiar with cooperative efforts required in acquiring surveying data and applying fundamental concepts to eliminate errors and set out the works
4	Provide information about new technologies that are used to abstracting the information of earth surface
5	Provide basic knowledge about principles of surveying for location, design and construction of engineering projects

UNIT-I	
Introduction to Surveying Introduction, Importance of surveying to Civil Engineering, Concepts of plane and geodetic surveying, Principles of surveying, Plans and maps, Meridians, Bearings, Dip, Declination, Local attraction, Calculation of bearings and included angles. **Introduction to Modern Instruments** Electromagnetic spectrum, Electromagnetic distance measurement, Total station, Lidar scanners for topographical survey. **Compass surveying**: Prismatic and surveyor's compasses, temporary adjustments. Video link / Additional online information: https://nptel.ac.in/content/storage2/courses/105107122/modules/module10/html/33-16.html	8 Hrs.
UNIT-II	
Introduction to Levelling Principles and basic definitions, Types of Levels, Types of adjustments, Types of levelling - Simple, Differential, Fly, Reciprocal, Profile, Cross sectioning, Booking of levels - Rise & fall and H. I methods (Numerical). **Areas and volumes** Measurement of area – by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, co-ordinates, introduction to planimeter, digital planimeter. Video link / Additional online information: https://nptel.ac.in/courses/105107122/	8 Hrs.

http://nptel.ac.in/courses/Webcourse contents/IIT%20Bombay/Mathematics%20I/ TOC- middle-M8.html	
UNIT-III	
Theodolite Surveying: Theodolite and types, fundamental axes and parts of theodolite, temporary adjustments of transit theodolite, Horizontal and Vertical angle measurements by repetition and reiteration. **Trigonometric levelling:** Single and Double plane for finding elevation of objects Computation of distances and elevations using Tacheometric method and Numericals. **Contours** Contours and their characteristics, Methods of contour plotting, Interpolation, application of contours. Video link / Additional online information: https://nptel.ac.in/courses/105107122/	8 Hrs.
UNIT-IV	
Curve Surveying: Curves – Necessity – Types, Simple curves, Elements, Designation of curves, Setting out simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), Setting out curves by Rankine's deflection angle method (Numerical problems). Compound curves, Elements, Design of compound curves, Setting out of compound curves (numerical problems). Reverse curve between two parallel straights (numerical problems on Equal radius and unequal radius). Transition curves. Video link / Additional online information: https://nptel.ac.in/courses/105104101/	8 Hrs.
UNIT-V	
Aerial Photogrammetry Introduction, Uses, Aerial photographs, Definitions, Scale of vertical photograph, Ground Co-ordinates, Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax. **Introduction to GIS** Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS and Applications in Civil Engineering(transportation, town planning). Video link / Additional online information: • https://www.digimat.in/nptel/courses/video/105104167/L04.html • https://swayam.gov.in/nd1_noc19_ce34/ • https://nptel.ac.in/courses/105103176/	8 Hrs.

LABORATORY EXPERIMENTS
1. (a) Measurements of distances using tape along with horizontal planes and slopes, direct ranging (b) Setting out perpendiculars. Use of cross staff, optical square
2. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass
3. Measurement of bearings of sides of a closed traverse and adjustment of closing error by Bowditch method
4. Determination of distance between two inaccessible points using compass and accessories
5. Determination of reduced levels of points using dumpy level/auto level (simple leveling)
6. Determination of reduced levels of points using dumpy level/auto level (differential leveling and inverted leveling)
7. Determination of difference in elevation between two points using Reciprocal leveling and to determine the collimation error
8. Conducting profile leveling, cross sectioning and block leveling. Plotting profile and cross sectioning in excel. Block level and contour by using Total Station
9. Measurement of horizontal angle by repetition and reiteration methods and Measurement of vertical angles using theodolite
10. Determination of horizontal distance and vertical height to a base inaccessible object using theodolite by single plane and double plane method.
11. Determination of distance and elevation using tachometric surveying with horizontal and inclined line of sight.
12. Conducting Closed traverse surveying using Theodolite and applying corrections for error of closure by transit rule.
13. Demonstration of Minor instruments like Clinometer, Ceylon Ghat tracer, Box sextant, Hand level, Planimeter, nautical sextant and Pentagraph.
14. Plotting of Layout for the Street by using Plane Table Survey

Course Outcomes: After completing the course, the students will be able to	
CO1	Execute survey using compass.
CO2	Find the level of ground surface and Calculation of area and volumes
CO3	Operate theodolite for field execution
CO4	Estimate the capacity of reservoir
CO5	Interpret satellite imageries

Reference Books	
1.	S.K. Duggal - Surveying Vol. II, Tata McGraw Hill Ltd ,Reprint 2015
2.	K.R. Arora, "Surveying Vol. 1" Standard Book House, New Delhi. – 2010
3.	Chang, K , "Introduction to Geographic Information Systems", Tata McGraw-Hill Publishing Co. Ltd, 2008
4.	George Joseph, "Fundamentals of Remote Sensing", University Press, 2003
5.	Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune Vidyarthi Griha Prakashan, 1988

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 self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies 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 complete 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	3	3	1	2	1	-	-	1	2	1	3	2
CO2	3	3	1	2	2	1	-	1	2	1	1	1
CO3	3	3	2	3	3	1	-	1	2	1	2	1
CO4	3	3	2	3	3	1	1	1	2	1	2	2
CO5	3	3	1	3	2	2	2	1	3	2	3	3

Semester: III		
BUILDING LAYOUT PLANNING (Ability Enhancement Course)		
Course Code: MVJ21CVA37		CIE Marks: 50
Credits: L:T:P: 1:0:2		SEE Marks: 50
Hours: 30		SEE Duration: 02 Hrs.

Course Learning Objectives: The students will be able to	
1	State basic vastu components required for the house
2	Explain the scientific reason for the vastu
3	Prepare the list of activities involved in the layout planning
4	Plan the effective layout for the residential building
5	List the activities involved in setting out of buildings in the field

UNIT-I	
Basics of Vastu: Introduction, Relation with vastu to civil engineering, vastu tips, place and direction indications, dimensions and placing of doors and windows as per vastu, scientific reasons for the vastu, things that should be in house and should not be in house	10 Hrs
UNIT-II	
Building Layout: Planning of Layout for Residential Building, Commercial Building, Temple, Hospital Building, Educational Institution	10 Hrs
UNIT-III	
Setting out of Building: Temporary Bench mark, Baseline, Horizontal Control, Vertical Control, Trenches, Reduced level excavation	10 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify the vastu components for the house
CO2	Assess condition of vastu for the given layout
CO3	Develop the plan layout for the different kinds of building
CO4	Restate setting out procedure
CO5	Explain the step involved in building layout planning

Reference Books	
1.	"A practical approach to Vaastu Shastra", Col. Bhaskar Sarkar, Peacock Books, 2008, Chennai, ISSN: HYOR-1GS-X3GW
2.	"Building Construction", Dr. B.C.Punmia, Er. Ashok Kumar Jain, Dr. Arun Kumar Jain, (Elevent Edition) 2016, Laxmi Publications (P) ltd.,2016, New Delhi.
3.	"Fundamentals of Building Construction: Materials and Methods", Edward Allen, Joseph Iano, (Seventh Edition) 2019,Wiley Publishers

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40

marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

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

Semester: III		
SAMSKRUTHIKA KANNADA (Theory)		
Course Code: MVJ21KAN36		CIE Marks: 50
Credits: L:T:P: 1:0:0		SEE Marks: 50
Hours: 15L		SEE Duration: 02 Hrs.
Course Learning Objectives: This course will enable students to understand Kannada and communicate in Kannada language		

UNIT-I	
೧. ಕನ್ನಡ ಭಾಷೆ-ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ. ೨. ಭಾಷಾ ಪ್ರಯೋಗಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ	3 Hrs
UNIT-II	
೧. ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ ೨. ಪತ್ರ ವ್ಯವಹಾರ.	3 Hrs.
UNIT-III	
೧. ಆಡಳಿತ ಪತ್ರಗಳು. ೨. ಸರ್ಕಾರದಆದೇಶ ಪತ್ರಗಳು	3 Hrs.
UNIT-IV	
೧. ಸಂಕೀಪ್ತ ಪ್ರಬಂಧರಚನೆ, ಪ್ರಬಂಧ ಮತ್ತು ಭಾಷಾಂತರ ೨. ಕನ್ನಡ ಶಬ್ದಸಂಗ್ರಹ	3 Hrs.
UNIT-V	
೧. ಕಂಪ್ಯೂಟರ್ ಹಾಗೂ ಮಾಹಿತಿತಂತ್ರಜ್ಞಾನ ೨. ಪಾರಿಭಾಷಿಕ ಆಡಳಿತ ಕನ್ನಡ ಪದಗಳು ಮತ್ತು ತಾಂತ್ರಿಕ/ಕಂಪ್ಯೂಟರ್ ಪಾರಿಭಾಷಿಕ ಪದಗಳು.	3 Hrs.

Reference Books	
1.	Adalitha Kannada – Dr. L Thimmesh, Prof. V Keshav Murthy

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

Semester: III		
BALIKE KANNADA (Theory)		
Course Code: MVJ21KAN36		CIE Marks: 50
Credits: L:T:P: 1:0:0		SEE Marks: 50
Hours: 15L		SEE Duration: 02 Hrs.
Course Learning Objectives: This course will enable students to understand Kannada and communicate in Kannada language		

UNIT-I	
Vyavharika Kannada –Parichaya (Introduction to Vyavharika Kannada)	3 Hrs
UNIT-II	
Kannada Aksharamaale haagu uchcharane(Kannada Alphabets and Pronunciation)	3 Hrs.
UNIT-III	
Sambhashanegaagi Kannada Padagalu (Kannada Vocubulary for Communication).	3 Hrs.
UNIT-IV	
Kannada Grammar in Conversations(Sambhasaneyalli Kannada Vyakarana)	3 Hrs.
UNIT-V	
Activities in Kannada	3 Hrs.

Reference Books	
1.	Adalitha Kannada – Dr. L Thimmesh, Prof. V Keshav Murthy

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

Semester: III		
Fourier Series , Transforms, Numerical and OptimizationTechniques (Theory)		
Course Code:	MVJ21MA31C	CIE Marks:50
Credits:	L:T:P: 3:1:0	SEE Marks: 50
Hours:	40L+10T	SEE Duration: 3 Hrs
Course Learning Objectives: The students will be able to		
1	Solve the linear differential equations using Laplace transforms	
2	Apprehend and apply Fourier transform	
3	Demonstrate Fourier Transform as a tool for solving Integral equations	
4	Solve initial value problems using appropriate numerical methods	
5	Students learn to linear programming problems in Civil and Chemical engineering	

UNIT-I	
Laplace Transforms: Definition, Transforms of elementary functions, Properties, Periodic function, Unit step function, Unit impulse function– problems. **Inverse Laplace Transforms:** Inverse Laplace Transforms, Convolution theorem to find inverse Laplace transform. Solution of linear differential equations using Laplace transforms. Self study: Solution of simultaneous first order differential equations Applications: Analysis of electrical and electronic circuits, used in Signal processing and in control systems. Video Link:http://nptel.ac.in/courses.php?disciplineID=111	10 Hrs
UNIT-II	
Fourier Series: Periodic functions, Dirichlet's condition, Fourier series of periodic functions with period 2π and arbitrary period $2c$. Fourier series of even and odd functions. Half range Fourier Series, Practical harmonic Analysis and Problems. Self study: Complex form of Fourier series. Applications: The Fourier series has many such applications in harmonic analysis, vibration analysis,acoustics, optics etc. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	10 Hrs
UNIT-III	
Fourier transforms: Infinite Fourier transform, Infinite Fourier sine and cosine transforms, Inverse Fourier transforms, Inverse Fourier sine and cosine transforms, Convolution theorem for Fourier transform. Self study: Convolution theorem for Fourier transform Applications: Fourier Transformation (FT) has huge application in studying to study vibrations in building/structures. Any kind of spectroscopy applied in chemical engineering (CE) is based in Fourier techniques. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	10 Hrs
UNIT-IV	

Numerical solution of ordinary differential equations: Numerical solution of first order and first degree; Taylor's series method, modified Euler's method, Runge-Kutta method of fourth-order. Differential Equations of second order: Runge-Kutta method and Milne's Predictor and Corrector method. Self study: Adams- Bash forth predictor and corrector methods Applications: Numerical Methods are used to provide „approximate" results for the differential equation problems being dealt with and their necessity is felt when it becomes impossible or extremely difficult to solve a given problem analytically. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	10 Hrs
UNIT-V	
Optimization Techniques: Linear Programming, Mathematical formulation of linear programming problem (LPP), Graphical Method, Simplex Method , Dual simplex methods and Big M methods. Self study: Two phase simplex methods. Applications: Linear Programming is used in a variety of fields including food and agriculture, engineering, transportation problems, manufacturing and energy. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	10 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Use Laplace transform and inverse transforms techniques in solving differential equations.
CO2	Know the use of periodic signals and Fourier series to analyze circuits and system
CO3	Demonstrate Fourier Transform as a tool for solving Integral equations.
CO4	Identify appropriate numerical methods to solve ODE.
CO5	Solve the mathematical formulation of linear programming problem.

Reference Books	
1.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 44th Edition, 2013.
2.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.
3.	Prof G.B.Gururajachar "Engineering Mathematics-III , Academic Excellent series Publications, 2016-17
4.	Ramana B. V., "Higher Engineering Mathematics", Tata McGraw-Hill, 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):

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.

Total marks: 50+50=100

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

High-3, Medium-2, Low-1

Semester: III		
Additional Mathematics-1 (Common to all branches)		
Course Code:	MVJ21MATDIP-I	CIE Marks:50
Credits:	L:T:P: 1:1:0	SEE Marks: 50
Hours:	30L+10T	SEE Duration: 3 Hrs
Course Learning Objectives: The students will be able to		
1	Familiarize the important and introductory concepts of Differential calculus	
2	Provide essential concepts integral calculus	
3	Gain knowledge of vector differentiation	
4	Learn basic study of probability	
5	Restate 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. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	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. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	8 Hrs
UNIT-III	
Vector Differentiation: Scalar and Vector point functions, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields. **Vector identities -** $div(\phi\vec{A}), curl(\phi\vec{A}), curl(grad(\phi)), div(curl\,\vec{A})$. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	8 Hrs
UNIT-IV	
Probability: Basic terminology, Sample space and events. Axioms of probability. Conditional probability – illustrative examples. Bayes theorem-examples. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	8 Hrs
UNIT-V	
Ordinary Differential Equations of First Order: Introduction – Formation of differential equation, solutions of first order and first	8 Hrs

degree differential equations: variable separable form, homogeneous, exact, linear differential equations. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	

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	
1.	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2013, .
2.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 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 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	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	1	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

Semester: IV		
COMPLEX ANALYSIS, PROBABILITY AND SAMPLING THEORY (Theory)		
Course Code: MVJ21MA41C		CIE Marks:50
Credits: L:T:P: 2:1:0		SEE Marks: 50
Hours:30L+10T		SEE Duration: 03 Hours

Course Learning Objectives: The students will be able to	
1	Understand the concepts of Complex variables and transformation for solving Engineering Problems
2	Understand the concepts of complex integration, Poles, and Residuals in the stability analysis of engineering problems
3	Use statistical methods in curve fitting applications
4	understand the probability distribution in civil and chemical engineering
5	Understand the concepts of Sampling theory in science and engineering

UNIT-I	
Complex variables - I: Functions of complex variables (Review), Analytic function, Cauchy-Riemann Equations in Cartesian and polar coordinates, Construction of analytic functions (Using Milne-Thomson method). **Transformations:** BilinearTransformation, Conformal transformation, Discussion of the transformation $w = z^2, w = e^z and\ w = z + \frac{1}{z}(z \neq 0)$ Applications: Algebraic geometry, applied mathematics, hydrodynamics, thermodynamics, and particularly quantum mechanics. Web Link and Video Lectures: • https://www.youtube.com/watch?v=oiK4gTgncww • https://www.youtube.com/watch?v=WJOf4PfoHow • https://math.mit.edu/~jorloff/18.04/notes/topic4.pdf • https://math.mit.edu/~jorloff/18.04/notes/topic10.pdf	8Hrs
UNIT-II	
Complex variables-II: Complex integration - Cauchy theorem, Cauchy's Integral Theorem- Problems, Taylor & Laurent series- Problems ,Singularities, Types of Singularities, Poles, Residues-definitions, Cauchy residue theorem(without proof) - Problems. Web Link and Video Lectures: • https://www.youtube.com/watch?v=oiK4gTgncww • https://www.youtube.com/watch?v=WJOf4PfoHow • https://math.mit.edu/~jorloff/18.04/notes/topic4.pdf • https://math.mit.edu/~jorloff/18.04/notes/topic10.pdf	8Hrs
UNIT-III	
Statistical Methods: Introduction, Correlation and coefficient of correlation, Regression - line of regression problems. **Curve Fitting:** Curve fitting by	8Hrs

method of least squares- fitting of the curves of the form, $y = ax + b, y = ax^2 + bx + c$ *and* $y = ae^{bx}$. Applications: Correlation and Regression, estimate the value of one variable corresponding to a particular value of the other variable, Curve Fittings such as parabola and hyperbola Web Link and Video Lectures: • https://www.youtube.com/watch?v=xTpHD5WLuoA • https://www.youtube.com/watch?v=fNLeogEjMmM	
UNIT-IV	
Probability Distributions: Random variables (discrete and continuous), probability mass/densityfunctions. Binomial distribution, Poisson distribution , Geometric distribution and normal distributions - problems. **Joint probability distribution:** Joint Probability distribution for two discrete random variables,expectation, covariance. Applications: Industries, quality control, in errors correction, medicine, agriculture, engineering, for analysis and interpretations of basic data obtainedfrom experiments. Web Link and Video Lectures: • https://www.youtube.com/watch?v=nrkd0IlVxkY • https://www.youtube.com/watch?v=6x1pL9Yov1k	8Hrs
UNIT-V	
Sampling Theory and Statistical Inference: Sampling, Type I and Type II errors, standard error, confidence limits, test of hypothesis for means, test for hypothesis for proportions, student's t-distribution, Chi-square distribution as a test of goodness of fit. Applications: A large number of analyses for process control, product quality control for consumer safety, and environmental control purposes are using Sampling Theory. Web Link and Video Lectures: • https://www.youtube.com/watch?v=zmyh7nCjmsg • https://www.youtube.com/watch?v=fuBvQJP0ecw&list=PLp6ek2hDcoNCp9o8aLQrbY15a- o0weoTd&index=2 • https://www.youtube.com/watch?v=tFRXsngz4UQ • https://www.youtube.com/watch?v=Q1yu6TQZ79w	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	State and prove Cauchy - Riemann equation with its consequences and demonstrate Con-formal Transformation.
CO2	Illustrate Complex Integration using Cauchy's Integral theorem, Cauchy's Integral formulaand Cauchy's Residue theorem.
CO3	Use Method of Least Square for appropriate Curves. And Fit a suitable curve by the method of least squares and determine the lines of regression for a set of statistical data.

