DESIGN OF STEEL STRUCTURES
B.TECH., VI Semester, Civil Engineering
[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

SubjectCode	22CV61	CIE	50
NumberofLectureHour/Week	3L	SEE	50
Total Number of Lecture Hours	42	Exam Hours	03

CREDITS –03

Course Objectives: This course will enable students to
1. Understand advantages and disadvantages of steel structures, steel code provisions and plastic behaviorof structural steel.
2. Learn the analysis and design of Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Behavior &Design of beam section.

CO#	Course Outcomes
CO1	Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behavior of structural steel
CO2	Understand the Concept of Bolted and Welded connections.
CO3	Understand the Concept of Design of compression members, built-up columns and columns splices.
CO4	Understand the Concept of Design of tension members, simple slab base and gusseted base.
CO5	Understand the Concept of Behavior &Design of beams.

Modules	Teaching Hours
Module -1 **Introduction:** Advantages and Disadvantages of Steel Structures, Limit state method, Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.	08 hours
Module -2 **Bolted Connections:** Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts Design of Simple bolted Connections (Lap and Butt joints)- Advantages and Disadvantages. **Welded Connections:** Introduction, Types and properties of welds, Weld Defects, Simple welded joints for truss member, Advantages and Disadvantages. Numerical	10 Hours
Module -3 **Design of Beams:** Introduction,Types of beams, Lateral stability of beams, Factors affecting lateral stability -Behavior of Beams in flexure, Beam types Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems]	08 Hours

Module -4 **Design of Column Bases:** Design of Simple Slab Base and Gusseted Base. **Design of Tension Members:** Introduction, Types of Tension members, Behavior of Tension members, modes of failure, Slenderness ratio, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices. Numerical	08 Hours
Module -5 **Design of Compression Members:** Introduction, Sections used for compression members, Behavior & types of failures, Effective length of compression members, Design of compression members. Design of Laced and Battened Systems. Numerical	08 Hours

Course Outcomes: After studying this course, students will be able to:

1. Possess a knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code-IS800:2007
provisions and plastic behavior of structural steel
2. Understand the Concept of Bolted and Welded connections.
3. Understand the Concept of Design of compression members, built-up columns and columns splices.
4. Understand the Concept of Design of tension members, simple slab base and gusseted base.

Program Objectives:

. Engineering knowledge
. Problem analysis
. Interpretation of data

Question Paper Pattern:

1. The question paper will have ten questions.
2. Each full question consists of 20 marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.
5. The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. N Subramanian., “Design of Steel Structures” (2016), Oxford University Press, New Delhi.
2. Duggal S K., “Limit State Method of Design of Steel Structures”, Tata McGraw Hill, New Delhi
3. Bhavikatti.S.S,”Design of Steel Structures” By Limit State Method as per IS:800-2007.

Reference Books:

1. Dayarathnam P, “Design of Steel Structures”, S Chand and Company Ltd., New Delhi.
2. Kazim S M A and Jindal R S, “Design of Steel Structures”, Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards,
New Delhi.

Course Articulation Matrix / Course mapping:

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	2										2	2	1	
CO2	2	3	2									2	2	2	3
CO3	2	3	2									2	2	2	3
CO4	3	3	2									2	2	2	2
CO5	3	3	2									2	2	2	3

HYDROLOGY AND IRRIGATION ENGINEERING

B.TECH., VI Semester, Civil Engineering

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

Subject Code	22CV62	**CIE**	50
Number of Lecture Hours/Week	03	**SEE**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS – 03

Course Objectives: This course will enable students to

1. Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation, and transpiration.
2. Quantify of runoff and use the concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

CO#	Course Outcomes
CO1	Understand the importance of hydrology and its components.
CO2	Measure precipitation and analyze the data and analyze the losses in precipitation.
CO3	Estimate runoff and develop unit hydrographs.
CO4	Calculate the quantity of irrigation water and frequency of irrigation for various crops.
CO5	Calculate the canal capacity, design the canal and compute the reservoir capacity.

Modules	Teaching Hours
Module -1	
Hydrology: Introduction, Importance of hydrology, Global distribution of water and Indian water availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation. Vertical Structure of the atmosphere. **Precipitation:** Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency	08 hours

of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of rainfall hyetographs.	
Module -2	
losses: Evaporation: Introduction, Process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control. **Evapo-transpiration:** Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation. **Infiltration:** Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.	08 Hours
Module -3	
Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis. **Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.	08 Hours
Module -4	
Irrigation: Definition. Benefits and ill effects of irrigation, System of irrigation: surface and ground water, flow irrigation, lift irrigation, Bandhara irrigation. Methods of water distribution to crops. **Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water, crops and crop seasons in India, irrigation efficiency, frequency of irrigation (Numericals).	10 Hours
Module -5	
Canals: Classification of canals, distribution system for canal irrigation. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method. **Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.	08 Hours

Course outcomes: After studying this course, students will be able to:

1. Understand the importance of hydrology and its components.
2. Measure precipitation and analyze the data and analyze the losses in precipitation.
3. Estimate runoff and develop unit hydrographs.
4. Calculate the quantity of irrigation water and frequency of irrigation for various crops.
5. Calculate the canal capacity, design the canal and compute the reservoir capacity.

Question paper pattern:

1. The question paper will have ten full questions carrying equal marks.
2. Each full question will be for 20 marks.
3. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have sub- question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
3. Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
4. Santosh Kumar Garg, " Irrigation Engineering and Hydraulic Structures", Khanna Publications, New Delhi

Reference Books:

1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.

