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

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Semester End Examination (SEE):

Total marks: 50+50=100

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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