CO4	Develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in digital signal processing, information theory anddesign engineering
CO5	Demonstrate testing of hypothesis of sampling distributions and illustrate examples relatedto discrete parameters.

Reference Books	
1.	Prof G.B.Gururajachar "Engineering Mathematics-III , Academic Excellent series Publications, 2016-17
2.	B.S. Grewal, "Higher Engineering Mathematics" Khanna Publishers, 44th Edition, 2013.
3.	Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley-India publishers, 10th edition, 2014.
4.	Ramana B. V., "Higher Engineering Mathematics", Tata McGraw-Hill, 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.

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

Semester: IV		
ANALYSIS OF DETERMINATE STRUCTURES (Theory)		
Course Code: MVJ21CV42		CIE Marks:50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours:40L		SEE Duration: 03Hours
Course Learning Objectives: The students will be able to		
1	Analyze different forms of structural systems.	
2	Use concept of ILD and moving loads s.	
3	Impart principles of elastic structural analysis and behavior of determinate structures.	
4	Impart knowledge about various methods involved in the analysis of determinate structures.	

UNIT-I	
Introduction: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and nonlinear analysis, Static and kinematic Indeterminacy of structural systems. **Analysis of Plane Trusses:** Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections. Laboratory Sessions/ Experimental learning: (Self Study) • Experiments on truss using Virtual labs • Analysis of trusses by method of sections • Formulation of Excel Sheet program for Method of joint to analyze simple truss Applications: (Self Study) • Behaviour of determinate structures. • Determination of axial forces in truss	8Hrs
UNIT-II	
Influence Lines: Concepts of influence lines- ILD for reactions, SF and BM for determinate beams, numerical problems. **Moving Loads:** Reactions, BM and SF in determinate beams for rolling loads using ILD (Max. values and absolute max. values for beams subjected to multiple loads). Laboratory Sessions/ Experimental learning: (Self Study) • Computation of Loads using a model making • Computation of Defection for determinate beams using Excel Sheet Applications: (Self Study) • Calculation of Forces in Design of Bridges • https://nptel.ac.in/courses/105105166/32	8Hrs
UNIT-III	
Deflection of Beams: Moment area method: Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate	8Hrs

prismatic beams, Beams of varying section, Use of moment diagram by parts. Conjugate beam method: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections. Laboratory Sessions/ Experimental learning: (Self Study) • Single Span Beams Experiment • Continuous Beams Experiment • Deflection check at different points Applications: (Self Study) • Knowledge on Behaviour of determinate structure	
UNIT-IV	
Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams using total strain energy. Laboratory Sessions/ Experimental learning: (Self Study) • Strain energy charts: for different materials • Computation of Deflection for determinate beams using Excel Sheet Applications: (Self Study) • Knowledge about the energy principles and energy theorems and its applications to determine the deflections of trusses and bent frames.	8Hrs
UNIT-V	
Arches and Cable Structures: Three-hinged circular and parabolic arches with supports at the same level; Determination of normal thrust, radial shear and bending moment; Analysis of cables under point loads and UDL; Length of cables with supports at the same levels.ps. Laboratory Sessions/ Experimental learning: (Self Study) • Computation of forces in Arches and Cables using Excel sheet. • Analysis of problems using model making Applications: (Self Study) • Knowledge about the analysis of Arches and Cables.	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Calculate the member forces in trusses by method of joints and method of sections.
CO2	Restate the concept of Principle of Virtual Work
CO3	Describe the energy principles and energy theorems and its applications to determine the deflections of beams and bent frames.
CO4	Determine the moment in determinate beams and frames having variable moment of inertia
CO5	Construct the shear force and bending moment in Arches and Cables.

Reference Books

1.	Bhavikatti, Structual Analysis, VikasPublishing House Pvt. Ltd, New Delhi, 4th edition, 2002.
2.	Reddy C S, "Basic Structural Analysis" , Tata McGraw-Hill Publishing CompanyLtd.,3rd edition, 2010.
3.	L S Negi and R S Jangid, "Structural Analysis", Tata McGraw-Hill Publishing Company Ltd.,6th edition,2004
4.	Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., New Delhi, 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.

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

Semester: IV		
TRANSPORTATION ENGINEERING (Theory)		
Course Code: MVJ21CV43		CIE Marks:50
Credits: L:T:P: 3:0:0		SEE Marks: 50
Hours:40L		SEE Duration: 03Hours
Course Learning Objectives: The students will be able to		
1	Brief on different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.	
2	Detail on different aspects of geometric elements and train them to design geometric elements of a highway network.	
3	Analyze pavement and its components, pavement construction activities and its requirements.	
4	Illustrate the basic knowledge in railways	
5	State the basic knowledge of airport planning and design	

UNIT-I	
Highway Development and Planning: Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing road development in India, problems on best alignment among alternate proposals Salient Features of 3rd and 4thtwenty year road development plans and Policies, Present scenario of road development in India (NHDP & PMGSY) and in Karnataka (KSHIP & KRDCL) Road development plan - vision 2021. **Highway Alignment and Surveys**: Ideal Alignment, Factors affecting the alignment, Engineering surveys-Map study, Reconnaissance, Preliminary and Final location & detailed survey, Reports and drawings for new and re-aligned projects.	8Hrs
UNIT-II	
Highway Geometric Design: Cross sectional elements–width, surface, camber, Sight distances–SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment–curves, super-elevation, widening, gradients, summit and valley curves. **Highway Drainage**: Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location	8Hrs
UNIT-III	
Pavement Materials: Subgrade soil - desirable properties-HRB soil classification-determination of CBR and modulus of subgrade reaction with Problems Aggregates- Desirable properties and tests, Bituminous materials Explanation on Tar, bitumen, cutback and emulsion-tests on bituminous material **Pavement Design**: Pavement types, Components	8Hrs
UNIT-IV	
Railways: Introduction to rail transportation and its limitation, merits and	

demerits, Railway track, concept of gauge, Advantages of uniform gauge and loading gauge, Components of permanent way and its ideal requirement, Wheel and Axles, Coning of Wheels, Components of permanent way and its ideal requirement, Rail ,various type of rail cross section, length of rail, defects in rail and remedies to reduce the defects, Measure to reduce the wear of rails, Characteristics of an ideal rail joints ,Rail fastening and fixtures Purpose of welding of rail joints, Type, function and requirement of an ideal sleeper.	8Hrs
UNIT-V	
Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.	8Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the different modes of transportation, history, organizations. Also understanding of planning, types of roads and highway projects.
CO2	Get insight in to alignment, essential surveys and geometrical elements with specifications as per IRC and design of highway geometric elements
CO3	Understand the pavement and its components and design of the pavement
CO4	Predict the capability of choosing alignment and design geometric aspects of railway system, runway and taxiway
CO5	Restate the layout plan of airport and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same Evaluating the highway economics by B/C, NPV, IRR, methods and also to introduce highway financing concepts.

Reference Books	
1.	Stephen P. Robbins & Mary Coulter, Management‖, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009
2.	JAF Stoner, Freeman R.E and Daniel R Gilbert , Management‖, Pearson Education,
3.	Stephen A. Robbins & David A. Decenzo& Mary Coulter, Fundamentals of Management‖ Pearson Education, 7th Edition, 2011.
4.	Robert Kreitner& Mamata Mohapatra, Management‖, Biztantra, 2008.

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	2	1	2	-	1	-	-	-	1	-	1	1
CO2	2	1	2	-	1	-	-	-	1	-	1	1
CO3	2	1	2	-	1	-	-	-	1	-	1	1
CO4	2	1	2	-	1	-	-	-	1	-	1	1
CO5	2	1	2	-	1	-	-	-	1	-	1	1

Semester: IV		
FLUID MECHANICS AND HYDRAULIC MACHINERY LABORATORY (Theory and Practice)		
Course Code: MVJ21CV44		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40L+26P		SEE Duration: 03+03 Hours
Course Learning Objectives: The students will be able to		
1	Provide the Fundamental properties of fluids and its applications	
2	Make the students to explain on Hydrostatic laws and application to solve practical problem	
3	Gain the knowledge on Principles of Kinematics and Hydrodynamics for practical applications.	
4	Basic design of pipes and pipe networks considering flow, pressure and its losses	
5	Arrive the basic flow rate measurements	

UNIT-I	
Prerequisites: Knowledge on basic Fluid Properties, Newton's Laws **Fluids & Their Properties:** Concept of fluid, Fluid as a continuum, Properties of fluid - Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Newton's law of viscosity (theory & problems), Compressibility and bulk modulus. **Fluid Pressure and Its Measurements:** Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth on fluid at rest. Types of pressure. Measurement of pressure using simple, differential manometers, Numerical problems. **Hydrostatic forces on Surfaces**: Definition, Total pressure, centre of pressure, total pressure on horizontal, vertical and inclined plane surface submerged in liquid. Laboratory Sessions/ Experimental learning: (Self Learning) • Determination of Capillary Rise of water and Capillary fall of mercury in a vertical tube • Measurement of Pressure in Differential U-tube Mercury Manometer • Calculation of pressure under curved surface using Excel Sheet Applications: (Self Learning) • Lifting Mechanism of hydraulic Jack and Hydraulic Press • Pressure in Artesian Wells, Water Tower and Dams Video link /Additional online information: (Self Learning) • Fluid Pressure : https://nptel.ac.in/courses/112105171/	8Hrs
UNIT-II	
Prerequisites: Knowledge on Centroid, Moment of Inertia, Knowledge of Calculus, Partial Derivative Equations **Kinematic Flow**: Introduction, Methods of describing fluid motion, types of fluid flow, rate of flow, basic principles of fluid flow, three-dimensional continuity equation in Cartesian coordinate system, Velocity of a fluid particle, Numerical problems.	8Hrs

Fluid Dynamics: Introduction, Euler's equation of motion along a streamline, Bernoulli's equation, Assumptions and limitations of Bernoulli's equation, Modified Bernoulli's equation (real fluid) (Online Mode), Numerical Problems (with and without losses). Laboratory Sessions/ Experimental learning: (Self Learning) • Model Making of Streamline and Potential line under Gravity Dam • Draw the Flow net diagram for upstream storage of Barrage • Formulation of Design steps for Lock Gate Analysis using Excel Sheet Applications: (Self Learning) • Design of different parts of Hydraulic Equipment • Pressure on Water Control Structures like Gravity Dam • Steady Flow Analysis in Turbines	
UNIT-III	
Prerequisites: Knowledge on basic dynamic principles. **Application of Bernoulli's Equation:** Introduction. Venturi meter, Numerical Problems. **Open Channel flow Hydraulics (Uniform flow):** Introduction, Classification of flow through channels. Chezy's and Manning's equation for flow through open channel. Most economical channel sections. Uniform flow through Open channels. Numerical problems. **Notches and Weirs:** Introduction, Classification, discharge over rectangular, triangular, trapezoidal notches, Numerical problems. Laboratory Sessions/ Experimental learning: (Self Learning) • Model Making Flow through pipe and calculation of energy loss under given slope • Formulate and analyze the pipe bend by momentum equation using Excel Sheet Applications: (Self Learning) • Liquid ejection instruments like Paint Gun and Insect-Sprayer • Dynamic lift acts on the Plane	8Hrs
UNIT-IV	
Hydraulic Machines: Introduction, Impulse-Momentum equation. Impart of a jet on stationary and moving curved vanes. Introduction to concept of velocity triangles. Impact of jet on a series of curved vanes-Problems. **Turbines**-Impulse Turbines: Introduction to turbines, Classification of turbines. Pelton wheel- Components, working principle and velocity triangles. Maximum power, efficiency, working proportions- Numerical problems. General layout of a hydro-electric plant, heads and efficiencies. Laboratory Sessions/ Experimental learning: (Self Learning) • Model Making of Rectangular, Triangular, Trapezoidal and Cippoletti notches under given Discharge • Experimental determination of hydraulic coefficients of given vertical orifice • Analyze the Cippoletti notch using Excel Sheet programming	8Hrs

Applications: (Self Learning) • Emptying of Fluid Storage Tanks	
UNIT-V	
Flow through Pipes: Introduction, Major and minor losses in pipe flow (Online Mode), Darcy- Weisbach equation for head loss due to friction in a pipe, Pipes in series, Pipes in parallel, Equivalent pipe, Head loss due to sudden expansion, Contraction, Numerical problems. **Centrifugal Pumps:** Components and working of centrifugal pumps. Types of centrifugal pumps (online mode). Work done by impeller, Heads and Efficiencies, Minimum starting speed of centrifugal pumps. Numerical problems, Multi-stage pumps. Laboratory Sessions/ Experimental learning: (Self Learning) • Determination of distribution of flow rate by Hardy Cross Method for a Residential Buildings • Converting Water supply line into Single Equivalent pipe system • Formulate Excel Sheet Program for Hardy Cross Method Applications: (Self Learning) • Design of Water Supply Network for a Village • Create a simple Water Pump (Hydraulic Ram) • Leaks detection in Pipelines • Identification of enclosed air packets in pipelines.	8Hrs
LABORATORY EXPERIMENTS	
1. Calibration of Venturi meter 2. Calibration of rectangular and triangular notches. 3. Determination of Friction Factor of the Pipe Materials (Major losses). 4. Determination of head losses for different pipe fittings (Minor losses: Sudden Enlargement, Bends and Contraction Only). 5. Measurement of Flow through Orifice 6. Calibration of Ogee and Broad crested weir 7. Experimental determination of force exerted by a jet on flat and curved plates 8. Determination of Cd for Venturi flume 9. Performance characteristics of centrifugal pump. 10. Performance characteristics of Pelton wheel. 11. Performance characteristics of Francis turbine. 12. Demo experiment on Verification of Bernoulli's theorem 13. Demo experiment Performance characteristics of Kaplan Turbine. 14. Demo experiment on Multistage centrifugal pump.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Recall the fundamental properties of fluids and fluid continuum
CO2	Solve problems on hydrostatics and kinematic flow
CO3	State the kinematic concepts related to fluid flow
CO4	Apply Bernoulli's principle for Orifice, Mouthpiece, Notches and Weirs.
CO5	Compute the discharge through pipes in a Pipe Network

Reference Books	
1.	P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic Machines", 20th edition, 2015, Standard Book House, New Delhi.
2.	R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", 9th Edition, 2015, Laxmi Publications, New Delhi.
3.	Victor L Streeter, Benjamin Wylie E and Keith W Bedford, "Fluid Mechanics", Tata McGraw Hill Publishing Co Ltd., New Delhi, 2008.
4.	S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill, New Delhi, 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.

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	3	2	3	2	-	-	-	1	1	-	1	1
CO2	2	2	1	2	2	-	-	1	1	1	1	1
CO3	2	2	1	1	2	-	1	1	1	-	1	1
CO4	2	3	1	1	-	-	-	-	-	-	1	1
CO5	3	3	2	1	2	-	-	1	1	1	1	1

Semester: IV		
CONCRETE TECHNOLOGY AND MATERIAL TESTING LABORATORY (Theory and Practice)		
Course Code: MVJ21CV45		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours

Course Learning Objectives: The students will be able to	
1	Recognize the importance of material characteristics and their contributions to strength development in Concrete
2	Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3	Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

UNIT-I	
Cement – Cement manufacturing process flow chart, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, Effect of heat of hydration during mass concreting at project sites. **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. Recycled aggregates. Water – qualities of water. **Chemical admixtures** – plasticizers, superplasticizers, accelerators, retarders and air entraining agents. **Mineral admixtures** – Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash.	8 Hrs
UNIT-II	
Workability-factors affecting workability. Measurement of workability–slump, Compaction factor, Vee-Bee Consistometer tests, and 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.	8 Hrs
UNIT-III	
Concept of Mix Design with and without admixtures, Selection criteria of ingredients used for mix design (Online Mode), Procedure of mix proportioning using IS10262 and current American (ACI)/ British (BS) methods. Numerical Examples of Mix Proportioning using IS-10262.	8Hrs
UNIT-IV	
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 .	8Hrs

Definition and significance of durability: Internal and external factors influencing durability, Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, Mechanisms- Sulphate attack – chloride attack, carbonation, efflorescence, freezing and thawing. Corrosion, Durability requirements as per IS-456.	
UNIT-V	
RMC- manufacture and requirement as per QCI-RMCPCS, properties, advantages and disadvantages, quality control, Self-Compacting concrete – concept, materials, tests, properties, application, typical mix, and quality control. Fiber reinforced concrete - Fibers types, properties, application of FRC. **Light weight concrete** - material properties and types. Typical light weight concrete mix and applications. In-situ testing of concrete- penetration and pull-out test. Rebound hammer test, ultrasonic pulse velocity, core extraction- principal, application, and limitations.	**8 Hrs**
LABORATORY EXPERIMENTS	
1. Cement testing- normal consistency, setting time, fineness, specific gravity, compressive strength. 2. Fine aggregate- moisture content, specific gravity, bulk density, bulking, sieve analysis. 3. Coarse aggregate- water absorption, specific gravity, moisture content, bulk density, sieve analysis. 4. Workability tests- Slump, Vee Bee consistometer, compaction factor. 5. Compressive strength – Cubes and Cylinders. 6. NDT – UPV, Rebound Hammer	

Course Outcomes: After completing the course, the students will be able to	
CO1	Assess quality of materials used for making concrete
CO2	Distinguish concrete behavior based on its fresh properties
CO3	Design appropriate concrete mix
CO4	Assess strength and durability
CO5	Select appropriate special concrete.