Course Articulation Matrix / Course mapping :

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	2					2	2					1		1	
CO2	2	2	2	2	1	2	2	1	1					1	
CO3	2	2	2	2	1	2	2	1	1					2	
CO4	2	2	2	2	1	2	1		1		2	2	2		
CO5	2	2	2	2	1	2	1		1		2	2	2		

Environmental Engineering

B.TECH., VI Semester, Civil Engineering

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

Subject Code	22CV631	**CIE**	50
NumberofLectureHour/Week	3L	**SEE**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS – 03

Course objectives: This course will enable studentsto

1. Understand the Environmental pollution Caused by Human Activities
2. To enable the student to understand source, collection and convey of water.
3. Quality of water and its permissible standards.
4. To know the Methods to treat the water physical, chemical and biological.
5. Understand different method of water treatment

MODULES	**Teaching Hours**
Module -1	
INTRODUCTION: Human activities and environmental pollution. Water for various beneficial uses and quality requirement. Need for protected watersupply**.** DEMAND OF WATER: Types of water demands- domestic demand in detail, institutional and commercial, public uses, fire demand. Per capita consumption – factors affecting per capita demand, population forecasting, different methods with merits &demerits- variations in demand of water, design periods & factors governing the design periods, numericals on population forecasting.	**8 Hours**
Module -2	
SOURCES: Surface and subsurface sources – suitability with regard to quality andquantity. COLLECTION AND CONVEYANCE OF WATER: Intake structures – different types of intakes; factor of selection and location of intakes. Pumps- Necessity, types – power of pumps; factors for the selection of a pump. Numerical on pumps.	**8 Hours**
Module -3	
QUALITY OF WATER: Objectives of water quality management. wholesomeness & palatability, water borne diseases. Water quality parameters – Physical, chemical and Microbiological. Sampling of water for examination. Water quality analysis (IS: 3025 and IS: 1622) using analytical and instrumental techniques. Drinking water standards BIS & WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. and toxic / trace organics.	**8 Hour**
Module -4	
WATER TREATMENT: Objectives – Treatment flow-chart. Aeration- Principles, types of Aerators. SEDIMENTATION: Theory, settling tanks, types, design. Coagulant aided	

sedimentation, jar test, chemical feeding, flash mixing, and clari- flocculator. FILTRATION: Mechanism – theory of filtration, types of filters, slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design – excluding under drainage system – back washing of filters. Operational problems in filters. Numerical on the filtration, sedimentation.	**10 Hours**
Module -5	
DISINFECTION: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. UV radiation treatment – treatment of swimming pool Water. FLOURIDATION AND DEFLOURADATION SOFTENING – definition, methods of removal of hardness by lime soda process and zeolite process RO & Membrane technique.Methods of Distribution system, Components of Distribution system, Layouts of Distribution networks	**08 hours**

Course Outcomes(COs):

On completion of this course, the student will be able to

CO#	Course Outcomes
CO1	The population forecasting
CO2	Students Able to understand Conveyance of water through pipes and pumps
CO3	BIS Standard for drinking water
CO4	Design of filter beds. With different media
CO5	Understands the concepts and application of methods and disinfection.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 10marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under amodule.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. 1. Water supply Engineering –S.K.Garg, KhannaPublishers
2. Environmental Engineering I –B C Punima and AshokJain
3. Manual on Water supply and treatment –CPHEEO, Minstry of Urban Development, NewDelhi.

Course Articulation Matrix / Course mapping :

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	2	2									2	3	1	
CO2	2	2	2				2					2	2	1	2
CO3	2	2	2									2	2	2	1
CO4	3	2	2				2					2	3	3	2
CO5	3	2	2				2	2				2	3	3	2

REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES

B.TECH., VI Semester, Civil Engineering

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

Subject Code	22CV632	**CIE**	50
Number of Lecture/Hours/Weeks	3L	**SEE**	50
Total Number of Lecture Hours	42	**Exam Hours**	03

CREDITS – 03

Course objectives: This course will enable students to

1.To learn various distress and damages to concrete and masonry structures
2.To understand the importance of maintenance of structures
3. To study the various types and properties of repair materials
4.To assess the damage to structures using various tests
5.To learn the importance and methods of substrate preparation

Modules	Teaching Hours
Module -1	
INTRODUCTION: An overview of present repair practices, distress identification and repair management, Causes of distress in concrete structures-Holistic Models for deterioration of concrete, Permeability of concrete, aggressive chemical agents, durability aspects, Condition SurveyDefinition, objectives, different stages-Preliminary inspection, planning stage, visual inspection, field laboratory testing stage, consideration for repair strategy	09 Hours
Module -2	
NON DESTRUCTIVE AND DESTRUCTIVE TESTING METHODS: Non-Destructive evaluation tests - Concrete strength assessment - Rebound hammer test - Ultrasonic pulse velocity tests, penetration resistance, pull out tests, core sampling and testing, Chemical tests - Carbonation tests and chloride content, Corrosion potential assessment, half cell potentiometer test, resistivity measurement, Identification and estimation of damage.	08 Hours
Module -3	
EVALUATION OF STRUCTURAL PROPERTIES: Fire damage assessment, structural integrity and soundness assessment, interpretation and evaluation of results, Evaluation of reserve strength of existing structures, analysis necessary to identify critical sections, active and passive repairs, modeling of repaired composite structures	08 Hours
Module -4	
REPAIR MATERIALS AND CASE STUDIES:Selection of repair materials for concrete-Essential parameters for repair materials-Strength and durability aspects, cost and suitability aspects, Materials for repair. Discussion of case studies- RCC buildings, water tanks, industrial structures-Identifying a suitable repair option for certain damage in a structure.	08 Hours
Module -5	

REPAIR/ REHABILITATION METHODS AND STRATEGIES: Rehabilitation and retrofitting methods-repair options, performance requirements of repair systems, factors for selection of repair methods, Repair stages, Methods of repair including foundation rehabilitation methods, chemical and electrochemical method. Repair/Rehabilitation strategies - Stress reduction technique, repair and strengthening of columns and beams, Compressive strength of concrete, cracks/joints, masonry, foundation, base isolation.	09 Hours

Course outcomes: On the completion of this course students are able to attain the following outcomes;

1. Various distress and damages to concrete and masonry structures
2. The importance of maintenance of structures, types and properties of repair materials etc
3. Assessing damage to structures and various repair techniques
4. Select Repair Material & identify a suitable repair option.
5. Evaluate structural properties.

Question paper pattern:

1. The question paper will have ten questions.
2. Each full question consists of 10 marks.
3. There will be 2 full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.
5. The students will have to answer 5 full questions, selecting one full question from each module

Text Books:

1. Varghese P.C., "Maintenance, Repair & Rehabilitation And Minor Works of Buildings" 1st Edition, PHI Learning Private Ltd., New Delhi., 2014.
2. Santhakumar A.R., "Concrete Technology" Oxford University Press, 2007, New Delhi
3. CPWD Handbook on Repair and Rehabilitation of RCC buildings, Govt. of India Press, New Delhi.
4. Raikar, R.N., "Learning from failures - Deficiencies in Design, Construction and Service" R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

Reference Books:

1. Shetty, M.S; Concrete Technology – Theory and Practice, S.Chand and Company, New Delhi, 1992.
2. Vidivelli, B; Rehabilitation of Concrete Structures, Standard Publishers Distributors, New Delhi, 2008
3. P.K.Guha, Maintenance and Repairs of Buildings, New Central Book Agency (P)Ltd, Kolkata.

Course Articulation Matrix / Course mapping:
Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1		2	2	2	2					1		1		3	2
CO2		2	2	2	1					1		1		2	3
CO3		2	2	2	1					1		1		2	3
CO4		2	2	2	1					1		1		2	3
CO5		2	2	2	1					1		1		2	3

HIGHWAY ENGINEERING

B.TECH., VI Semester, Civil Engineering

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

Subject Code	22CV641	CIE	50
Number of Lecture Hours/Week	03	SEE	50
Total Number of Lecture Hours	42 Hours	Exam Hours	03

CREDITS – 03

Course objectives:

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same inINDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economicimpact).will understand about highway alignment and surveys.
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highwaynetwork.
4. Understand pavement and its components, pavement construction activities and itsrequirements.
5. Gain the skills of evaluating the highway economics and pavement failure and remedial measures. Gain the importance of highway drainage and will know how to design surface and subsurface drainage.

Module -1	**Teaching Hours**
Principles of Transportation Engineering: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport Jayakar committee recommendations, and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute **Highway Development and Planning:** Road types and classification, road patterns, planning surveys, master plan – saturation system of road planning, phasing, 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 Karnataka (KSHIP & KRDCL) Road development plan - vision 2021 and 2025 numerical Problems.	08 HOURS
Module -2	
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. **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, numerical Problems.	14 HOURS
Module -3	
Pavement Materials: Subgrade soil - desirable properties-HRB and IS 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 and mix design – Marshall Method.. **Pavement Design:** Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical methodonly)-Examples	08 HOURS
Module -4	

Pavement Construction: Earthwork; cutting and Filling, Preparation of subgrade, Specification and construction of i) Granular Sub base, ii) WBM Base, iii) WMM base, iv) Bituminous Macadam, v) Dense Bituminous Macadam vi) Bituminous Concrete, vii) Dry Lean Concrete sub base and PQC viii) concrete roads	04 HOURS
Module -5	
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, numerical Problems. **Highway Economics and Failure in Pavement:** Highway user benefits, VOC using charts only-Examples, Economic analysis - annual cost method-Benefit Cost Ratio method, BOT-BOOT concepts. Important failure in flexible and rigid pavement and their remedial measures.	08 HOURS

Course outcomes: After studying this course, students will be able to:

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of requireddata.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavementconstruction.
3. Design road geometrics, structural components of pavement anddrainage.
4. Students able to perform the quality test on highway construction materials and contrast conventional and modern construction practices.

5.Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financingconcepts

Program Objectives:

- Engineeringknowledge
- Problemanalysis
- Interpretation ofdata

TextBooks:

1. S K Khanna and C E G Justo, " Highway Engineering", Nem Chand Bros,Roorkee
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, NewDelhi.
3. R Srinivasa Kumar, "Highway Engineering", UniversityPress.
4. K.P.subramanium, "Transportation Engineering", SciTech Publications,Chennai.