Reference Books	
1.	Concrete Technology - Theory and Practice, M.S. Shetty, 8, 2018, S. Chand and Company, 978-9352533800.
2.	Concrete Technology, M L Gambir, 5, 2017, McGraw Hill Education, 978-1259062551.
3.	Properties of Concrete, Neville A.M, 5, 2012, Pearson, 978-8131791073.
4.	IS 456, IS10262.

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 self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies 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 complete 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	3	2	-	-	-	-	-	-	2	-	-	-
CO2	3	2	-	-	-	-	-	-	2	-	-	-
CO3	3	2	-	-	-	-	-	-	2	-	-	-
CO4	3	2	2	-	-	-	-	-	2	1	-	-
CO5	3	2	2	2	-	-	-	-	2	1	-	-

Semester: IV		
CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND CYBER LAW (Theory)		
Course Code: MVJ21CPH46		CIE Marks:50
Credits: L:T:P: 1:0:0		SEE Marks: 50
Hours:15L		SEE Duration: 02 Hours

Course Learning Objectives: The students will be able to	
1	To know the fundamental political codes, structure, procedures, powers, and duties of Indian constitution, Indian government institutions, fundamental rights, directive principles and the duties of the citizens.
2	To provide overall legal literacy to the young technograts to manage complex societal issues in the present scenario.
3	To understand engineering ethics & their responsibilities, identify their individual roles and ethical responsibilities towards society.

UNIT-I	
Introduction to Indian Constitution The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian Constitution, The Making of the Constitution, The role of the Constituent Assembly – Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and Limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and Significance in Nation Building.	3Hrs
UNIT-II	
Union Executive and State Executive: Parliamentary System, Federal System, Centre-State Relations. Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives – Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Article 370, 371, 371J) for some States.	3Hrs
UNIT-III	
Elections, Amendments and Emergency Provisions: Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments – 7,9,10,12,42,44,61,73,74,75,86, and 91,94,95,100,101,118 and some important Case Studies. Recent Amendments with explanation. Important Judgements with Explanation and its impact on society (from the list of Supreme Court Judgements). Emergency Provisions, types of Emergencies and it's consequences. **Constitutional Special Provisions:** Special Constitutional Provisions for SC & ST, OBC, Special Provision for Women, Children & Backward Classes.	3Hrs
UNIT-IV	
Professional / Engineering Ethics: Scope & Aims of Engineering &	3Hrs

Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India) : Profession, Professionalism, Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering - Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, IPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering.	
UNIT-V	
Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship, Cybercrimes and enforcement agencies.	3Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Have constitutional knowledge and legal literacy
CO2	Understand Engineering and Professional ethics and responsibilities of Engineers.
CO3	Understand the cyber crimes and cyber laws for cyber safety measure.
Reference Books	
1.	Constitution of India and Professional Ethics, T.S. Anupama, Sunstar Publisher
2.	Durga Das Basu (DD Basu): "Introduction to the Constitution on India", (Students Edition.) Prentice –Hall EEE, 19th/20th Edn., (Latest Edition) or 2008.
3.	Shubham Singles, Charles E. Haries, and Et al : "Constitution of India and Professional Ethics" by Cengage Learning India Private Limited, Latest Edition – 2018.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

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

Semester: IV		
PYTHON FOR CIVIL ENGINEERS (Ability Enhancement Course)		
Course Code: MVJ21CVA47		CIE Marks:50
Credits: L:T:P: 1:0:1		SEE Marks: 50
Hours:30		SEE Duration: 02 Hours
Course Learning Objectives: The students will be able to Write programs in python		

UNIT-I	
Introduction to python -syntax, installation	3Hrs
UNIT-II	
Python basics- print statement, comments, data structures and types, input and output, operations.	3Hrs
UNIT-III	
Python program flow-If statement, looping structures, break and continue.	3Hrs
UNIT-IV	
Functions and modules- parameters, variable arguments, scope of a function, standard modules.	3Hrs
UNIT-V	
Classes in python: creating classes, instance, inheritance and polymorphism. Programs related to civil engineering	3Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the knowledge of python to solve civil engineering problems
CO2	Demonstrate various physical models
CO3	Understand python programs and Apply concepts of looping.
Reference Books	
1.	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser Data Structures and Algorithms in Python John Wiley & Sons, Incorporated.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks: CIE for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE): SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level. **Total marks: 50+50=100**

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	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	1	1

Semester: IV		
ADDITIONAL MATHEMATICS-II (Theory)		
Course Code: MVJ21MATDIP-II		CIE Marks:50
Credits: L:T:P: 1:1:0		SEE Marks: 50
Hours:30L+10T		SEE Duration: 03 Hours
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. Self study: Application of Cayley-Hamilton theorem (without proof) to compute the inverse of a matrix-Examples. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	8Hrs
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. Self study: Curve tracing. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	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. Self study: Volume tetrahedron. Video Link: http://nptel.ac.in/courses.php?disciplineID=111	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.	8Hrs

Self study: Method of variation of parameters Video Link: http://nptel.ac.in/courses.php?disciplineID=111	
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. Self study: One dimensional heat and wave equations and solutions by the method of separable of variable Video Link:http://nptel.ac.in/courses.php?disciplineID=111	8Hrs

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.	G. B. Gururajachar, Calculus and Linear Algebra, Academic Excellent Series Publication, 2018-19
3.	Chandrashekar K. S, Engineering Mathematics-I, Sudha Publications, 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	3	3	0	2	0	0	0	0	0	0	1	1
CO2	3	3	0	2	0	0	0	0	0	0	1	1
CO3	3	3	0	3	0	0	0	0	0	0	0	1
CO4	2	2	0	3	0	0	0	0	0	0	1	1
CO5	2	2	0	2	0	0	0	0	0	0	0	1

Semester: IV	
SUMMER INTERNSHIP I (Intra/Inter College)	
Course Code: MVJ21INT48	
Course Learning Objectives: The students will be able to	
1	Get the skill exposure to different specialization
2	Apply the theoretical concept in field application
3	Prepare the comparison statement of difference activities
Inter/Intra Institutional Internship: This shall be carried out by students for 3 weeks during the intervening vacation of II and III semesters for students admitted to the I semester and during the intervening vacation of III and IV semesters for lateral entry Diploma students admitted to III semester. The Summer Internship-I shall include inter/intra institutional activities.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop skills related to different specialization of engineering
CO2	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO3	Prepare them for life-long learning to face the challenges and support the technological changes

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	2	2	2	3	3	2	1	1	2	1	1	2
CO2	2	2	2	3	3	2	1	1	2	1	2	2
CO3	2	2	2	3	3	2	1	1	2	1	2	2

Semester: V		
ENTREPRENEURSHIP AND CONSTRUCTION MANAGEMENT (Theory)		
Course Code: MVJ21CV51		CIE Marks:50
Credits: L:T:P:S: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs

Course Learning Objectives: The students will be able to	
1	Introduce the field of management, task of the manager, importance of planning and types of planning
2	Explain the role and importance of the entrepreneur in economic development and the concepts of entrepreneurship.
3	Discuss the importance of Small-Scale Industries and the related terms and problems involved.
4	Outline the Tender process and Contract document.
5	Introduce the field of management, task of the manager, importance of planning and types of planning

UNIT-I	
Management: Characteristics of management, functions of management, of planning process, types of plans. **Construction Project Formulation**: Introduction to construction management, project organization **Construction Planning and Scheduling**: Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path critical path method, PERT method. Laboratory Sessions/ Experimental learning • Case study on decision making process in a corporate. Applications • Planning in engineering field. Web Link and Video Lectures • https://nptel.ac.in/courses/110/105/110105146/ • https://nptel.ac.in/courses/122/108/122108038/	8Hrs
UNIT-II	
Resource Management: Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity. **Construction Equipments**: classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance. Laboratory Sessions/ Experimental learning • Case study of steel plant departmentalization. Applications • Effective communication in a corporate.	8Hrs

Web Link and Video Lectures • https://nptel.ac.in/content/storage2/courses/122106031/slides/3_2s.pdf	
UNIT-III	
Construction Quality, safety and Human Values: Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management **HSE:** Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. **Ethics** : Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing. Laboratory Sessions/ Experimental learning • Case study of a startup. Application • Social auditing in a software company Web Link and Video Lectures • https://nptel.ac.in/courses/110/106/110106141/ • https://nptel.ac.in/courses/127/105/127105007/	8Hrs
UNIT-IV	
Entrepreneurship: Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions. **Micro, Small & Medium Enterprises (MSME):** definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC, Single Window Agency: SISI, NSIC, SIDBI, KSFC. Laboratory Sessions/ Experimental learning • Case study on the growth of small-scale industries. Application • Small Scale Industries	8Hrs
UNIT-V	
Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document ,Law of Contract as per Indian Contract act 1882 , Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting Laboratory Sessions/ Experimental learning • Investigation on the market in correspondence to project.	8Hrs

Application • Preparations of project report.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Prepare a project plan based on requirements and prepare schedule of a project by understanding the activities and their sequence
CO2	Understand labour output, equipment efficiency to allocate resources required for an activity / project to achieve desired quality and safety.
CO3	Establish as an ethical entrepreneur and establish an enterprise utilizing the provisions offered by the federal agencies.
CO4	Identify the social responsibilities of business towards Different Groups
CO5	Discuss Contract documents of domestic and international construction works

Reference Books	
1.	Principles of Management, Tripathy PC & Reddy P, 1999, Tata McGraw Hill.
2.	Management and Entrepreneurship, NVR Naidu and T. Krishna Rao, I.K. International Publishing House Pvt, Ltd. New Delhi
3.	Civil Engineering Contracts and Estimates , B.S. Patil, Universities Press
4.	Management, Stephen P. Robbins & Mary Coulter, 10th Edition, 2009, Prentice Hall (India) Pvt. Ltd
5.	Management, JAF Stoner, Freeman R.E and Daniel R Gilbert, 6th Edition, 2004, 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.

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

Semester: V		
ANALYSIS OF INDETERMINATE STRUCTURES (Theory)		
Course Code: MVJ21CV52		CIE Marks:50
Credits: L:T:P:S: 3:0:0		SEE Marks: 50
Hours: 40L		SEE Duration: 3 Hrs

Course Learning Objectives: The students will be able to	
1	Apply the knowledge of mathematics, science and Engineering fundamentals to solve relatively complex Engineering structures.
2	Develop relevant equations for displacement method and apply the same for analysis on structures for different loading and boundary conditions.
3	Analyze structural system and interpret data.
4	Develop conditions for force method and apply the same for analysis on structures with different load and boundary conditions.
5	Apply the knowledge of mathematics, science and Engineering fundamentals to solve relatively complex Engineering structures.

UNIT-I	
Introduction: Methods of analysis of indeterminate structures – Force and displacement methods. **Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3. Laboratory Sessions/ Experimental learning: (Self-Learning) • Modelling and software analysis of beams and plane frames with Kinematic indeterminacy <=3 Applications: (Self-Learning) • Numerical problems involving Kinematic indeterminacy greater than 3 by Slope Deflection method. • Indeterminate Truss analysis. 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-II	
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 ≤3. Laboratory Sessions/ Experimental learning: (Self-Learning) • Modelling and software analysis of beams and plane frames with Kinematic indeterminacy >3	8 Hrs

Applications: (Self-Learning) • Numerical problems involving Kinematic indeterminacy greater than 3 by Moment Distribution 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	
UNIT-III	
Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway. Laboratory Sessions/ Experimental learning: (Self-Learning) • Modelling and software analysis of multi-storey frames with gravity loads. Applications: (Self-Learning) • Numerical problems involving Kinematic indeterminacy greater than 3 by Kani's 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
UNIT-IV	
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. **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
UNIT-V	
Analysis of Beams: Consistent Deformation method - Propped Cantilever Beam and Fixed Beams only. Clapeyron's Theorem of Three Moments – Continuous Beams and Fixed Beam only.	8 Hrs

Laboratory Sessions/ Experimental learning: (Self-Learning) • Verification of analysis results of force methods Applications: (Self-Learning) • Development of Three moment equation Video link / Additional online information: (Self-Learning) • https://archive.nptel.ac.in/courses/105/105/105105109/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify Indeterminate structures and determine the moment in indeterminate having variable moment of inertia and subsidence using slope defection method.
CO2	Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
CO3	Analyze the continuous beams and frames by moment distribution method and Kani's method and understanding its iterative nature of obtaining solutions.
CO4	Analyze the trusses and frames by flexibility and stiffness matrix method of system approach.
CO5	Acquire the knowledge to analyze the statically indeterminate beams subjected to gravity loads by force methods.

Reference Books	
1.	Theory of Structures, Punmia B.C, Ashok Kumar Jain & Arun Kumar Jain, 2014, Laxmi Publications, India.
2.	Theory of structures, Ramamrutham, S, 2011, Dhanpat Rai publications.
3.	Structural Analysis, Hibbeler, R.C, 2014, Pearson India
4.	Structural Analysis, Reddy C S, 2010, Tata McGraw-Hill Publishing Company Ltd

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	2	1	2	-	1	-	-	-	1	-	1	1
CO2	2	1	2	-	1	-	-	-	1	-	1	1
CO3	2	1	2	-	1	-	-	-	1	-	1	1
CO4	2	1	2	-	1	-	-	-	1	-	1	1
CO5	2	1	2	-	1	-	-	-	1	-	1	1

Semester: V		
DESIGN AND DETAILING OF RC STRUCTURES (Theory and Practice)		
Course Code: MVJ21CV53		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours
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	Illustrate a procedural knowledge in designing various structural RC elements.	
3	Impart the culture of following the codes for strength, serviceability, and durability as an ethics.	
4	Provide knowledge in analysis and design of RC elements for the success in competitive examinations.	

UNIT-I	
Pre requisites: Basic knowledge of Structural Analysis **Introduction to Limit State Design and Serviceability**: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety. 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. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Calculation of deflection and cracking of singly reinforced beam only. Laboratory Sessions/ Experimental learning: (Self Learning) • To compare various components designed using older methods and limit state method. • Comparison of components designed using older methods and limit state method Applications: (Self Learning) • To access the importance of strength and serviceability criteria in the design. Video link: • https://nptel.ac.in/courses/105/105/105105105/	8 Hrs
UNIT-II	
Limit State Analysis of Beams: Analysis of singly reinforced, doubly reinforced, and flanged beams for flexure and shear. Laboratory Sessions/ Experimental learning: (Self-Learning) • Generate excel sheets for analysis of beams Applications: • In analyzing beams of single and multistoried buildings. Video link: • https://nptel.ac.in/courses/105/105/105105105/	8Hrs

UNIT-III	
Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams for shear, design for combined bending and torsion as per IS-456. Laboratory Sessions/ Experimental learning: (Self-Learning) • Generate excel sheets for design of beams/ develop 3D models in software to understand detailing. Applications: • In designing beams of single and multistoried buildings. Video link: • https://nptel.ac.in/courses/105/105/105105105/	8Hrs
UNIT-IV	
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. Importance of bond, anchorage length and lap length. Laboratory Sessions/ Experimental learning: (Self-Learning) • Models of beams and slabs/ Site visits to understand the RC detailing of various components. Applications: • In designing slabs and stairs for single and multi-storied buildings. Video link: • https://nptel.ac.in/courses/105/105/105105105/	8Hrs
UNIT-V	
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 and for axial load & moment. Laboratory Sessions/ Experimental learning: (Self Learning) • Generate excel sheets for design / develop 3D models in software to understand detailing. Applications: • In designing columns and footings for single and multistoried buildings Video link: • https://nptel.ac.in/courses/105/105/105105105/	8Hrs
LABORATORY EXPERIMENTS	
Prerequisites: Design and Detailing Specifications as per IS 456, SP34, SP16	
1. Detailing of Singly Reinforced, Doubly Reinforced, Cantilever Beams 2. Detailing of Staircase, Lintel and Chajja 3. Detailing of Column 4. Detailing of Slab (one way and two way) under different restrained conditions 5. Detailing of Footings	

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the design philosophy and principles.
CO2	Solve engineering problems of RC elements subjected to flexure, shear and torsion.
CO3	Illustrate on the procedural knowledge in designs of RC structural elements such as slabs, columns and footings
CO4	Identify the different failure modes of steel tension and compression members and beams and compute their design strengths.
CO5	Design column splices and bases as per the Indian Standards