Reference Books:

1. Relevant IRCCodes
2. Specifications for Roads and Bridges-MoRT&H, IRC, NewDelhi.
3. C. JotinKhisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd.New Delhi.
4. Bituminous road construction in India by Prithvi singh Kandhal

Course Articulation Matrix / Course mapping:

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	2	1	2				2	2		2	3	3	1	2	
CO2	2	1	3				2	2		2	3	3		1	
CO3	1	2	2			1	1	1		2	3	3			3
CO4	2	2	3				2	2		2	3	2			3
CO5	2	2	2				1	2	2	3	3	3	3		3

Alternate Building Materials

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

SEMESTER –VI

Subject Code:	22CV642	CIE	50
Number of Lecture Hours/Week	3L	SEE	50
Total Number of Lecture Hours:	42	Exam Hours	03

CREDITS –03

Course Objectives: This course will enable students to:

1.Understand environmental issues due to building materials and the energy consumption in building materials.

2. Study of various masonry blocks, masonry motor and structural behavior of masonry under compression.

3.Study the alternative building materials in present context.

4. Understand the alternative building technologies which are followed in present construction field.

Modules	Teaching Hours
Module -1: Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Requirements for buildings of different climatic regions. Green concepts in buildings, Green building ratings – IGBC(Indian Green Building Council). Rainwater harvesting & solar passive architecture. Environmentally friendly and cost-effective building technologies.	08 Hours
Module -2: Alternate Materials for Construction: Pozzolana cements - (Raw materials, Manufacturing process, Properties and uses). Fibers - (metal and synthetic, Properties and applications). Fiber reinforced plastics - (Properties and applications). Building materials from Agro-industrial wastes, Industrial and mine wastes - (Properties and applications). Masonry blocks using industrial wastes. Construction and demolition waste as building materials.	10 Hours
Module -3: Elements of Structural Masonry: Masonry, Elements of Structural Masonry, Masonry materials, requirements of masonry units. characteristics of - (bricks, stones, clay blocks, concrete blocks, laterite Blocks, Fal- G blocks and Stabilized mud block). Manufacture of - (stabilized blocks, Aerated Blocks).	08Hours
Module -4: Structural Masonry Mortars: Cementitious materials, Sand - (natural & manufactured), Mortars, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar. Uses of masonry, compressive strength of masonry	08 Hours

elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry.	
Module -5:Equipment for Production of Alternate Materials Equipment's for production of stabilized blocks, Machines for manufacture of concrete, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, Cost analysis: Case studies using alternatives.	08 Hours

Course Outcomes: After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost-effective building technologies;
2. Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
3. Understand the different types of masonry units
4. Select the appropriate type of masonry mortar for civil engineering constructions.
5. Learning of different equipment required for manufacturing of building materials and select appropriate equipment for the selected materials.

Question Paper Pattern:

1. The question paper will have ten full questions carrying equal marks.
2. Each full question will be for 20 marks.
3. There will be two full questions (with a maximum of four sub- questions) from each module.
4. Each full question will have sub- question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module.

Text Books:

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers.

Reference Books:

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub. 3. IGBC Green Homes Rating System, CII pub. 4. Relevant IS Codes.

Course Articulation Matrix / Course mapping:

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	2	1	2				2	2		2	3	3	3	1	1
CO2	2	1	3				2	2		2	3	3	3	1	1
CO3	1	2	2			1	1	1		2	3	3	3	2	1
CO4	2	2	3				2	2		2	3	2	3	2	1
CO5	2	2	2				1	2	2	3	3	3	3	3	1

SOLID WASTE MANAGEMENT **[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]** VI SEMESTER			
Course Code	22CV651	**CIE**	50
NumberofLectureHour/Week	3L+1	**SEE**	50
Total Number of Lecture Hours	52	**Exam Hours**	3
CREDITS –04			

Course Objectives: This course will enable students to

1.Understanding of problems of municipal waste, biomedical waste, hazardous waste, e-waste, industrial waste etc.

2. Knowledge of legal, institutional and financial aspects of management of solid wastes.

3.Become aware of Environment and health impacts of solid waste mismanagement

4: Identifying recycling and reuse options (composting, source separation, and re-use of shredded tires, recycled glass, fly ash, etc.)

5.evaualte different processing methods

Modules	**Teaching Hours**
Module -1	
SOURCES AND TYPES :Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO's.	12 hours
Module -2	
ON-SITE STORAGE AND SEGREGATION OF SOLID WASTE . On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – 3R system	8 Hours
Module -3	
COLLECTION AND TRANSFER : Methods of Residential and commercial waste collection – Collection vehicles – Manpower– Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems resolving	10 Hours
Module -4	
OFF-SITE PROCESSING Objectives of waste processing – Physical Processing techniques and Equipment's; Resource recovery from solid waste composting and bio methanation; Thermal processing options – case studies under Indian conditions.	12 Hours
Module -5	

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation. Dumpsite land reclaim	10 Hours

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	an understanding of the nature and characteristics of municipal solid wastes.
CO2	Acquire knowledge on the regulatory requirements regarding municipal solid waste management.
CO3	ability to plan waste minimization and design storage, collection, transport, processing and disposal of municipal solid waste.
CO4	Identifying (composting, source separation, and re-use of shredded tires, recycled glass, fly ash, etc
CO5	The students will be able to utilize the waste by material recovery sheet

Question Paper Pattern:

The question paper will have ten questions. **Question paper pattern:**

- The question paper will have tenquestions.
- Each full question consists of 10marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under amodule.