Reference Books	
1.	Unnikrishnan Pillai and Devdas Menon, "Reinforced Concrete Design", McGraw Hill, New Delhi, 2017
2.	H J Sah, "Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)", Charotar Publishing House Pvt. Ltd. 2014
3.	IS: 456-2000, "Indian Standard Code Of Practice For Plain And Reinforced Concrete"
4.	SP 16 (1978): Design Aids for Reinforced Concrete to IS 456:1978

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 complete

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	2	1	3	1	-	1	-	-	1	-	1	1
CO2	1	1	3	2	-	1	-	-	1	-	1	1
CO3	2	2	1	3	-	1	-	-	2	-	1	1
CO4	1	1	2	2	-	1	-	-	2	-	1	1
CO5	1	1	2	3	-	1	-	-	2	-	1	1

Semester: V		
WATER SUPPLY AND WASTEWATER ENGINEERING (Theory and Practice)		
Course Code: MVJ21CV54		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50+50
Hours: 40L+26P		SEE Duration: 03+03 Hrs
Course Learning Objectives: The students will be able to		
1	Evaluate the sources and conveyance systems for raw and treated water.	
2	Design physical and chemical methods to ensure safe and potable water supply.	
3	Explain the concept and design of various physicochemical and biological treatment units	

UNIT-I	
WATER: Introduction, Need for protected water supply schemes, Sources water, Water supply systems- Intakes- Water demand- various types of water demand and their estimation- potable and wholesome water quality parameters - drinking water standards- Waterborne diseases- - Comparison from quality and quantity of various sources. Laboratory Sessions/ Experimental learning: Population Forecasting and Urban Planning Practice: A Case Study Video link: https://nptel.ac.in/courses/105105201/	8 Hrs
UNIT-II	
WATER TREATMENT: Layout and general outline of water treatment units- Screening- Aeration- sedimentation- principles- design factors for sedimentation tank- coagulation-flocculation- clarifier design- coagulants- feeding arrangements. **FILTRATION AND CHLORINATION**: Filtration- theory- working of slow and rapid gravity filters- multimedia filters- design of filters- troubles in operation- comparison of filters – disinfection- theory of chlorination- chlorine demand- and other disinfection practices- Miscellaneous treatment methods. **WATER DISTRIBUTION SYSTEMS**: Water distribution systems- Requirements, Layout of Water distribution systems- Design procedures- Hardy Cross and equivalent pipe methods. Laboratory Sessions/ Experimental learning: Design and fabricate low-cost potable filtration unit for the treatment of surface water source. Video link: https://nptel.ac.in/courses/105105201/	8 Hrs
UNIT-III	
WASTE WATER COLLECTION AND CHARACTERSTICS: Conservancy and water carriage systems- sewage and storm water estimation- time of concentration- storm water overflows combined flow- characteristics	8 Hrs

of sewage- effluent discharge standards- cycles of decay- decomposition of sewage- examination of sewage- B.O.D- C.O.D equations. HOUSE DRAINAGE Design of sewers- shapes and materials- sewer appurtenances- house drainage- components requirements- sanitary fittings- traps- one pipe and two pipe systems of plumbing. Laboratory Sessions: • Sampling and testing of wastewater samples to identify various physical, chemical, and biological characteristics of water. (Env.Lab experiments) • Model making of Municipal Wastewater treatment showing various treatment units. Applications: (Self – Learning) • Sample collection procedures and analysis. • Knowledge of BIS standards for various physical, chemical, and biological parameters. Video link / Additional online information: • https://nptel.ac.in/courses/105104102/	
UNIT-IV	
WASTE WATER TREATMENT: Layout and general outline of various units in a waste water treatment plant- primary treatment design of screens- grit chambers- skimming tanks- principles of design- biological treatment- trickling filters- activated sludge process- rotating biological contactors and standard high rate filters. Laboratory Sessions: • Model making of suspended and attached growth systems. • Preparation of flow chart showing various waste treatment processes. Applications: (Self – Learning) • Understand the sludge processing techniques and its behavior in different feeding conditions. • Knowledge on varying F/M ratios and understand its applications for various modifications of ASP. Video link / Additional online information: • https://nptel.ac.in/courses/105104102/ • https://nptel.ac.in/courses/105105048/	8 Hrs
UNIT-V	
LOW COST WASTE WATER TREATMENT: Working principle and design of Oxidation ponds- design and operation of Oxidation ditches- Case studies- Sludge digestion and factors effecting- design of Digestion tank- Sludge disposal methods- septic tanks- soak pits.	8 Hrs

Laboratory Sessions: • Experimental determination of coagulation process. • A visit to college STP to make them understand and give practical exposure about the various wastewater treatment procedures. Applications: (Self – Learning) • Understand the importance of denitrification and removal of phosphorous from the wastewater. • Behavior of digested sludge on drying and its practical use as a manure. Video link / Additional online information: • https://nptel.ac.in/courses/105104102/	

LABORATORY EXPERIMENTS

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 and Residual Chlorine.
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 Iron by spectrophotometer.
11. Determination of Sodium and Potassium by flame photometer.
12. Determination of COD(Demonstration)
13. Air Quality Monitoring (Demonstration)
14. Determination of Sound-by-Sound level meter at different locations (Demonstration)
15. Determination of pH and Turbidity.

Course Outcomes: After completing the course, the students will be able to	
CO1	an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
CO2	understanding of water quality criteria and standards, and their relation to public health,
CO3	design and evaluate water supply project alternatives on basis of chosen selection criteria
CO4	estimate sewage generation and design sewer system including sewage pumping stations
CO5	perform basic design of the unit operations and processes that are used in sewage treatment

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

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 self -study are 20 (2 presentations are be held for 10 marks each). The marks obtained in test, quiz and self -studies 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 complete 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	3	3	3	1	-	2	2	1	1	-	2	1
CO2	3	3	2	1	-	1	2	-	1	1	2	1
CO3	3	3	2	1	-	2	2	-	1	1	2	1
CO4	3	3	2	2	-	2	2	-	1	1	2	1
CO5	3	3	2	2	-	2	2	-	1	1	1	1

Semester: V		
PAVEMENT MATERIALS (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	Explain the different types, properties and tests on soil sub grade.
2	Explain the properties of aggregates and different test procedures and specifications.
3	Explain the origin, properties, constituents and preparation of bitumen, tar, cutback bitumen and emulsions.
4	Illustrate the bituminous mix design method.
5	Explain in detail about HMA, WMA, CMA Explain types of cement, tests on cement, types of concrete, fillers, and sealers.

UNIT-I	
Prerequisites: Knowledge on basics of Soil Mechanics **Soil Characterization:** Properties of sub grade layers; different types of soils, Soil Classification; Index and other basic properties of soil; A critical look at the different laboratory and in - situ procedures for evaluating the mechanical properties of soils viz. SPT, CPT, CBR, Plate Load test, Field compaction and control. Laboratory Sessions: • Basic tests on soil. • Soil Stability Test. Applications: • To find out the Physical requirements of Aggregates with respect to IRC specifications. • To find out the Optimum Binder Content for Bituminous Mixes. Video link / Additional online information: • https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-26.pdf • https://www.youtube.com/watch?v=fqYK4JGIVJY • https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-24.pdf	8 Hrs
UNIT-II	
Prerequisites: Knowledge on basic Highway Engineering materials. **Bitumen:** Bitumen and Tar: Origin, preparation, properties and chemical constitution of bituminous road binders; requirements, Grades of bitumen i.e. Penetration Grade, Viscosity Grade. bitumen structure, Rheology of bitumen, Elastic modulus, Dynamic modulus, visco-elastic and fatigue properties, creep test,	8 Hrs

Bituminous Emulsions and Cutbacks, Preparation, characteristics, uses and tests, Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion, Modified binders. Laboratory Sessions: • Basic tests on bitumen. Applications: • To find out the Physical requirements of Bitumen with respect to IRC specifications. Video link / Additional online information: • https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105106053/lec31.pdf https://nptel.ac.in/courses/105105107/	
UNIT-III	
Prerequisites: Knowledge on basic Highway Engineering materials. Bituminous Mixes: Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties. Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Long term and short-term ageing and its effect on bitumen performance, Tests to simulate ageing of bitumen viz. RTFOT and PAV. Desirable properties of bituminous mixes, Design of bituminous mixes: Modified Marshall's specifications, Hubbard Field method of mix design, Hveem's method of mix design; Introduction to super pave mix design procedure, HMA, WMA, CMA. Laboratory Sessions/ Experimental learning: • Rutting test and Fatigue test • Marshall Mix Design Applications: • To determine the stability of the mix • To Prepare the stable bituminous mix for the road construction	8Hrs
UNIT-IV	
Pre requisites: Types of equipment Pavement construction. Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice, productivity calculation. Problem on equipment usage charges. Investment on equipment, depreciation. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction. Laboratory Sessions/ Experimental learning:	8 Hrs

• Refer standard contract forms and identify important clauses. Application: • Equipment selection. Video link / Additional online information: • https://nptel.ac.in/courses/105103093/, • https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105104161/lec12.pdf, • https://syedsohailuddin.files.wordpress.com/2018/07/is-1200-17.pdf	
UNIT-V	
Prerequisites: Knowledge on basic Highway Engineering materials. **Quality control** Sub grade: Preparation of sub grade- construction of embankments and cuts for roads; Quality control tests. Flexible Pavements: Specifications of materials, construction method and field control check for of flexible pavement layers –BM- DBM and BC Cement Concrete Pavements: – PQC-FRCC- Specifications and method of cement concrete pavement construction; Quality control tests; Construction of various types of joints. Laboratory Sessions/ Experimental learning: • Compaction Test(density) • Quality tests of aggregate. • Quality test on the Bituminous and cement concrete during the construction Video link / Additional online information (related to module if any): • https://nptel.ac.in/content/storage2/courses/105101087/downloads/Lec-19.pdf	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Gain knowledge about aggregates, properties and tests.
CO2	Capable of doing mix design for different layers of pavement.
CO3	Gain the Knowledge Bituminous Mixes and its Properties.
CO4	Assess quality of materials.
CO5	Inspect and estimate the work of equipment

Reference Books	
1.	Khanna, S.K., Justo, C.E.G., and Veeraragavan, A., `Highway Engineering', Nem Chand and Bros, Roorkee, 2014.
2.	Partha Chakroborty and Animesh Das, 'Principles of Transportation Engineering', Prentice Hall (India), New Delhi, 2011.
3.	Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, Prentice–Hall, 2002.
4.	Freddy L Roberts, Prithvi S Kandhaletal, "Hot Mix Asphalt Materials, mixture design and construction" -(2ndEdition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA, 2009.

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	2	2	1	-	-	-	-	-	-	-	-	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1
CO3	2	2	1	1	1	-	-	-	1	-	-	1
CO4	2	2	1	-	-	-	1	-	1	-	-	1
CO5	2	2	1	-	-	-	1	1	-	-	1	1

Semester: V		
WATER RESOURCES MANAGEMENT (Theory)		
Course Code: MVJ21CV552		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	Judge surface and ground water resources.
2	Address the issues of water resources management.
3	Explain the principles of integrated water resources management.
4	Apply the legal framework of water policy.
5	Suggest the different methods of water harvesting.

UNIT-I	
Water Resources: Hydrologic Cycle, Global water resources and Indian Water resources, Water Balance, Available Renewable Water Resources, Surface Water Resources, Groundwater Resources- Types of Aquifers, and Groundwater as a Storage Medium. **Water resources management**: The Water Balance as a Result of Human Interference, Storm water management, Flood water management, Fresh water management, Ground water management, Wastewater management, Urban water management, Water pollution and water quality management. Water table- Factors affecting water table, Water Scarcity Laboratory Sessions/ Experimental learning: • Identification of water management system available in a region Applications: • Water quantity estimation • Water quantity management • Quantifying the water scarcity. Video link / Additional online information: • https://nptel.ac.in/courses/114105044/ • https://nptel.ac.in/courses/114105044/ • https://nptel.ac.in/courses/114105044/	8 Hrs
UNIT-II	
Water Resources Planning and Management: Necessity, Planning and management issues, System components, planning scales, Approaches. Planning and management aspects, Analysis, Models for impact prediction and evaluation, Adaptive Integrated Policies, Post Planning and management Issues. Meeting the Planning and Management Challenges. Laboratory Sessions/ Experimental learning:	8 Hrs

• Analyzing the alternate solutions for water quality problem in a given region Applications: • Preparing analytical framework of management system • Model analysis for selecting the optimum solution • Management of Water quality issues through system approach Video link / Additional online information: • https://nptel.ac.in/courses/105108130/	
UNIT-III	
Integrated Water Resources Management: Definition of IWRM- Natural and human integration system, Principles- Water as a finite and vulnerable resource, Participatory approach, The important role of women in water management, Water as an economic good, Implementation of IWRM, Legislative and Organizational Framework. **Private sector Involvement**: Types and Forms of Private Sector Involvement, Benefits of IWRM in different sector- Environmental sector, Food and agriculture sector, water supply and sanitation. Laboratory Sessions/ Experimental learning: • Identification of private sector participation in water supply for a given Applications: • Decision making for water quantity problems based on IWRM Concept • Evaluation of value of water • Monitoring Private sector involvement in water management Video link / Additional online information: • http://www.digimat.in/nptel/courses/video/105101010/L08.html • https://nptel.ac.in/courses/114105044/	8Hrs
UNIT-IV	
Water Governance: Definition, Necessity of water governance, Principles of effective governance- Approaches, performance and operation water governance challenges, water governance cycle **National Water Policy**: National water resource council, 1987 & 2002 Nation water policy Irrigation Management Transfer Policies and Activities , Legal Registration of ,WUAs , Legal Changes in Water Allocation, – Role of Local Institutions – Community Based Organizations. Laboratory Sessions/ Experimental learning: • Verification of implementation of water policies in a given region. Applications: (Self Learning) • Justification on water allocation • Highlighting the water policies during the decision-making process	8 Hrs

in water management • Evaluation of effective participation of WUA Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/114105044/	
UNIT-V	
Water conservation: Definition, Goals, Water conservation techniques- Conservation by surface water storage, Conservation of rain water, Ground water conservation (Online mode), Catchment area protection (CAP) - Inter-basin transfer of water- Adoption of drip sprinkler irrigation, Management of growing pattern of crops, Reducing evapotranspiration, Reducing evaporation from various water bodies- Recycling of water , Measures of water conservation, simple water saving methods. **Water Harvesting:** Water Harvesting Techniques, Micro-catchments, Design of Small Water Harvesting Structures, Farm Ponds, Percolation Tanks, Yield from a Catchment, Rain water Harvesting-various techniques related to Rural and Urban area(Online mode). Laboratory Sessions/ Experimental learning: • Design Rainwater harvesting structure in a given region to conserve water. Applications: • Design of Rainwater harvesting system • Evaluation of effective conservation of water. • Implementation of micro irrigation system	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Discuss the potential of groundwater and surface water resources.
CO2	Illustrate the issues related to planning and management of water resources
CO3	Outline IWRM in different regions.
CO4	List out the legal issues of water policy
CO5	Predict the method for water harvesting based on the area.

Reference Books	
1.	Engineering Hydrology , K. Subramanya, 2017, Tata McGraw Hill Publishers, New Delhi
2.	Ground Water, H.M. Raghunath, 2016, Wiley Eastern Publication, New Delhi.
3.	Integrated Water Resources Management, Mollinga, P. et al, Water in South Asia Volume I, 2006, Sage Publications.
4.	Water Resources Systems Planning and Management, Daniel P. Loucks and Eelco van Beek, 2005, UNESCO 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	2	2	1	-	-	-	-	-	-	-	-	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1
CO3	2	2	1	1	1	-	-	-	1	-	-	1
CO4	2	2	1	-	-	-	1	-	1	-	-	1
CO5	2	2	1	-	-	-	1	1	-	-	1	1

Semester: V		
REPAIR AND REHABILITATION OF STRUCTURES (Theory)		
Course Code: MVJ21CV553		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	Investigate the cause of deterioration of concrete structures.	
2	Strategies different repair and rehabilitation of structures.	
3	Evaluate the performance of the materials for repair.	

UNIT-I	
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.	8 Hrs
UNIT-II	
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	
Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection	8 Hrs
UNIT-IV	
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 posttensioning, Section enlargement and guidelines for seismic rehabilitation of existing building.	8 Hrs
UNIT-V	
Materials for Repair and Retrofitting: Artificial fiber 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	Identify the causes for structural (Concrete) deterioration.
CO2	Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.
CO3	Recommend maintenance requirements of the buildings and preventive measures against influencing factors.
CO4	Select suitable materials
CO5	Suggest an appropriate method for repair and rehabilitation.

Reference Books	
1.	Repair of Concrete Structures, R.T.Allen and S.C. Edwards, Blakie and Sons.
2.	Deterioration, Maintenance and Repair of Structures, Sidney, M. Johnson.
3.	Concrete Structures – Materials, Maintenance and Repair, Denison Campbell, Allen & Harold Roper, Longman Scientific and Technical.
4.	Learning for failure from Deficiencies in Design, Construction and Service, Raiker R.N, R&D Center (SDCPL) and CPWD Manual

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	2	2	-	-	-	-	-	-	2	-	-	-
CO2	2	2	-	-	-	-	-	-	2	-	-	-
CO3	2	2	-	-	-	-	-	-	2	-	-	-
CO4	2	2	2	-	-	-	-	-	2	1	-	-
CO5	2	2	2	2	-	-	-	-	2	1	-	-

Semester: V		
TRAFFIC ENGINEERING (Theory)		
Course Code: MVJ21CV554		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 the human factors and vehicular factors in traffic engineering design.
2	Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
3	Use an appropriate traffic flow theory and to comprehend the capacity & signalized intersection analysis.
4	Understand the basic knowledge of Intelligent Transportation System.
5	

UNIT-I	
Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.	8 Hrs
UNIT-II	
Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service-Concept, applications and significance.	8 Hrs
UNIT-III	
Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.	8Hrs
UNIT-IV	
Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.	8 Hrs
UNIT-V	

Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the human factors and vehicular factors in traffic engineering design.
CO2	Conduct different types of traffic surveys and analysis of collected data using statistical concepts.
CO3	Use an appropriate traffic flow theory and to comprehend the capacity of intersection
CO4	Use an appropriate traffic flow theory and to carry out the signalized intersection analysis.
CO5	Understand the basic knowledge of Intelligent Transportation System.

Reference Books	
1.	Kadiyali.L.R. "Traffic Engineering and Transport Planning ", Khanna Publishers, Delhi, 2013
2.	S K Khanna and CEG Justo and A Veeraragavan, "Highway Engineering", Nem Chand and Bros.
3.	Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
4.	SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994

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												
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CO2	2	2	3	3	1	-	-	-	-	-	-	-
CO3	3	2	3	3	-	1	-	1	2	-	1	-
CO4	1	2	3	3	-	-	-	-	-	-	-	-
CO5	1	2	3	3	-	-	-	-	-	-	-	-

Semester: V		
ENVIRONMENTAL STUDIES (Theory)		
Course Code: MVJ21ENV56		**CIE Marks: 50**
Credits: L:T:P: 1:0:0		**SEE Marks: 50**
Hours: 15 L		**SEE Duration: 02 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	
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/	**3 Hrs**
UNIT-II	
Advances in Energy Systems (Merits, Demerits, Global Status and 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/	**3 Hrs**
UNIT-III	
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/	**3 Hrs**

UNIT-IV	
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	**3 Hrs**
UNIT-V	
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/	**3 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 for 50 marks, executed by way of tests (T) and assignments. A minimum of three quizzes are conducted along with tests. Test portion is evaluated for 40 marks and assignment is evaluated for 10 marks. The three tests are conducted for 40 marks each and the average of all the tests are calculated for 40. The marks for the assignments are 10 (2 assignments for 5 marks each). The marks obtained in test and assignment are added and report CIE for 50 marks.

Semester End Examination (SEE):

SEE for 50 marks, executed by means of an examination. The Question paper contains objective type questions for 50 marks covering the entire syllabus having same complexity in terms of COs and Bloom's taxonomy level.

Total marks: 50+50=100

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

Semester: V		
RESEARCH METHODOLOGY AND IPR		
Course Code:	**MVJ21RMI57**	**CIE Marks:50**
Credits: L:T:P:S:	**1:2:0:0**	**SEE Marks: 50**
Hours:	**30**	**SEE Duration: 3 Hrs**
Course Learning Objectives: The students will be able to		
1	To give an overview of the research methodology and explain the technique of defining a research problem and explain the basic ethics in research.	
2	To develop a suitable outline for research studies through various sources of information from literature review and data collection.	
3	To develop an understanding of the results and on analysis of the work carried.	
4	To Demonstrate enhanced Scientific writing skills.	
5	To Develop an Understanding on Various Intellectual Property Rights and importance of filing patents.	

UNIT-I	
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem. ***Ethics in Engineering Research:*** Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.	**6 Hrs**
UNIT-II	
Research Writing and Journal Publication Skills: Understanding the importance of quality research papers, Differences between conference papers, journal articles, and other academic publications, criteria for selecting a journal, understanding impact factors and journal rankings. place of the literature review in research, how to review the literature, structure of a research paper, effective use of figures and tables, preparing a cover letter and author contributions, Responding to reviewers' comments. **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, Tools for citation management, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments.	**6 Hrs**
UNIT-III	
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. ***Results and Analysis:*** Importance and scientific methodology in recording results, importance of negative results, different ways of recording, industrial requirement, artifacts versus true results, types of analysis (analytical, objective, subjective), outcome as new idea, hypothesis, concept, theory, model etc.	**6 Hrs**

UNIT-IV	
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	**6 Hrs**
UNIT-V	
Introduction to Intellectual Property Rights: Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights. Kinds of Intellectual property rights—Copy Right, Patent, Trademark, Trade Secret and trade dress, Design, Layout Design, Geographical Indication, Plant Varieties and Traditional Knowledge. Patents: Trips Definition, Patentable and Non-Patentable inventions, Legal requirements for patents. Patent application process: Prior art search, Drafting of a patent, Filing of a patent, Patent document: specification and claims, Granting of patent, Management of IP, Commercialization of IP – Assignment, licensing and infringement.	**6 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1	formulate the research problem and follow research ethics.
CO2	carry to carrying out a Literature survey for the topic identified
CO3	Analyse the research and interpret the outcomes of the research.
CO4	Enhance their technical writing skills
CO5	Understand the importance of Patenting, Licensing and technology transfer.

Text Books	
1.	**C.R. Kothari, Research Methodology, Methods and Techniques, 2nd Revised edition,** New Age International Publishers, 2015
2.	**Neeraj Pandey and Khushdeep Dharni, Intellectual Property Rights, PHI Learning Pvt Ltd, 2014**

Reference Books	
1.	**Geoffrey Marczyk, David De Matteo, David Festinger (2005) Essentials of Research Design and Methodology, John Wiley & Sons, Inc.**
2.	**Carol Ellison (2010) McGraw-Hill's Concise Guide to Writing Research Papers, McGraw-Hill**
3.	**Sinha, S.C. and Dhiman, A.K., (2002). Research Methodology, Ess Publications. 2nd volume.**
4.	**Wadehra, B.L. (2000). Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing**

Assessment Details (both CIE and SEE)

· The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

· The student has to obtain a minimum of 40% of maximum marks in CIE and a minimum of 40% of maximum marks in SEE.

· Semester End Exam (SEE) is conducted for 50 marks (2 hours duration).

· Based on this grading will be awarded.

· The student has to score a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

· Three Unit Tests each of 30 Marks (30 MCQ's) (duration 01 hour)

1. First test at the end of 5th week of the semester.

2. Second test at the end of the 10th week of the semester.

3. Third test at the end of the 15th week of the semester.

· Report Writing /Presentation/ Assignment to attain the COs and POs for 20 Marks, (Students can decide the topic for Mini Project and start doing literature survey, report of literature survey can be considered for assignments) At the end of the 13th week of the semester

· The average of three tests and report writing/presentation/Assignment summing to 50 marks

Semester End Examination:

· Theory SEE will be conducted by College as per the scheduled timetable, with common question paper for the subject

· SEE paper will be set for 50 questions of each of 01 marks. The pattern of the question paper is MCQ. The time allotted for SEE is 02 hours

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

High-3, Medium-2, Low-1

Semester: V		
UNIVERSAL HUMAN VALUES (Theory)		
Course Code: MVJ21UHV58		**CIE Marks: 50**
Credits: L:T:P: 2:0:0		**SEE Marks: 50**
Hours: 30 L		**SEE Duration: 02 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	
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_Kt 6jqzA3p Z3yA7g_OAQz • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**6 Hrs**
UNIT-II	
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	**6 Hrs**
UNIT-III	

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 Respect (9) Exploring Systems to fulfill Human Goal Video link: • https://www.youtube.com/watch?v=F2KVW4WNnS • https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw	**6 Hrs**
UNIT-IV	
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	**6 Hrs**
UNIT-V	
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	**6 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	
3.	AICTE SIP UHV-I Teaching Material, https://fdp-si.aicte india.org/ AicteSipUHV _download.php
4.	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):

CIE for 50 marks 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):

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.

Total marks: 50+50=100

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

Semester: VI			
HYDROLOGY AND IRRIGATION ENGINEERING (Theory)			
Course Code: MVJ21CV61			CIE Marks: 50
Credits: L:T:P: 2:1:0			SEE Marks: 50
Hours: 30L+10T			SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to			
1	Explain the concept of hydrology and analyze hydrological data		
2	Measure the components of hydrological cycle		
3	Analyze the flood hydrograph, unit hydrograph and S curve hydrograph		
4	Demonstrate the system of irrigation		
5	List and explain the Irrigation structures		

UNIT-I	
Prerequisite: Knowledge on Water in earth, Water cycle, weather & climate **Hydrology**: Introduction- Surface and Ground water Hydrology, Importance and Application of Hydrology in Engineering, Hydrologic cycle- Horton's representation, Engineering representation, Descriptive representation. Climate, Weather -Meteorological measurements **Precipitation**: Forms and types of precipitation, measurement of precipitation (Simon's gauge & Syphon gauge only), and selection of rain gauge station. Adequacy of rain gauges, methods of computing average rainfall, interpolation of missing data, adjustment of missing data by double mass curve method, Hyetograph and mass curve of rainfall, Frequency analysis. Laboratory Sessions/ Experimental learning: Determination of the average annual rain fall of the river basin by collecting the data • Case study on the Precipitation data Analysis Applications: • Measuring the rainfall in the field • Determining the missing rainfall data • Presenting of rainfall data for Hydrological analysis Video link / Additional online information: • https://nptel.ac.in/courses/105104029/#	8Hrs
UNIT-II	
Prerequisite: precipitation and Runoff **Losses from precipitation**: Evaporation: Definition, factors affecting, measurement (Class A pan). Estimation using empirical methods (Meyer's and Rohwer's equation), evaporation control. Evapo-transpiration: Definition, factors affecting, measurement, estimation (Blaney criddle method) **Infiltration**: Definition, factors affecting measurement (double ring infiltrometer), infiltration indices, Horton's equation of infiltration.	8Hrs

Runoff –Process, Estimation of runoff and Factor affecting runoff. Laboratory Sessions/ Experimental learning: • Measurement of evaporation rate of a reservoir and identification of evaporation control measures • Case study on Evaporation control Applications: • Evaporation rate measurement the in the reservoir • Measurement of infiltration rate for the different landscape • Measuring the runoff in a river Video link / Additional online information: • https://nptel.ac.in/courses/105104029/#	
UNIT-III	
Prerequisite: Flood & Drought, **Hydrographs:** Definition, components of hydrographs, unit hydrograph and its derivation from simple storm hydrograph, base flow separation, Unit Hygrograph, S Hydrograph – Applications and numerical problems **Estimation of flood & flood routing**: Definition of flood, methods of estimation of flood, Flood routing- Classification and introduction to Flood routing techniques, Flood control and management. Laboratory Sessions/ Experimental learning: • Plotting the hydrograph of a river basin by collecting the relevant data. • Case study on Flood mitigation measures Applications: • Analyzation of runoff and Rainfall relationship • Prediction of Flood • Proposing the flood mitigation measures Video link / Additional online information: • https://nptel.ac.in/courses/105104029/	8 Hrs
UNIT-IV	
Prerequisite: Irrigation, Crops, and Crops seasons. **Irrigation Engineering**: Introduction, need for irrigation, advantages and disadvantages of irrigation, Systems of irrigation: Gravity irrigation, lift irrigation, Flow irrigation, Furrow Irrigation, Strip Irrigation, Border Irrigation, Basin Irrigation, Micro Irrigation- Components- Advantages and disadvantages. **Water Requirement of Crops:** Introduction, definitions, crop seasons of India, water requirement of a crop, duty, delta, base period. Consumptive use, Irrigation efficiencies, Assessment of irrigation water. Laboratory Sessions/ Experimental learning: • Identifying the suitable irrigation system in the particular field to	8 Hrs

improve the productivity • Case study on Selection of irrigation methods Applications: • Increasing the water productivity • Analyzing Effective Irrigation water management techniques • Design the irrigation system Video link / Additional online information: • https://nptel.ac.in/courses/1051 2159/ • https://nptel.ac.in/courses/105102159/	
UNIT-V	
Prerequisite: Open channel flow **Irrigation Structures:** Definition, Irrigation water storage and water diversion structures, Dam- Components, types, functions, Tank- Components and Functions, Diversion head works, weir, River training works- Components. **Canals:** Definition, Types of canals, Alignment of canals, Design of canals by Kennedy's and Lacey's methods- Problems. Laboratory Sessions/ Experimental learning: • Identification of irrigation structure in a given region • Case study on canal design Applications: • Design of water storage structures, Design of canal • Rehabilitation of Irrigation structures Video link / Additional online information: • https://nptel.ac.in/courses/105103096/	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Use the precipitation data for the hydrological research
CO2	Predict the components of Hydrological cycle
CO3	Use the hydrographs of the basin for runoff analysis
CO4	Illustrate the suitable irrigation system by calculating the water requirement of the crop
CO5	Explain the various irrigation structures

Reference Books	
1.	K. Subramanya, "Engineering Hydrology",4th Edition Tata McGraw Hill Publishers, New Delhi,2017
2.	Punmia B C and Lal Pandey, "Irrigation and Water Power Engineering" Lakshmi Publishers, 2018
3.	Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi,2019
4.	Te Chow, V., "Applied hydrology", Tata McGraw-Hill Education,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 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	2	1	-	-	-	1	-	-	-	1	-	-
CO3	2	1	-	2	1	-	-	-	-	2	-	-
CO4	2	-	-	2	1	1	2	-	-	-	1	-
CO5	2	2	-	-	1	-	2	1	-	1	-	-

Semester: VI		
DESIGN AND DETAILING OF STEEL STRUCTURES (Theory and Practice)		
Course Code: MVJ21CV62		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours

Course Learning Objectives: The students will be able to	
1	Introduce steel structures and its basic components
2	Introduce structural steel fasteners like welding and bolting
3	Design tension members, compression members
4	Design beams and beam-column
5	Design column splices and bases

UNIT-I	
Introduction: Advantages and Disadvantages of Steel structures, Loads and Load combinations, Design considerations, Limit State Method (LSM) of design, Failure criteria for steel, Codes, Specifications, and section classification. **Plastic Behavior of Structural Steel:** Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, conditions of plastic analysis, Theorem of Plastic collapse, Methods of Plastic analysis, Plastic analysis of continuous beams Experimental learning: • Developing animated videos to understand formation of plastic hinges Applications: • To select the type of member and to understand the plastic behavior of steel structures. Video link: • https://nptel.ac.in/courses/105/105/105105162/	8 Hrs
UNIT-II	
Bolted Connections: Introduction, Behavior of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG), Pin Connections, Simple Connections, Moment resistant connections, Beam to Beam connections, Beam and Column splices, Semi rigid connections. **Welded Connections:** Introduction, Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds, Simple joints, Moment resistant connections, Continuous Beam to Column connections, Continuous Beam to Beam connections, Beam Column splices, Tubular connections.	8 Hrs

Experimental learning: • Develop 3D models using any modelling software to understand various connections. Applications: • In developing connections between various elements of a steel structure. Video link: • https://nptel.ac.in/courses/105/105/105105162/	
UNIT-III	
Design of Tension Members: Introduction, Types of tension members, Slenderness ratio, Behavior of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets. Design of splices and gussets Experimental learning: • Field visit to understand various tension members. Applications: • In designing trusses, purlins and beams of multistoried buildings. Video link: • https://nptel.ac.in/courses/105/105/105105162/	8 Hrs
UNIT-IV	
Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, Built up compression members. Experimental learning: • Field visit to understand various compression members Applications: • In designing trusses and columns of multistoried buildings. Video link: • https://nptel.ac.in/courses/105/105/105105162/	8 Hrs
UNIT-V	
Design of Column Bases and Beams: Introduction, Beam types, Lateral stability of beams, factors affecting lateral stability, Behavior of simple and built-up beams in bending (without vertical stiffeners), Design strength of laterally supported beams in Bending, Design strength of laterally unsupported beams, Shear strength of steel beams, Maximum deflection, Design of beams and purlins.	8 Hrs

Experimental learning: • Develop 3D models using any modelling software to understand behavior of beams. Applications: • In designing columns and footings for multistoried buildings Video link: • https://nptel.ac.in/courses/105/105/105105162/	

LABORATORY EXPERIMENTS
1. Detailing of Plastic behavior of continuous beams 2. Detailing of Welded and Bolded Connections 3. Detailing of Tension members 4. Detailing of Compression members 5. Detailing of column Base

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the basic elements of a steel structure
CO2	Illustrate the fundamentals of structural steel fasteners.
CO3	Design basic elements of steel structure like tension members, compression members, beams and beam-columns
CO4	Identify the different failure modes of steel tension and compression members and beams and compute their design strengths
CO5	Design column splices and bases

Reference Books	
1.	Subramanian, –Design of Steel Structures‖, Oxford University Press, New Delhi, 2013
2.	Gambhir. M.L., –Fundamentals of Structural Steel Design‖, McGraw Hill Education India Pvt. Ltd., 2013
3.	Shiyekar. M.R., –Limit State Design in Structural Steel‖, Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.
4.	Duggal. S.K, –Limit State Design of Steel Structures‖, Tata McGraw Hill Publishing Company, 2005
5.	Shah.V.L. and Veena Gore, –Limit State Design of Steel Structures‖, IS 800–2007 Structures Publications, 2009

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	1	2	2	-	-	1	-	-	1	-	-	1
CO2	1	1	2	-	-	1	-	-	1	-	-	1
CO3	1	2	2	-	-	1	-	-	1	-	-	1
CO4	1	1	2	-	-	1	-	-	1	-	-	1
CO5	1	1	2	-	-	1	-	-	1	-	-	1

Semester: VI		
SOIL MECHANICS, FOUNDATION ENGINEERING & LABORATORY (Theory and Practice)		
Course Code: MVJ21CV63		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours

Course Learning Objectives: The students will be able to	
1	Ability to plan and execute geotechnical site investigation program for different civil engineering projects
2	Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils
3	Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures
4	Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure
5	Capable of estimating load carrying capacity of single and group of piles

UNIT-I	
Introduction: Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships. Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis (sieve and Hydrometer analysis) Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970). Laboratory Sessions/ Experimental learning: (Self-Learning) • Index property tests	8 Hrs
UNIT-II	
Soil Structure and Clay Mineralogy: Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipment's and their suitability. Laboratory Sessions/ Experimental learning: (Self-Learning)	8 Hrs

• Compaction (Proctor) tests	
UNIT-III	
Flow through Soils: Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation. **Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions. Applications: (Self Learning) • Flow Measuring into a reservoir • Hydraulic Critical Zone	8 Hrs
UNIT-IV	
Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method). **Bearing Capacity of Shallow Foundation:** Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method, Modes of shear failure, Factors affecting Bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.	8 Hrs
UNIT-V	
Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests. Well Foundations: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation.	8 Hrs
LABORATORY EXPERIMENTS	
1 Determination of Specific Gravity of Soil Solids by Density Bottle Method 2 Determination of Specific Gravity of Soil Solids by Pycnometer Method 3 Determination of Water Content of Soil by Oven Drying Method 4 Determination of Water Content of Soil by infrared moisture method 5 Determination of Particle size Distribution by Sieve Analysis 6 Determination of Particle size Distribution by Hydrometer analysis 7 Determination of Field Density of Soil by Core-cutter Method 8 Determination of Field Density by Sand Replacement Method	

9 Determination of the Liquid Limit by Casagrande Method 10 Determination of the Liquid Limit by Cone Penetration Method 11 Determination of Plastic Limit of the Soil 12 Determination of Shrinkage Limit 13 Moisture Content–Dry Density Relationship by Standard Proctor Compaction Test 14 Moisture Content–Dry Density Relationship by Modified Proctor Compaction Test 15 Determination of Permeability of a Soil sample by Constant-head Method 16 Falling Head Permeability test for fine Grained Soils 17 Unconfined Compression Test. 18 Determination of Shear Parameters by Direct Shear Test 19 Determination of Shear Parameters of a given Soil sample of Soil by Triaxial Shear Test 20 One-Dimensional Consolidation Test. 21 Vane Shear Test 22 California Bearing Ratio Test 23 Demonstration of Miscellaneous Equipment's such as Augers, Proctor's needle.