The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 1993.
2. Vesilind, P.A. and Rimer, A.E., “Unit Operations in Resource Recovery Engineering”, Prentice Hall, Inc., 1981
3. Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2000

Reference Books:

1. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000.
2. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
3. Manser A.G.R. and Keeling A.A.," Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996
4. George Tchobanoglous and Frank Kreith"Handbook of Solidwaste Management", McGraw Hill, New York, 2002
5.Sasikumar.K, Sanoop Gopi Krishna,"Solid Waste Management", PHI learning, New Delhi,2009

Course Articulation Matrix / Course mapping:

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-		2		2		1	2	2		

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

AIR POLLUTION AND CONTROL

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

SEMESTER – VI

SubjectCode	22CV652	CIE	50
NumberofLectureHour/Week	4L	SEE	50
Total Number of Lecture Hours	52	Exam Hours	03

CREDITS – 04

Course objectives: This course will enable studentsto

1. Study the sources and effects of air pollution.
2. Learn the meteorological factors influencing air pollution.
3. Analyze air pollutant dispersion models.
4. Illustrate particular and gaseous pollution control methods.
5. to improve the knowledge on emerging trends

Modules	Teaching Hours
Module -1	
Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.	10Hours
Module -2	
Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.	12Hours
Module -3	
Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM2.5, PM10, SOX, NOX, CO, NH3)	12Hours
Module -4	
Control Techniques: Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP.	8Hours
Module -5	
Air pollution due to automobiles, standards and control methods. Noise pollution causes, effects and control, noise standards. Environmental issues,global episodes, laws, acts, protocols, Industrial air pollution effect and control.	10Hours

Course Outcomes(COs):

*On completion of this course,*the student will be able to

EXTENSIVESURVEYLAB

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

SEMESTER – VI

CO#	Course Outcomes
CO1	Identify the major sources of air pollution and understand their effects on healthand environment.
CO2	Evaluate the dispersion of air pollutants in the atmosphere and to develop airquality models
CO3	Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.
CO4	Choose and design control techniques for particulate and gaseous emissions
CO5	Ability to justify the use of pollution control equipment and there design.

Question paper pattern:

- The question paper will have tenquestions.
- Each full question consists of 10marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under amodule.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.
2. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell, “Introduction t o Environmental Engineering” McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, “Air Pollution Control Engineering” , Waveland Pr Inc.
2. Anjaneyulu Y, “Text book of Air Pollution and Control Technologies”, Allied Publishers.

Course Articulation Matrix / Course mapping :

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	1	2	1	1		1	2	1	2	1	1		1		
CO2	2	2	1	1	1	1	2	1	2	1	1		1		
CO3	2	2	1	1	1	1	2	1	1	1	1		1		
CO4	1	1	1	1		2	2	2	2	1	1		1		
CO5	1	2	1	1		2	2	2	2	1	1		1		

SubjectCode	22CVL66	CIE	50
NumberofLectureHour/Week	2P	SEE	50
Total Number of Lecture Hours	28	Exam Hours	03

CREDITS – 01

CourseLearningObjectives: Thiscoursewillenablestudentsto

1. UnderstandthepracticalapplicationsofSurveying.
2. UseTotalstationandotherMeasurementEquipments.
3. Workin teamsand learntimemanagement,communication, andpresentation skills

Course Outcomes(COs):

*On completion of this course,*the student will be able to

CO #	Course Outcomes
CO1	Apply surveying knowledge and tools effectively for projects
CO2	UnderstandingTaskenvironment,goals,Responsibilities,working in teams towards common goals,Organisationalproformancesexpectations,Technicalbehavioural competencies.
CO3	Application of individual effectiveness skills in terms and organizational context,Goal setting and time management,communications.
CO4	Professional etiquettes at workplace,meeting and general
CO5	Orientation towards conflicts in terms and organizational environment,understanding sources of conflicts,conflicts resolution styles and techniques.

1. **NEWTANK PROJECTS:**Thework shallconsistof;
   a. Reconnaissancesurveyfor selectionof site andconceptualizationofproject.
   b. Alignmentofcenterlineoftheproposedbund,Longitudinalandcrosssectionsofthecenter line.
   c. Detailed surveyrequired for project execution likeCapacity surveys, Details at Wasteweir and sluice points, Canal alignment etc. as per requirement
   d. Design andpreparationofdrawing withreport.
2. **WATERSUPPLYANDSANITARYPROJECT:**Theworkshall consistof;
   a. Reconnaissancesurveyfor selectionofsiteandconceptualizationofproject.
   b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
   c. Preparationofvillagemapbyusingtotalstation.
   d. Surveyworkrequired forlaying ofwatersupplyandUGD
   e. Locationofsitesforwatertank.Selectionoftypeofwatertanktobeprovided.(groundlevel, overhead and underground)
   f. Designofall elementsandpreparationofdrawingwith report.
3. **HIGHWAYPROJECT:** Theworkshallconsistof;
   a. Reconnaissancesurveyfor selectionof site andconceptualizationofproject.
   b. Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using total station.
   c. Report should justify the selected alignment with details of all geometric designs for traffic anddesign speed assumed.
   d. Drawingshallincludekeyplaninitialalignment,finalalignment,longitudinalsectionalongfinal

alignment,typicalcrosssectionsofroad.

4. **RESTORATIONOFANEXISTINGTANK:**Theworkshallconsistof;
   a. Reconnaissancesurveyfor selectionofsiteandconceptualizationofproject.
   b. Alignmentofcenterlineoftheexisting bund,Longitudinalandcross sectionsofthecenterline.
   c. Detailed surveyrequired for project execution likeCapacity surveys, Details at Wasteweir and sluice points, Canal alignment etc. as per requirement
   d. Designofall elementsandpreparationofdrawingwith report.