Course Outcomes: After completing the course, the students will be able to	
CO1	Examine physical and index properties of the soil
CO2	Classify based on index properties and field identification
CO3	Identify OMC and MDD, plan and assess field compaction program
CO4	Analyze shear strength and consolidation parameters to assess strength and deformation characteristics
CO5	Investigate in-situ shear strength characteristics (SPT- Demonstration)

Reference Books	
1.	Punmia B C, Soil Mechanics, and Foundation Engineering- (2017), 16th Edition, Laxmi Publications co., New Delhi
2.	Lambe T.W., "Soil Testing for Engineers," Wiley Eastern Ltd., New Delhi
3.	Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4.	Bowles J.E., "Engineering Properties of Soil and Their Measurements," - McGraw Hill Book Co. New York

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 self - study are 20 (2 presentations are be held for 10 marks each). The marks obtained in

test, quiz and self -studies 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 complete 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	2	2	-	1	1	1	1	-	1	1	-	-
CO2	2	1	1	-	1	1	1	-	-	1	-	-
CO3	1	2	2	2	-	-	1	-	1	1	-	-
CO4	1	-	1	2	1	2	1	-	1	1	-	-
CO5	2	1	-	1	-	1	1	-	1	1	-	-

Semester: VI		
SUSTAINABILITY CONCEPTS IN ENGINEERING (Theory)		
Course Code: MVJ21CV641		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	Describe about the principles, indicators, and general concept of sustainability
2	Apprehend the local, regional, and global impacts of unsustainable designs, products and processes
3	Student shall be able to apply the sustainability concepts in engineering
4	Know built environment frameworks and their use
5	Analyze how building and design is judged and valued by clients and stakeholders and how to implement sustainability

UNIT-I	
Prerequisites: Knowledge on sustainable approach in engineering **Sustainability** - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act. Experimental learning: • In-situ investigation of high strength sustainability materials Applications: • In construction of building Video link: • https://nptel.ac.in/courses/127/105/127105018/	8 Hrs
UNIT-II	
Prerequisites: Knowledge on environmental impacts of modern engineering tool **Air Pollution**, Effects of Air Pollution; Water pollution- sources, Sustainable wastewater treatment, Solid waste – sources, impacts of solid waste, Zero waste concept. Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon footprint Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking. Experimental learning:	8 Hrs

• In-situ determination of air pollution, water pollution and solid waste management. Applications: • In maintaining the good environment. Video link: • https://nptel.ac.in/courses/110/105/110105073/	
UNIT-III	
Prerequisites: Knowledge on sustainable building materials for civil engineering **Basic concepts of sustainable habitat**, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport. Experimental learning: • laboratory strength determination of the green building materials Applications: • In application of green technology in the sustainability will reduce the pollution to the environment Video link: • https://nptel.ac.in/courses/105/105/105105157/	8 Hrs
UNIT-IV	
Prerequisites: Knowledge on using modern tool in engineering **Energy sources**: Basic Concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, biofuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting. Experimental learning: • laboratory investigation of energy sources Applications: • In utilizing the sustainability approaches will save the environment pollution Video link: • https://nptel.ac.in/courses/105/102/105102195/	8 Hrs
UNIT-V	
Prerequisites: Knowledge on using eco-friendly materials **Green Engineering concepts**, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis. Experimental learning:	8 Hrs

• In-situ evaluation of properties for different building martials and pollution control devices Applications: • In utilizing the sustainability approaches will save the environment pollution Video link: • https://nptel.ac.in/courses/105/102/105102195/	

Course Outcomes: After completing the course, the students will be able to	
CO1	Learn the sustainability concepts, understand the role and responsibility of engineers in sustainable development
CO2	Quantify sustainability, and resource availability, Rationalize the sustainability based on scientific merits
CO3	Understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines
CO4	Application of engineering knowledge in utilization of natural resources for the production materials.
CO5	Make a decision in applying green engineering concepts and become a lifelong advocate of sustainability in society

Reference Books	
1.	Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage Learning
2.	Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication
3.	Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers
4.	Daniel A. Vallero and Chris Brasier, "Sustainable Design: The Science of Sustainability and Green Engineering", Wiley-Blackwell

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	1	1	-	-	2	1	1	-	1	-	-	1
CO2	2	-	-	-	1	1	-	-	3	1	1	-
CO3	1	2	2	1	-	1	-	-	-	-	-	1
CO4	3	1	1	1	1	-	-	-	1	-	2	-
CO5	1	1	1	-	-	2	-	-	3	-	-	1

Semester: VI		
RESOURCE ALLOCATION AND MANAGEMENT (Theory)		
Course Code: MVJ21CV642		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 different types of resources and planning	
2	Illustrate on characteristics of resources and labour Management	
3	Represent materials and equipment's required for construction activities	
4	Apply the time management strategies on effective planning	
5	Detail on Resource allocation and levelling	

UNIT-I	
Resource Planning: Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time. Laboratory Sessions/ Experimental learning: (Self Learning) • Develop the check list for Resource planning for construction activities Applications: (Self Learning) • Resource Planning for Residential Building Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106149/	8 Hrs
UNIT-II	
Labour Management: Systems approach, Characteristics of resources, Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, Optimum use Labour. Laboratory Sessions/ Experimental learning: (Self Learning) • Develop the check list for Classes of Labour for construction activities Applications: (Self Learning) • Labour Arrangement for Construction of slab for a residential building Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106149/	8 Hrs
UNIT-III	
Materials and Equipment: Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution.	8 Hrs

Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source and handling. Laboratory Sessions/ Experimental learning: (Self Learning) • Selection of Equipment for the Shutting materials preparation Applications: (Self Learning) • Preparation of column shuttering Material using cutting machine Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106149/	
UNIT-IV	
Time Management: Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects – Cash flow and cost control. Laboratory Sessions/ Experimental learning: (Self Learning) • Planning for Time management of Footing Layout marking, shuttering and concreting Applications: (Self Learning) • Item of work and its cash flow control measures Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106149/	8 Hrs
UNIT-V	
Resource Allocation and Levelling: Time-cost trade off, Computer application – Resource leveling, resource list, resource allocation, Resource loading, Cumulative cost – Value Management. Laboratory Sessions/ Experimental learning: (Self Learning) • Development of resource planning by MS Project Applications: (Self Learning) • Value management for an Apartment building (G+10) Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106149/	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Restate the different types of resource planning for a construction activity
CO2	Illustrate the required characteristics of resources and labour for the item of work
CO3	Explain the materials and equipment's required for a particular construction activity
CO4	Create the checklist for effective planning through time management
CO5	Explain on Resource allocation and leveling for a construction activity

Reference Books	
1.	Andrew,D., Szilagg, "Hand Book of Engineering Management", 2002.
2.	Harvey, A., Levine, "Project Management using Micro Computers", Obsorne - McGraw Hill C.A.Publishing Co., Inc. 2005. Industry, Granda Publishing Ltd
3.	James.A., Adrain, "Quantitative Methods in Construction Management", American Elsevier Publishing Co., Inc., 2002
4.	Oxley Rand Poslcit, "Management Techniques applied to the Construction",2000

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	1	1	-	1	1	2	2	-	3	-	3	2
CO2	1	1	-	1	1	2	2	-	3	-	3	2
CO3	1	1	-	1	1	2	2	-	3	-	3	2
CO4	1	1	-	1	1	2	2	-	3	-	3	2
CO5	1	1	-	1	1	2	2	-	3	-	3	2

Semester: VI			
OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT (Theory)			
Course Code: MVJ21CV643			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 the concepts of global scenario of Health & safety		
2	Students should be able to analyze and solve basic agronomical issues		
3	Be efficient in the operation of industrial hygiene equipment		
4	Illustrate the importance and need of Fire & Safety		
5	Know the basics of fire and its classification		

UNIT-I	
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. Laboratory Sessions/ Experimental learning: • Measurement of Sound/Noise Level at Various Location and Compare it with Standard Values Applications: • Documentation of the report on noise level in the working environment Video link / Additional online information: • https://nptel.ac.in/courses/114106017/	8Hrs
UNIT-II	
Ergonomics at Workplace: Ergonomics Task analysis, Preventing Ergonomic Hazards, Workspace 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. Laboratory Sessions/ Experimental learning: • A study on analysis of occupational health hazards in a working place Video link / Additional online information: • https://nptel.ac.in/courses/110105094/	8 Hrs
UNIT-III	
Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and	8 Hrs

Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety. Laboratory Sessions/ Experimental learning: • Demonstration and training on the usage of personal protective equipments, breathing apparatus, Emergency evacuation drill etc. Applications: • Awareness program on the utilization of the facilities provided to maintain the health of workers in working places Video link / Additional online information: • https://www.who.int/occupational_health/regions/en/oehemhealthcareworkers.pdf	
UNIT-IV	
Health Considerations at Workplace: 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. Laboratory Sessions/ Experimental learning: • Identification rehearsals of Portable extinguishers, Filling of DCP powder in Portable Extinguisher and wearing Protective clothing, Mock drills Applications: • A detailed report on classification of fire extinguishers Video link / Additional online information: • Fire protection: basic concept, fire resistance, introduction of combustion process, https://nptel.ac.in/courses/105102176/	8 Hrs
UNIT-V	
Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Roles and responsibilities of workers, managers, and supervisors. Laboratory Sessions/ Experimental learning: • A performance study on responsibility of management for safety in industries, safe guarding the workers • A study on OSHAS by considering a case-study Applications: • Documentation on an effective safety management in a manufacturing industry from workers health point of view. Video link / Additional online information: • https://www.osha.gov/Publications/laboratory/OSHA3404laboratory-safety-guidance.pdf • https://nptel.ac.in/courses/110105094/	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Gains the knowledge about the various types of hazards and their control measures
CO2	Gains the knowledge about the occupational health issues
CO3	Able to analyze and solve occupational health issues
CO4	Able to know the basics of fire and its precautions, active and passive fire protection system in building or other industries/ premises.
CO5	To render the concept of safety analysis and confined space

Reference Books	
1.	Fire Protection and Prevention By: Birendra Mohan San, Publishers: UBS Publishers & Distributors Pvt Ltd., Edition: First Edition, Year of Publication: 2008
2.	Industrial safety management By: L.M. Deshmukh, Publishers: Tata Megraw Hill, New Delhi, Year: 2006,First Edition
3.	Risk assessment- A Practical Guide, 1993, Institution of Occupational Safety and Health, United Kingdom
4.	Handbook Of Fire Technology By: R.S. Gupta, Orient Longman Publishers, Second Edition, 2005
5.	Handbook Of Fire And Explosion Protection Engineering By: Dennis P Nolan, Crest Publishing House, First Edition, 2007

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	-	2	-	-	-	2	2	-	-	-	3	1
CO2	-	2	-	-	-	2	2	-	-	-	3	1
CO3	2	3	2	2	2	3	1	-	2	3	-	1
CO4	-	2	-	-	3	2	2	-	2	2	3	1
CO5	2	3	2	2	-	2	-	3	2	1	1	1

Semester: VI		
ADVANCED SOFTWARE IN CIVIL ENGINEERING APPLICATION (Ability Enhancement Course)		
Course Code: MVJ21CVA66		CIE Marks: 50
Credits: L:T:P: 2:0:0		SEE Marks: 50
Hours: 30		SEE Duration: 03 Hrs.
Course Learning Objectives: The students will be able to Learn the application of SKETCHUP		
Introduction to SKETCHUP. a. User Interface b. Creating 3D views of structure Video link:https://help.sketchup.com/en/sketchup/getting-started-self-paced-tutorials		

Semester: VI		
MINI PROJECT (Project)		
Course Code: MVJ21CVMP67		CIE Marks: 50
Credits: L:T:P: 0:0:4		SEE Marks: 50
Hours: -		SEE Duration: 03 Hrs.

Course Learning Objectives: The students will be able to	
1	Support independent learning.
2	Develop interactive, communication, organization, time management, and presentation skills.
3	Impart flexibility and adaptability.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students.

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Course outcomes: On completion of the course, students would be able to	
CO1	Describe the project and be able to defend it. Develop critical thinking and problem solving skills.
CO2	Learn to use modern tools and techniques. Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.

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

Semester: IV	
SUMMER INTERNSHIP II (Industry)	
Course Code: MVJ21INT68	
Course Learning Objectives: The students will be able to	
1	Get the skill exposure to different specialization
2	Apply the theoretical concept in field application
3	Get Acquainted with Current Trends and Industry
Internship: This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO2	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO3	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	2	2	2	3	3	2	1	1	2	1	1	2
CO2	2	2	2	3	3	2	1	1	2	1	2	2
CO3	2	2	2	3	3	2	1	1	2	1	2	2

Semester: VII		
ESTIMATION AND PROJECT MANAGEMENT (Theory and Practice)		
Course Code: MVJ21CV71		CIE Marks:50+50
Credits: L:T:P: 3:0:1		SEE Marks: 50 +50
Hours:40 L+ 26 P		SEE Duration: 03+03 Hours
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	
Quantity Estimation for Building: Study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised, Estimation of building - Short wall and long wall method - centre line method. **Estimate of R.C.C structures:** Slab, beam, column, footings, with bar bending schedule.	8 Hrs
UNIT-II	
Estimate of Structures: Steel truss, manhole and septic tanks. **Quantity Estimation for Roads:** Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling.	8Hrs
UNIT-III	
Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings. **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.	8Hrs
UNIT-IV	
Contract Management-Tender and its Process: Invitation to tender, Pre-qualification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: covering Award of contract, letter of intent, 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, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting. Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC	8Hrs
UNIT-V	
Contract Management-Post award : Basic understanding on definitions,	8Hrs

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 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, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties (land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation, valuation for mortgage, valuation of land.	

LABORATORY EXPERIMENTS

1. Case Study - Incorporating Pre-construction Cost Estimating in Construction Engineering and Management Programs
2. Case Study – Multiple Valuation Approaches Of Projects For Different Construction Designs & Techniques
3. Case Study-Construction Disputes
4. Building Contract Law-Indian Essays

Course Outcomes: After completing the course, the students will be able to	
CO1	Prepare detailed and abstract estimates for buildings & RC structures.
CO2	Prepare detailed and abstract estimates for roads and different structures.
CO3	Compute Specifications & Analyze the rates for different item of work.
CO4	Interpret Contract documents of domestic and international construction works
CO5	Prepare valuation reports of buildings.

Reference Books	
1.	"Estimating and costing", Datta B.N ,2016, UBSPD Publishing House, New Delhi ,ISBN: 9788174767707
2.	"Civil Engineering Contracts and Estimates", B.S. Patil, 7th Edition, Universities Press,Taylor & Francis Ltd,ISBN: 9780367133313
3.	" Estimating Construction Costs" Robert L Peurifoy , Garold D. Oberlender , 5th Edition , Tata McGraw-Hill , New Delhi
4.	PWD Data Book ,CPWD Schedule of Rates (SoR). and NH SoR – Karnataka MORTH Specification for Roads and Bridge Works – IRC 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 Mark

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	3	3	2	2	1	3	1	3	3	2	2	2
CO2	3	2	1	-	-	3	-	3	1	-	3	1
CO3	3	-	1	-	-	3	-	2	2	1	3	1
CO4	3	2	1	-	-	3	-	3	1	-	3	1
CO5	3	-	1	-	-	3	-	2	2	1	3	1

Semester: VII		
DESIGN OF PRE-STRESSED CONCRETE ELEMENTS (Theory)		
Course Code: MVJ21CV721		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		
Course objective is to: This course will enable students to • Use the basics of prestressing to concrete elements. • Restate the basic principle of prestressing including losses. • Interpret the deflections in a prestressed concrete member. • Analyze the section for flexure, shear under limit state of serviceability and design the pre- stressed beam under permissible stress condition. • Describe the design of anchorage zones.		

UNIT-I	
Prerequisites: Concept of stress-strain characteristics of steel and concrete. Introduction- 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 (Online mode). Laboratory Sessions/ Experimental learning: (Self Learning) • Experimental investigation to verify the efficiency and strength of post-tensioning systems. • Industrial visit to witness pre-tensioning and post-tensioning methods and different types of end anchorages. Applications: (Self Learning) • Understanding of principles of prestressing concept. • Find out the mechanism of the working of tensioning systems and various tools available to prestress the structures. Video link / Additional online information: (Self Learning) (Introduction to PSC, high strength concrete and steel, stress-strain characteristics and properties, pre- tensioning and post-tensioning systems, tensioning methods and end anchorages.) • https://nptel.ac.in/courses/105/106/105106117/	8 Hrs
UNIT-II	
Losses of Prestress: Stresses in concrete due to prestress and loads, stresses in steel due to loads, cable profiles, various losses encountered in pre-tensioning and post tensioning methods (Online Mode), determination of jacking force. Laboratory Sessions/ Experimental learning: (Self Learning) • Calculation of losses in a prestressed concrete beam. • FE software analysis to study the effect of cable profiles in	8 Hrs

determining the stress distribution in post-tensioned member. Applications: (Self Learning) • Estimating various losses of prestressing. • Find out the behaviour of prestressed concrete beam under different cable profiles. Video link / Additional online information: (Self Learning) (Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force.) • https://nptel.ac.in/courses/105/106/105106117/	
UNIT-III	
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. Laboratory Sessions/ Experimental learning: (Self Learning) • FE software analysis to study the effect of cable profiles in determining the deflections in post- tensioned member. Applications: (Self Learning) • Knowledge of deflection behavior of post-tensioned member under the loads and tendon profiles. • Understanding of long-term deformations due to creep in PSC. Video link / Additional online information: (Self Learning) (Short term and long-term deflections, elastic deflections under transfer loads and due to different cable profiles. Deflection limits as per IS 1343). • https://nptel.ac.in/courses/105/106/105106117/	8 Hrs
UNIT-IV	
Prerequisites: Knowledge of Limit State of Strength & Serviceability. **Flexure** -Types of flexural failure, IS Code recommendations (Online Mode). Ultimate flexural strength of sections. **Shear** - IS Code recommendations (Online Mode), 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. Laboratory Sessions/ Experimental learning: (Self Learning) • Analysis and design of simple prestressed concrete beams, encompassing bending and shear performance. • Comparative analysis of behavior of PSC and RCC sections under flexure and shear. Applications: (Self Learning) • Gives in depth knowledge of performance of PSC beams under flexure and shear. Video link / Additional online information: (Self Learning) (Types of flexural failure, IS code recommendations, ultimate flexural strength of sections, IS Code recommendations, shear resistance of	8 Hrs

sections, shear reinforcement, control of deflections and cracking. Design of Beams.) • https://nptel.ac.in/courses/105/106/105106117/	
UNIT-V	
Design of End block: Transmission of Prestress in pretension members, transmission length, Anchorage stress in post-tensioned members (Online Mode). Bearing stress and bursting tensile force stresses in end blocks- Methods, I.S. code provision for the design of end block reinforcement. Laboratory Sessions/ Experimental learning: (Self Learning) • Software analysis of stress in anchorage zone in post-tensioned members. • Case study on the effect of reinforcement on anchorage zone cracks in prestressed concrete members. Applications: (Self Learning) • Learn design of end zone reinforcement to check the bursting effect of the tensile stresses. Video link / Additional online information: (Self Learning) (Transmission of Prestress, Bearing stress and design of end block reinforcement). • https://nptel.ac.in/courses/105/106/105106117/	8 Hrs

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- N. Krishna Raju - Tata McGraw Hill Publishers- Sixth Edition, 2018.
2.	Pre-stressed Concrete- N. Rajagopalan- Narosa Publishing House- Second Edition, 2015.
3.	Pre-stressed Concrete structures- P. Dayaratnam- Medtech Publishers- Seventh Edition, 2017.
4.	K U Muthu - "Prestressed Concrete"- PHI Learning, 2016.

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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

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

Semester End Examination (SEE):

Total marks: 50+50=100

SEE for 50 marks is executed by means of an examination. The Question paper 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/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	1	2	-	1	-	-	-	-	-	-	-	1
CO3	1	2	-	2	-	-	-	-	-	-	-	1
CO4	1	2	2	2	-	-	-	-	-	-	-	1
CO5	1	2	3	2	-	-	-	-	-	-	-	1

Semester: VII		
DESIGN OF HYDRAULIC STRUCTURES (Theory)		
Course Code: MVJ21CV722		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	Analyze 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	
Gravity Dams: Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.	8 Hrs
UNIT-II	
Earth Dams: Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.	8 Hrs
UNIT-III	
Spillways: Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices. Diversion Headworks: Design of aprons- Bligh's and Koshla's theory, Simple Problems.	8 Hrs
UNIT-IV	
Cross Drainage Works: Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.	8 Hrs
UNIT-V	
Canal Regulation Works: Introduction, Function of a regulator. Canal falls: Necessity and types. Canal outlets: Necessity and types.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Check the stability of gravity dams and design the dam.
CO2	Estimate the quantity of seepage through earth dams.
CO3	Detail the Spillway analysis and design of apron
CO4	Design spillways and aprons for various diversion works.
CO5	Select particular type of canal regulation work for canal network

Reference Books	
1.	S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.
2.	Punmia and Pandey Lal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
3.	K. R. Arora. "Irrigation, Water Power and Water Resources Engineering" Standard Publications, New Delhi.

4.	R. K. Sharma, "Text Book of Irrigation Engineering and Hydraulic Structures", Oxford and IBH, 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.

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

Semester: VII		
SOLID WASTE MANAGEMENT (Theory)		
Course Code: MVJ21CV723		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	Restate the different elements of solid waste management from generation of solid waste to disposal.	
2	Analyze different processing technologies.	
3	Evaluate landfill site and conversion of municipal solid waste to compost or biogas.	
4	Identify sources, collection, treatment, and disposal of various types of solid waste.	
5	Analyze the energy recovery techniques from solid waste.	

UNIT-I	
Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. functional elements of solid waste management system Generation rate, Numerical Problems. **Collection**: Collection of solid waste- services and systems, equipment's. **Transportation**: Need of transfer operation, transfer station, transport means and methods, route optimization. Solid waste management 2000 rules with 2016 amendments. Laboratory Sessions: • Poster Presentation on composition of Solid waste • Collection of solid waste generation data of the campus Applications: (Self Learning) • Identification of various sources, collection and transportation of solid waste. • Effects of mishandling of solid waste on human beings and environment. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	8 Hrs
UNIT-II	
Processing techniques: Purpose of processing, Chemical volume reduction (incineration) - Process description, 3T's, principal components in the design of municipal	8 Hrs

incinerators, Air pollution control, Mechanical volume reduction (compaction), Mechanical size reduction (shredding), component separation (manual and mechanical methods). Laboratory Sessions: • Poster Presentation on Processing of Municipal Solid Waste Applications: (Self Learning) • Identification of different processing techniques of Solid waste. • Identification of factors responsible for the design of Incinerators. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	
UNIT-III	
Composting Aerobic and anaerobic method - process description, process microbiology, design consideration, Mechanical composting, Vermicomposting, Numerical Problems. **Sanitary Landfilling**: Definition, advantages and disadvantages, site selection, methods, reaction occurring in landfill- Gas and Leachate movement, Control of gas and leachate movement, Design of sanitary landfill. Numerical Problems. Laboratory Sessions: • Poster Presentation on Design of Sanitary Landfills. • Checklist for Composting techniques. Applications: (Self Learning) • Identification of factors responsible for site selection for a Sanitary Landfill. • Effects of mishandling Sanitary Landfill Site. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	8 Hrs
UNIT-IV	
Sources, collection, treatment and disposal of :Biomedical waste, E-waste, Hazardous waste and Construction and Demolition waste Laboratory Sessions: • Collection of E-waste generation data of the campus.	8 Hrs

• Poster Presentation on collection, transport, and processing of Construction waste. Applications: (Self Learning) • Segregation of Biomedical waste and its impact on Biomedical waste handling and processing. • Identification of characteristics of Hazardous waste. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	
UNIT-V	
Waste management rules and its amendments- Plastic Waste, E-waste, Biomedical Waste and Hazardous Waste. Energy recovery technique from solid waste management Laboratory Sessions: • Poster Presentation on Energy recovery techniques from solid waste management Applications: (Self Learning) • Different energy recovery techniques and their implications. Video link / Additional online information: • https://nptel.ac.in/courses/120/108/120108005/ • https://nptel.ac.in/courses/105/103/105103205/ • https://nptel.ac.in/courses/105/105/105105160/ • https://nptel.ac.in/courses/105/106/105106056/	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Evaluate different elements of solid waste management system
CO2	Design suitable processing system
CO3	Asses the disposal site for solid waste
CO4	Identify sources, collection, treatment, and disposal of various types of solid waste
CO5	Apply the energy recovery techniques utilizing solid waste

Reference Books	
1.	George Tchobanoglous, Hilary Theisen , Samuel A Vigil, “Integrated Solid Waste Management: Engineering principles and management issues”, M/c Graw hill Education . Indian edition, 1993.
2.	Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering”, Tata Mcgraw Hill Publishing Co ltd, ISBN: 9789351340263, 9789351340263, 2017
3.	Municipal Solid Wastes (Management and Handling) Rules, 2000.Ministry of

	Environment and Forests Notification, New Delhi, the 25th September, 2000. Amendment – 1357(E) – 08-04-2016.
4.	Municipal Solid waste management manual, Part II published under Swachh Bharat Mission, Central Public Health And Environmental Engineering Organization (CPHEEO), 2016, Ministry of Urban Development, Government of India.

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	2	2	-	-	-	1	1	2	-	-	-	1
CO2	2	2	1	-	-	1	-	-	-	-	-	-
CO3	2	2	-	-	-	1	-	-	-	-	-	-
CO4	2	2	-	-	-	1	1	2	-	-	-	-
CO5	2	2	-	-	-	1	1	2	-	-	-	1

Semester: VII			
OPEN CHANNEL HYDRAULICS (Theory)			
Course Code: MVJ21CV724			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	State the Principles of dimensional analysis and design hydraulic models.		
2	Design of open channels of different cross sections through concept of economical sections.		
3	Develop Water surface profiles at different bed slope condition using Energy concepts of fluid in open channel.		
4	Make student to Explain on working principles of the hydraulic machines and analyzing the performance of turbines under design condition.		
5	Gain the knowledge on working principles of Pumps		

UNIT-I	
Basic Flow Concepts: Types of channels, classification of flows, basic equations, velocity distribution, velocity coefficients, pressure distribution. Energy and momentum principles: Specific energy, critical flow, section factor for critical flow computation, first hydraulic exponent, computation of critical flow, specific force, specific force, channel transitions.	8 Hrs
UNIT-II	
Open Channel Flow Hydraulics (Uniform Flow): Introduction, Classification of flow through channels (Online Mode), Chezy's and Manning's equation for flow through open channel, Most economical channel sections, Uniform flow through Open channels, Numerical Problems. Uniform flow in mobile boundary channels: Incipient motion condition, shield's analysis, regimes of flow, prediction of regimes, flow resistance. Laboratory Sessions/ Experimental learning: (Self Learning) • Determination of Metacentric height to check the stability of partially submerged boat • Formulation of Excel Sheet program for Chezy's and Manning's method Applications: (Self Learning) • Stability Analysis of Submarine • Arrive the optimum weight of Hot-Air Balloon • Measure Relative density by Hydrometer Video link / Additional online information: (Self Learning) • Buoyancy, Metacenter, Stability and Rigid body motion:	8 Hrs

https://nptel.ac.in/courses/ 105103192/ • Open Channel Flow: https://nptel.ac.in/courses/105107059/	
UNIT-III	
Open Channel Flow Hydraulics (Non-Uniform Flow): Specific Energy and Specific energy curve, Critical flow and corresponding critical parameters, Metering flumes (Online Mode), Numerical Problems. Hydraulic Jump, Expressions for conjugate depths and Energy loss, Numerical Problems. Gradually varied flow, Equation, Back water curve and afflux, Description of water curves or profiles, Mild, steep, critical, horizontal and adverse slope profiles, Numerical problems. Laboratory Sessions/ Experimental learning: (Self Learning) • Computation of Gradually Varied Flow profiles for a given slope pattern • Model Making of Hydraulic Jump under different Froude Number • Calculation of Critical depth and energy using Excel sheet Applications: (Self Learning) • Flow Measuring into a reservoir • Hydraulic Critical Zones Video link / Additional online information: (Self Learning) • Open Channel Flow: https://nptel.ac.in/courses/105107059/ • Free Surface flow: https://nptel.ac.in/courses/105106114/	8 Hrs
UNIT-IV	
Design of channels: Rigid boundary channels, non-scouring channels, alluvial channels. **Rapidly varied flow**: Flow over sharp crested weir, spillways, flow under sluice gate.	8 Hrs
UNIT-V	
Unsteady flow: Waves, celerity of small gravity wave, St. Venant's equation, surges in open channels.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Create mathematical model of hydraulics variables using dimensional analysis
CO2	Analyze the relationship between dependent and independent model parameters
CO3	Apply the Energy concepts to compute the flow in open channel sections
CO4	Draw the water surface profiles at different bed slope conditions
CO5	Design turbines for the given data with their operation characteristics

Reference Books	
1.	P N Modi and S M Seth, "Hydraulics and Fluid Mechanics, including Hydraulic

	Machines", 20th edition, 2015, Standard Book House, New Delhi.
2.	R.K. Bansal, "A Textbook of Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2010
3.	S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill,New Delhi. 2006
4.	J.B. Evett, and C. Liu, "Fluid Mechanics and Hydraulics", McGraw-Hill Book Company.- 2009.

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	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	1	-	1	1	-	1
CO2	2	2	1	2	-	1	1	-	-	1	1	1
CO3	2	1	1	1	-	1	-	-	1	1	-	1
CO4	2	1	1	2	-	1	1	-	1	1	-	1
CO5	2	1	1	2	-	1	1	-	-	1	1	1

Semester: VII		
PAVEMENT DESIGN (Theory)		
Course Code: MVJ21CV731		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 about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2	Excel in the path of analysis of stress, strain and deflection in pavement.
3	Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas) and also the same of rigid pavement by IRC 58-2002
4	Understand the various causes leading to failure of pavement and remedies for the same.
5	Develop skills to perform functional and structural evaluation of pavement by suitable methods.

UNIT-I	
Introduction: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement Fundamentals of Design of Pavements: Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.	8 Hrs
UNIT-II	
Design Factors: Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above. Flexible pavement Design: Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.	8 Hrs
UNIT-III	
Flexible Pavement Failures, Maintenance and Evaluation: Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method. Design factors for runway pavements, Design methods for Airfield pavement and problems on above.	8 Hrs
UNIT-IV	
Stresses in Rigid Pavement : Types of stress, Analysis of Stresses,	8 Hrs

Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above. Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.	
UNIT-V	
Rigid Pavement Failures, Maintenance and Evaluation: Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Systematically generate and compile required data's for design of pavement (Highway & Airfield).
CO2	Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
CO3	Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
CO4	Evaluate the performance of the pavement.
CO5	Develop maintenance statement based on site specific requirements

Reference Books	
1.	S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2.	L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3.	Yang H. Huang , "Pavement Analysis and Design", University of Kentucky.
4.	Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.