5. **TOWN/HOUSING/ LAYOUTPLANNING:**Thework shallconsistof;
   a. Reconnaissancesurveyfor selectionofsiteandconceptualizationofproject.
   b. Detailedsurveyrequiredforprojectexecutionlikecontoursurveys
   c. Preparationoflayoutplansasper regulations
   e. Centerlinemarking-transferofcentrelinesfrom planto ground
   f. Designof allelementsandpreparationof drawingwithreportasper regulations

Courseoutcomes: Afterstudyingthiscourse,studentswillbeableto:

1. ApplySurveying knowledgeandtoolseffectivelyfortheprojects
2. Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towardscommon goals, Organizational performance expectations, technical and behavioral competencies.
3. Applicationofindividualeffectivenessskillsinteamandorganizationalcontext,goalsetting,time management, communication and presentation skills.
4. Professionaletiquettesatworkplace,meetingand general
5. Establishingtrustbasedrelationshipsinteams&organizationalenvironment
6. Orientation towards conflicts in team and organizational environment, Understanding sources ofconflicts, Conflict resolution styles and techniques

ReferenceBooks:

TrainingmanualsandUser manuals
Relevantcoursereferencebooks

Course Articulation Matrix / Course mapping :
Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	1	2	1	1		1	2	1	2	1	1		1	2	3
CO2	2	2	1	1	1	1	2	1	2	1	1		1	1	3
CO3	2	2	1	1	1	1	2	1	1	1	1		1	1	3
CO4	1	1	1	1		2	2	2	2	1	1		1	1	3
CO5	1	2	1	1		2	2	2	2	1	1		2	1	3

SOFTWARE APPLICATION LAB-II
[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]
SEMESTER –VI

Subject Code	22CVL67	**CIE**	50
Number ofLecture Hours/Week	02	**SEE**	50
Total Number ofLecture Hours	28	**Exam Hours**	03
CREDITS – 01			

Course objectives:
1. Use industry standard software in a professional set up.
2. understand the fundamentals of project management.
3. Develop/ generating report.

Course Outcomes(COs):
On completion of this course,the student will be able to
1. Understand data structures & create a project
2. Create OBS, WBS
3. Add activities & create relationships View calendars & schedule project
4. Format schedule data ,Define& assign roles and resources
5. Optimize the project plan and Execute the project

Sl. No	Experiments	Teaching Hours
1	Introduction to Project Management • Basics of project management • Importance of project management software like Primavera	28 hours
2	. Introduction to Primavera • Navigation of the Primavera P6 interface • Features and capabilities	
3	Creating of Project • Setting up a new project • Defining Project details (start date, end date, etc.) • Organizing project structures (Work Breakdown Structure - WBS)	
4	Adding Activities • Adding activities manually • Assigning roles to activities • Establishing relation between activities	
5	Planning and Scheduling • Scheduling Types, Progress Override, Scheduling Logs • Assigning durations to activities • Applying Constraints and deadlines	
6	Project Resource management • Types of Resources (labor, equipment, materials) • Adding and organizing Resources	
7	Reports Creation • Generating basic reports • Global Reports, Weekly Report, Project closing report • Customizing reports to meet project requirements	

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- Instructions as printed on the cover page of answer script for split up of marks is to be followed

REFERENCE BOOKS:

- **Training manuals and User manuals and Relevant course reference books**

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	2	2	2	2					1			1		3	
CO2	3	2	2	2					1			1		3	
CO3	3	2	2	2					1			1		3	
CO4	2	2	2	2					1			1		3	
CO5	2	2	2	2					1			1		3	

ENVIRONMENTAL ENGINEERING LAB

B.TECH., VI Semester, Civil Engineering

[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]

Subject code	22CVL68	CIE	50
Number of lecture hours per week	02	SEE	50
Total number of lecture hours	28	Exam hours	03

CREDITS 01

Course Learning Objectives: This course will enable students,

1. To learn different methods of water &waste waterquality
2. To conduct experiments to determine the concentrations of water and wastewater
3. To determine the degree and type oftreatment
4. Tounderstandtheenvironmentalsignificanceandapplicationinenvironmentalengineeringpractice
5. Understanding professional and ethical responsibility

Course Outcomes(COs):

*On completion of this course,*the student will be able to

CO#	Course Outcomes
CO1	Acquirecapabilitytoconductexperimentsandestimatetheconcentrationofdifferentparameters.
CO2	Compare theresultwithstandardsanddiscussbasedonthepurposeofanalysis.
CO3	Determinetypeoftreatment,degreeoftreatmentforwaterandwastewater.
CO4	Identify the parameter to be analyzed for the student project work in environmentalstream.
CO5	Compute and visualize the working of various units and write report.

EXPERIMENTS	Teaching Hours
1. Preparation chemical reagents required for laboratory analysis by standard method.	2HR
2. Determination of pH, Conductivity, TDS and Turbidity.	2HR
3. Determination of Alkalinity	2HR
4. Determination of Acidity	2HR
5. Determination of Calcium, Magnesium and Total Hardness.	2HR
6. Determination of Dissolved Oxygen a. Determination of BOD.	2HR
7. Determination of Chlorides	2HR
8. Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.	2HR
9. Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids.iv) volatile solids	2HR
10. Determination of optimum coagulant dosage using Jar test apparatus.	2HR
11. Determination of Fluorided by spectrophotometer	2HR
12. Determination of Nitrate by spectrophotometer	2HR
13. Determination of Sulphate by spectrophotometer	2HR

14. Determination of COD(Demonstration),Air Quality Monitoring (Demonstration),Sound pollution Monitoring(Demonstration)	2HR

Course Outcomes: After studying this course, students will be able to:

1. Acquirecapabilitytoconductexperimentsandestimatetheconcentrationofdifferentparameters.
2. Compareth eresultwithstandardsanddiscussbasedonthepurposeofanalysis.
3. Determinetypeoftreatment,degreeoftreatmentforwaterandwastewater.
4. Identify the parameter to be analyzed for the student project work in environmentalstream.