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	2	2	-	-	-	-	-	-	2	-	-	-
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CO3	2	2	-	-	-	-	-	-	2	-	-	-
CO4	2	2	2	-	-	-	-	-	2	1	-	-
CO5	2	2	2	-	-	-	-	-	2	1	-	-

Semester: III		
ADVANCED FOUNDATION ENGINEERING (Theory)		
Course Code: MVJ21CV732		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	Discuss the knowledge in calculating the bearing capacity and settlement of soils ·	
2	Examine the advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course	
3	Illustrate profound understanding of shallow and deep foundation analyses	
4	Classify the choice of foundation design parameters	
5	Relate the cause and effect of dynamic loads on foundation	

UNIT-I	
Prerequisites: basic geotechnical engineering, advanced geotechnical engineering, soil mechanics General bearing capacity equation-Terzaghi's, Brinch Hansen's and Meyerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. (Online mode) Principles of design of footing, Proportioning of footings for equal settlement. Laboratory Sessions/ Experimental learning: (Self Learning) • Standard penetration test • Dynamic cone penetration test • Vane shear test Applications: (Self Learning) • Model making of footings • Case study of settlement of foundation	8 Hrs
UNIT-II	
Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation (online mode), Design of raft foundation-Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS- 2950) procedure. Laboratory Sessions/ Experimental learning: (Self Learning) • Design of raft foundation using software Applications: (Self Learning) • Introduction to Ansys software	8 Hrs

UNIT-III	
Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles. Laboratory Sessions/ Experimental learning: (Self Learning) • Model making of pile foundation Applications: (Self Learning) • Case studies related to pile foundation in clay and sand	8 Hrs
UNIT-IV	
Well Foundations: Introduction, Different shapes, and characteristics of wells. Components of well foundation (online mode), Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts. Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic, and floating caissons. Advantages and disadvantages of floating caissons. Laboratory Sessions/ Experimental learning: (Self Learning) • Poster preparation of well foundation and caissons Applications: (Self Learning) • Case studies related mitigation to sinking of well foundation	8 Hrs
UNIT-V	
Machine Foundations: Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, (online mode), general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control. Laboratory Sessions/ Experimental learning: (Self Learning) • Poster preparation of machine foundation • Vibration analysis of a machine foundation Applications: (Self Learning) • Case studies related to vibration isolation and control .	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Find the settlement and bearing capacity of soil
CO2	Describe the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
CO3	Identify the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles
CO4	Recall the basics of analysis and design principles of well foundation, drilled piers and caissons

CO5	Use the design principles of machine foundations program

Reference Books	
1.	Punmia B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Co., India
2.	Murthy V.N.S., Advanced Foundation Engineering, CBS PUBLISHERS
3.	Donald P. Coduto, Geotechnical Engineering Principles & Practices, Prenticehall of India Ltd, India
4.	Bowles J.E., Foundation Analysis and Design, McGraw Hill Pub. Co. New York

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	2	2	-	-	-	-	-	-	2	-	-	-
CO2	2	2	-	-	-	-	-	-	2	-	-	-
CO3	2	2	-	-	-	-	-	-	2	-	-	-
CO4	2	2	2	-	-	-	-	-	2	1	-	-
CO5	2	2	2	2	-	-	-	-	2	1	-	-

Semester: VII			
CONSTRUCTION METHODS, PLANNING AND MANAGEMENT (Theory)			
Course Code: MVJ21CV733			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	Discuss project preparation, Planning and Analysis with its types, measures & tools for assessment.		
2	Illustrate various management techniques for successful completion of construction projects.		
3	Classify various types of equipment's used in construction projects.		
4	Explain the various safety concepts and requirements applied to construction projects.		
5	Examine materials management technique in construction		

UNIT-I	
Prerequisites: Building materials, Construction management **Project Planning:** Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. (Online mode). Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data. Application of MS-Project and Primavera for planning Laboratory Sessions/ Experimental learning: (Self Learning) • Scheduling a residential building with G+1 project using MS-Project • Scheduling a residential building with G+1 project using Primavera Software Applications: (Self Learning) • Knowledge about MS-Project and Primavera software • Able to access the real time project scheduling and planning Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106149/ • https://nptel.ac.in/courses/105/103/105103093/	8 Hrs
UNIT-II	
Scheduling Procedures- Construction Scheduling, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modeling) techniques. LOB technique, Mass haul diagrams. **Project Controlling-** Monitoring and Control, Crashing (Online mode), Resource Leveling, Updating. Laboratory Sessions/ Experimental learning: (Self Learning) • Resource allocation and management using Primavera Software Applications: (Self Learning)	8 Hrs

• Knowledge about the network analysis • Identifying different methods of scheduling a project Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/102/105102199/	
UNIT-III	
Construction Equipment's and Management- Identification, Planning of equipment, Selection of Equipment, Equipment Management in Projects, Maintenance Management,(Online Mode). Equipment cost, Operating cost, Cost Control of Equipment, Depreciation Analysis, Replacement of Equipment, Replacement Analysis , Safety Management **Equipment for Earthwork**- Fundamentals of Earth Work Operations, Earth Moving Operations, Types of Earth Work Equipment- Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment (Online Mode) Laboratory Sessions/ Experimental learning: (Self Learning) • Case study on selection of construction equipment Applications: (Self Learning) • Behavior of different types of equipment used in construction • Knowledge about planning and selection of equipment in construction projects Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/103/105103206/	8 Hrs
UNIT-IV	
Construction Quality, Safety and Human Values- Quality and Safety Concerns in Construction - Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management (Online Mode). **HSE**- Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms /ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. **Ethics**- Morals, values and ethics, need of engineering ethics. (Online Mode). Laboratory Sessions/ Experimental learning: (Self Learning) • Case study on construction safety • Poster preparation on construction safety Applications: (Self Learning) • Understanding the quality and safety concerns in construction • Knowledge about total quality management measures taken in construction Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/110/105/110105094/	8 Hrs

UNIT-V	
Labor and Material Utilization- Historical Perspective, class of labour, Wages & statutory requirement, (Online Mode). Labor Productivity, Factors Affecting Job-Site Productivity, Labour Relations in Construction, Problems in Collective Bargaining, **Materials Management** - Material Procurement and Delivery, Inventory Control, Trade-offs of Costs in Materials Management Laboratory Sessions/ Experimental learning: (Self Learning) • Sample preparation of checklist for material procurement Applications: (Self Learning) • Knowledge in latest skills for managing supply chain, logistics, delivery, storage of materials and impart training for improving output Video link / Additional online information: (Self Learning) • https://nptel.ac.in/courses/105/106/105106206	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Use relevant software packages for planning, scheduling, executing and controlling of construction projects.
CO2	Predict the total time required to complete the job without delay and delay in the project
CO3	Classify the type and capacity of construction equipment used in construction site.
CO4	Illustrate safety manuals and practice safety in construction operations
CO5	Examine the modern trends in project management

Reference Books	
1.	Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2.	Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
3.	Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 1997
4.	Calin M. Popescu, Chotchai Charoenngam, "Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications", Wiley, New York, 1995.

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

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CO-PO Mapping												
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO10	PO11	PO12
CO1	3	2			2				2	1		
CO2	2	3		1	1	1						
CO3	3	2	1						1	1		
CO4	2	1	1	1		2		1		1		
CO5	3	2			1		1		1	1		

Semester: VII		
GROUND IMPROVEMENT TECHNIQUES (Theory)		
Course Code: MVJ21CV734		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		
• State the engineering behavior of natural soils & various methods adopted for Evaluation of soil conditions • 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 • Explain the techniques and methods adopted for dewatering and grouting methods • Apply the knowledge on stabilization of soils. • Illustrate the various reinforcement techniques adopted for stabilization of soils.		

UNIT-I	
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, Hydraulic, Physico-chemical, Electrical, Thermal methods, etc. and their applications Laboratory Sessions: • Identification of various soils and their characteristics Applications: • Study on physical and chemical characteristics of various soils • Based upon the soil nature, find out the suitable method adopted for stabilization of soils	8 Hrs
UNIT-II	
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. Laboratory Sessions: • Analyzing the various mechanical methods adopted for various	8 Hrs

types of soil Applications: • Understand the various mechanical instruments used for stabilization • Type and method adopted for stabilization of soils Video link / Additional online information: • Water resource system : https://nptel.ac.in/courses/105108130	
UNIT-III	
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. Laboratory Sessions: • Identification of dewatering and grouting methods for stabilization of soils Applications: • Decision making for selection of suitable pumping methods • Grouting methods adopted for Dam, Reservoir and tunnel construction	8 Hrs
UNIT-IV	
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 Laboratory Sessions: • Verification of suitable chemical methods for stabilization of soils. Applications: • Justification of suitable additives used for chemical stabilization • Evaluation of effective utilization of chemicals in the soil stabilization	8 Hrs
UNIT-V	
Soil improvement by using Reinforcing Elements - Introduction to	8 Hrs

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 Laboratory Sessions: • Design the suitable method of Reinforcement. Applications: • Stabilization of soil by adopting of various reinforcement techniques • Evaluation of Ground improvement techniques in Seismic Hazard zones	

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.	Bell, F.G., "Methods of treatment of unstable ground", Butterworths, London
4.	Ingles. C.G. and Metcalf J.B , "Soil Stabilization; Principles and Practice", Butterworths

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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Semester End Examination (SEE):

Total marks: 50+50=100

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CO3	1	1	2	2	-	-	-	-	1	-	1	1
CO4	1	1	2	2	1	-	-	-	1	-	1	1
CO5	1	1	2	2	1	-	-	-	1	-	1	1

Semester: VII		
ENVIRONMENTAL IMPACT ASSESSMENT (Theory)		
Course Code: MVJ21CV741		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		
Course objective is to: This course will enable students to • To identify the major challenges in environmental issues and evaluate possible solutions. • Develop analytical skills, critical thinking and demonstrate socio-economic skills for sustainable development. • To analyze an overall impact of specific issues and develop environmental management plan.		

UNIT-I	
Introduction: Environment – Components of Environment Ecosystem: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. Impacts of Agriculture & Housing Impacts of Industry, Mining & Transportation Environmental Impact Assessment, Sustainable Development.	8 Hrs
UNIT-II	
Natural Resources, Water resources – Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle. Energy – Different types of energy, Conventional sources & Non Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	8 Hrs
UNIT-III	
Environmental Pollution – Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water & Waste Water Management.	8 Hrs
UNIT-IV	
Air Pollution & Automobile Pollution: Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. Solid Waste Management, E - Waste Management & Biomedical Waste Management - Sources, Characteristics & Disposal methods.	8 Hrs
UNIT-V	
Introduction to GIS & Remote sensing, Applications of GIS & Remote Sensing in Environmental Engineering Practices. Environmental Acts & Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs), Environmental Education & Women Education.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand 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 and describe the realities that managers face when dealing with complex issues

Reference Books	
1.	Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited
2.	R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi.
3.	Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005
4.	P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006

Continuous Internal Evaluation (CIE):

Theory for 50 Marks

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

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	1		1	3	1		1		1	1		
CO2	2	2	3	3	1							
CO3	3	2	3	3		1		1	2		1	
CO4	1	2	3	3								
CO5	1		1	3	1		1		1	1		

Semester: VII		
REMOTE SENSING AND GIS (Theory)		
Course Code: MVJ21CV742		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 basic concepts of Remote Sensing.
2	Identify the various Remote Sensing Platforms and its limitations
3	Illustrate various international space programs
4	Brief various Geographical Information System (GIS) method
5	Solve real time problem by the application of RS & GIS

UNIT-I	
Introduction to Remote Sensing: **Introduction:** Introduction to Remote Sensing: Definition - History & Concepts - Electromagnetic Radiation (Source, Mode of Energy transfer, Radiation Principles, Black body radiation); Electro Magnetic Radiation (EMR): EMR Spectrum - EMR Interaction with Atmosphere (Absorption, Scattering & Atmospheric windows) - EMR Interaction with Earth surface (Absorption & reflection) - Spectral Response pattern - Energy budgeting in Remote Sensing.	8 Hrs
UNIT-II	
Sensor and its characteristics: **Sensors and Platforms:** Resolutions (Spectral, Spatial, Temporal, Radiometric) –Platforms Sensors - Scanning & Orbiting Mechanism of Satellites and Data Acquisition. Optical Remote Sensing: Basic concepts -Optical sensors and scanners. **Thermal & Microwave Remote Sensing**: Thermal Remote Sensing: Basic concepts-Thermal sensors & scanners - Thermal Inertia. Microwave Remote Sensing: Basic concepts Microwave sensors and Radiometers - Geometric characters – Radar grammetry (SLAR/SAR)-LIDAR -Hyper spectral Remote Sensing: basic concepts.	8 Hrs
UNIT-III	
Remote Sensing Satellite Programme: Remote Sensing Satellites: LANDSAT Series - IRS Series - IRS-P series - Cartosat - Spot Series - ASTER, MODIS - IKONOS - QUICKBIRD - ORBVIEW -ERS - Meteorological Satellites -Shuttle Mission - Developments of Remote Sensing in India - Future Remote Sensing Missions	8 Hrs
UNIT-IV	
Introduction to Geographical Information System (GIS): Definition - Usefulness of GIS - Components of GIS - Computer Hardware, Software Modules and Organizational Context of GIS. **Data Structure:**	8 Hrs

Data Structure in GIS - Types of Data (Points, Lines and Polygons) - Data Base Structures (Raster Data Structures and Vector data Structures) - Data Conversion (Vector to Raster and Raster to Vector)	
UNIT-V	
Integrated Applications of Remote sensing and GIS: Applications in Land use Land cover analysis, change detection, Water Resources, Urban Planning, Environmental Planning, Natural Resource Management and Traffic Management. Location Based Services and its Applications.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Collect data and delineate various elements from the satellite imagery using their spectral signature
CO2	Identified various Remote Sensing Platforms and its limitations
CO3	Restate and apply sustainability concepts in various space programmes
CO4	Analyze different features of ground information to create raster or vector data.
CO5	Perform digital classification and create different thematic maps for solving specific problems & Make decision based on the GIS analysis on thematic maps.

Reference Books	
1.	Anji Reddy M., "Remote sensing and Geographical information system", B.S. Publications 2008
2.	S Kumar, "Basics of remote sensing & GIS", Laxmi publications 2005
3.	Chor Pang Lo and Albert K.W Yeung, "Concepts & Techniques of GIS", PHI, 2006
4.	John R. Jensen, "Remote sensing of the environment" , An earth resources perspective – 2nd dition – by Pearson Education 2007

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.

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

Semester: VII		
INDUSTRIAL POLLUTION & PREVENTION (Theory)		
Course Code: MVJ21CV743		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		
To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control		

UNIT-I	
Industrial wastes and their sources: Various industrial processes, Sources, and types of solid, liquid, gaseous wastes, Noise & radiation emissions. Sources of industrial water usages and various industrial processes requiring water use and required water quality.	8 Hrs
UNIT-II	
Processes responsible for deterioration in water quality, Various waste water streams, Control and removal of specific pollutants in industrial waste waters, e.g., oil and grease, bio-degradable organics, chemicals such as cyanide, fluoride, toxic organics, heavy metals, radio activity etc. Waste water reuse & recycling, Concept of zero discharge effluent.	8 Hrs
UNIT-III	
Control of gaseous missions: Hood and ducts, Tall stacks, Particulate and gaseous pollutant control, Solid waste generation and disposal management. Hazardous wastes: Definitions, concepts and management aspects. Noise & radiation: Generation, control and management.	8 Hrs
UNIT-IV	
Recent trends in industrial waste management, Cradle to grave concept, Life cycle analysis, Clean technologies; Case studies of various industries, e.g., dairy, fertilizer, distillery, sugar, pulp and paper, iron and steel, metal plating, thermal power plants, etc.	8 Hrs
UNIT-V	
Environmental audit: Definition and concepts, Environmental audit versus accounts audit, Compliance audit, Relevant methodologies, Various pollution regulations, Introduction to ISO and ISO14000.	8 Hrs

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify industrial sources of pollution.
CO2	Identify cause of deterioration of water
CO3	Outline and use the control techniques for the particulate and gaseous emissions.
CO4	Outline degree of treatment and type of treatment for disposal, reuse and recycle.
CO5	Assess compliance with regulatory requirement.

Reference Books	
1.	Shen T.T., "Industrial Pollution Prevention", Springer, 1999.
2.	Stephenson R.L. and Blackburn J.B., Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New York, 1998
3.	Freeman H.M., "Industrial Pollution Prevention Hand Book", McGraw Hill Inc., New Delhi, 1995.
4.	Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw Hill, 2000

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	1	-	1	-	-	-	-	1	-	-	-	-
CO2	2	-	1	3	2	-	-	1	-	-	-	-
CO3	3	-	-	1	1	-	1	1	-	-	-	-
CO4	-	-	-	-	-	-	-	1	-	-	-	-
CO5	-	-	-	-	-	-	-	1	-	-	-	-

Semester: VII		
PROJECT PHASE-I (Theory)		
Course Code: MVJ21CVP75		CIE Marks: 50
Credits: L:T:P: 0:0:2		SEE Marks: 50
Hours:		SEE Duration: 03 Hrs.

Course Learning Objectives: The students will be able

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - I: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the project and use modern tools and techniques
CO2	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO3	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.

Reference Books	
1.	Shen T.T., "Industrial Pollution Prevention", Springer, 1999.
2.	Stephenson R.L. and Blackburn J.B., Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New York, 1998
3.	Freeman H.M., "Industrial Pollution Prevention Hand Book", McGraw Hill Inc., New Delhi, 1995.
4.	Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw Hill, 2000

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

Semester: VIII		
PROJECT PHASE-II (Theory)		
Course Code: MVJ21CVP81		CIE Marks: 50
		SEE Marks: 50
		SEE Duration: 03 Hrs.

Course Learning Objectives: The students will be able

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability and inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the project and be able to defend it. Develop critical thinking and problem solving skills.
CO2	Learn to use modern tools and techniques. Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
CO3	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO4	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO5	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

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

Semester: VIII	
RESEARCH /INDUSTRIAL INTERNSHIP (Industrial Oriented)	
Course Code: MVJ21INT82	
Course Learning Objectives: The students will be able	
1	To get the field exposure and experience
2	To apply the theoretical concept in field application
3	To prepare the comparison statement of difference activities
Research / Industrial Internship: This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop skills to work in a team to achieve common goal. Develop skills of project management and finance.
CO2	Develop skills of self-learning, evaluate their learning and take appropriate actions to improve it.
CO3	Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	2	2	2	3	3	2	1	1	2	1	1	2
CO2	2	2	2	3	3	2	1	1	2	1	2	2
CO3	2	2	2	3	3	2	1	1	2	1	2	2

Semester: VIII
SEMINAR
Course Code: MVJ21CVS83
Course Learning Objectives: The students will be able
To inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.
Seminar: Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey; organize the Course topics in a systematic order. • Conduct literature survey in the domain area to find appropriate topic. • Prepare the synopsis report with own sentences in a standard format. • Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation. • Present the seminar topic orally and/or through power point slides. • Communicate effectively to answer the queries and involve in debate/discussion. • The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop knowledge in the field of Civil Engineering and other disciplines through independent learning and collaborative study.
CO2	Identify and discuss the current, real-time issues and challenges in engineering & technology. Develop written and oral communication skills.
CO3	Explore concepts in larger diverse social and academic contexts.
CO4	Apply principles of ethics and respect in interaction with others.
CO5	Develop the skills to enable life-long learning.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	2	2	2	3	3	2	1	1	2	1	1	2
CO2	2	2	2	3	3	2	1	1	2	1	2	2
CO3	2	2	2	3	3	2	1	1	2	1	2	2
CO4	2	2	2	3	3	2	1	1	2	1	2	2
CO5	2	2	2	3	3	2	1	1	2	1	2	2