Question paper pattern:

Two experiments shall be asked from the above set ofexperiments.
Oneexperimenttobeconductedandfortheotherstudentshouldwritedetailedprocedure.

References

1. IS codes-3025series
2. Standard method for examination of water and waste water, APHA, 20th edition

ClairSawyerandPerryMcCartyandGeneParkin,"ChemistryforEnvironmentalEngineeringand Science", McGraw-Hill Series in Civil and EnvironmentalEngineering.

Course Articulation Matrix / Course mapping :

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1	PSO2	PSO3
CO1	3	2	3			2	3	1	2	2		2	1	2	
CO2	3	2	3			2	3	1	2	2		2	1	2	
CO3	3	2	3			2	3	1	2	2		2	1	2	
CO4	3	2	3			2	3	1	2	2		2	1	2	
CO5	3	2	3			2	3	1	2	2		2	1	2	

PROJECT-VI B.TECH., VI Semester, Civil Engineering [As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]			
Subject Code	22PRJ69	CIE Marks	50
Number Lecture Hour/Week	2P	SEE Marks	50
Total Number of Lecture Hours	24	Exam Hours	03
CREDITS-01			

Course Objectives: Students will be taught to:

1. Get exposure about the civil engineering coursework to solve real-world problems.
2. Design the working model of the open ended problem.
3. Understand concepts of safety durability and environmental impacts.
4. Understand the latest technology and software tools.
5. Prepare technical documentation of the project.

STUDENTS WILL BE GIVEN A OPEN ENDED PROBLEM OF THE SOCIETY AND ASKED TO SOLVE BY DESIGNING AND IMPLEMENTING THE SYSTEM IN TEAM.

Course outcomes: After studying this course, students will be able to:

CO1. Apply the knowledge of civil engineering and to solve the real time problems of the society.
CO2. Analyze the various existing solutions available to solve the real time problem and propose the best solution.
CO3. Design and implement the system to solve the real time problem of the society.
CO4. Conduct investigations on the output and prepare the technical documentation of the designed system in a team.
CO5. Use the modern tool available like advanced software tools.

COURSE OUTCOME AND PROGRAMME OUTCOME MAPPING (1/2/3):

Note: 1-Low, 2-Medium, 3-High

CO/PO	PO.1	PO.2	PO.3	PO.4	PO.5	PO.6	PO.7	PO.8	PO.9	PO.10	PO.11	PO.12	PSO.1	PSO.2
CO1	3	-	-	-	-	-	-	-	-	-	-	2	3	3
CO2	-	3	-	-	-	-	-	-	-	-	-	2	3	3
CO3	-	-	3	-	-	3	-	-	-	-	-	2	3	3
CO4	-	-	-	3	-	3	3	3	3	3	3	3	3	3
CO5	-	-	-	-	3	-	-	-	-	-	-	2	-	-

CONSTRUCTION INDUSTRIAL SAFETY ENGINEERING [As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme] SEMESTER			
Course Code	22ACV611A	CIE	50
NumberofLectureHour/Week	01	SEE	50
Total Number of Lecture Hours	14	Exam Hours	03
CREDITS –01			

Course Objectives: This course will enable students to

CO1: Describe the theories of accident causation and preventive measures of industrial accidents. (Cognitive Knowledge level: Understand)

CO2: Explain about personal protective equipment, its selection, safety performance & indicators and importance of housekeeping. (Cognitive Knowledge level: Understand)

CO3: Explain different issues in construction industries. (Cognitive Knowledge level: Understand)

CO4:Describe various hazards associated with different machines and mechanical material handling. (Cognitive Knowledge level: Understand)

CO5:Utilise different hazard identification tools in different industries with the knowledge of different types of chemical hazards. (Cognitive Knowledge level: Apply)

Modules	Teaching Hours
Module I	
Safety introduction: Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.	5 hours
Module II	
Personal protection in the work environment, Types of PPEs, Personal protective equipment- respiratory and non-respiratory equipment. Standards related to PPEs. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.	6 Hours
Module III	
Safety issues in construction: Introduction to construction industry and safety issues in construction Safety in various construction operations – Excavation and filling – Under-water works – Under-pinning & Shoring – Ladders & Scaffolds – Tunneling – Blasting – Demolition – Confined space – Temporary Structures. Familiarization with relevant Indian Standards and the National Building Code provisions on construction safety. Relevance of ergonomics in construction safety. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders.	7Hours
Module IV	

Safety hazards in machine: Machinery safeguard-Point-of-Operation, Principle of machine guarding -types of guards and devices. Safety in turning, and grinding. Welding and Cutting-Safety Precautions of Gas 4 welding and Arc Welding. Material Handling-Classification-safety consideration- manual and mechanical handling. Handling assessments and techniques- lifting, carrying, pulling, pushing, palletizing and stocking. Material Handling equipment-operation & maintenance. Maintenance of common elements-wire rope, chains slings, hooks, clamps. Hearing Conservation Program in Production industries.	7Hours
Module V	
(Hazard identification and analysis:Hazard and risk, Types of hazards –Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants - The Dow Fire and Explosion Hazard Index, Preliminary hazard analysis, Hazard and Operability study (HAZOP)) – methodology, criticality analysis, corrective action and follow-up. Control of Chemical Hazards, Hazardous properties of chemicals, Material Safety Data Sheets (MSDS).	7Hours

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	1.Which are the various accident causation theories? Explain. 2. Define terms: Accident, Reportable accident, Dangerous occurrence.
CO2	1. Discuss different types of personal protective equipment 2. Discuss about how to compare the safety performance of two industries. 3. Discuss the significance of work permit system in accident prevention.
CO3	1. Distinguish ladders and scaffolds along with their safety features. 2. Discuss the safety requirement for a confined space entry. 3. Explain the important provision in the National Building Code.
CO4	1. Explain the various principles used in machine guarding. 2. Explain the issues in mechanical material handling.
CO5	1.Selection of different types of fire extinguishers accordance to type of fire. 2.Conduct a HAZOP study for a batch rector of your choice. 3. Determine different types of Chemical hazards associated with industries

Question Paper Pattern:

The question paper will have ten questions.

Text Books:

1. R.K Jain (2000) Industrial Safety, Health and Environment management systems, Khanna Publications.
2. Paul S V (2000), Safety management System and Documentation training Programme handbook, CBS Publication.
3. Krishnan, N.V. (1997). Safety management in Industry. Jaico Publishing House, New Delhi.
4. John V. Grimaldi and Rollin H.Simonds. (1989) Safety management. All India Traveller Book Seller, Delhi.
5. Ronald P. Blake. (1973). Industrial safety. Prentice Hall, New Delhi.

Reference Books:

1. Alan Waring. (1996). Safety management system. Chapman & Hall, England.
2. Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai.
3. AIChE/CCPS. (1992). Guidelines for Hazard Evaluation Procedures. (second edition). Centre for Chemical Process Safety, American Institute of Chemical Engineers, New York.

CourseArticulation Matrix / Course mapping:

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2				2	2	2				1	2	1	
CO2	2	1	2		1	1	1	1				1	1	2	3
CO3	2	2	2		1	1	1	1	1	1		1	2	2	3
CO4	2	2	2		1	1	1	1	1	1		1	1	2	3
CO5	2	2	2	1	1	1	1	1	1	1		1	1	2	3

DRONE SURVEYING **[As per NEP, Outcome Based Education(OBE) and Choice Based Credit System(CBCS) Scheme]** SEMESTER			
Course Code	22ACV611B	CIE	50
NumberofLectureHour/Week	01	SEE	50
Total Number of Lecture Hours	14	Exam Hours	03
CREDITS –01			

Course Objectives: This course will enable students to

1. This course introduces the basic concepts of drone surveying.
2. This course covers image processing and photogrammetry of drone data.
3. It also covers the mapping, modelling and application of drone surveying in various fields of Civil Engineering.

Modules	**Teaching Hours**
Module I	
Introduction to Drones, History of Drone/UAS/UAVs, payload, batterylife, Specs for good results, Regulations of DGCA and Drone license, Preand Post Flight planning- Flight execution and photography, datacollection- Image Format, GSD, Scale and Resolution	2hours
Module II	
SURVEYING WITH DRONE: Consideration for hardware selections,comparison on surveying drone and its accuracy, Techniques ofcontrolling errors, Consideration of GCP in vertical and horizontalaccuracies, Planning and estimation of drone surveying jobs, Autonomous flight vs. manual and hybrid flight profiles	2Hours
Module III	
IMAGE PROCESSING AND PHOTOGRAMMETRY: Aerial Triangulation,post processing softwares, Analyzing Data, Contouring, DEM, DSM, Cut,Fill, and Volumetric Measurement Calculation and orthophoto generation.	3Hours
Module IV	
MAPPING AND MODELING: Introduction to mapping and modelling concepts, Understanding RTK, PPK and GCP's, Overview of populardata processing software platforms and functions.	3Hours
Module V	

DRONE APPLICATIONS: Application of drone for Surveying & Mapping-Construction, Irrigation and Agricultural, Engineering Land Survey andTransportation.	4Hours

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Explain the fundamentals of Drone surveying
CO2	Describe the Methods of Surveying with Drone
CO3	Explain the concepts of Image processing and Photogrammetry
CO4	Explain modelling with Drones
CO5	Discuss the Drone applications

Question Paper Pattern:

The question paper will have ten questions.

Text Books:

1.“Remote Sensing and Image Interpretation”, Lillesand and Kiefer, 5th Edition, John Wiley and Sons, 2008

2 "One Nation Under Drones: Legality, Morality, and Utility of Unmanned Combat Systems",John E. Jackson

Reference Books:

1.“Remote Sensing and Geographical Information System”, A.M. Chandra, S.K. Ghosh, Narosa Publishing house, 1st Edition, 2007

2 “Aerial Photography and Image Interpretation”, David P Paine, Wiley Higher Education, 2nd Edition, 2006

3 "Drones and Support for the Use of Force", James Igoe Walsh.

CourseArticulation Matrix / Course mapping:

Note: 1-Low, 2-Medium, 3-High

CO#	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1				2				1			1	2	1	
CO2	1				2				1			1	1	2	
CO3	1				2				1			1	2	1	3
CO4	1	1			2				1			1	1	2	3
CO5		1			2				1			1	1	2	3