



JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY

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Criteria	2 Teaching-learning and Evaluation
Key Indicator	2.6 Student Performance and Learning Outcomes
Metric	2.6.1 The institution has stated learning outcomes (generic and programme specific) / graduate attributes which are integrated into assessment process and widely publicized through the website and other documents

COs of All Courses – Department of Civil Engineering

(BTech- CE)



Semester: I

SNo	Course Codes	Course Name	Course Outcomes
1.	18B17GE171	Workshop Practices	CO1. Study of various carpentry processes and its applications in carpentry CO2. Study and practice the use of various carpentry tools for different carpentry processes CO3. Study and manufacturing of different wood working joints CO4. Study the principles, classification and application of different welding processes CO5. Study and Manufacturing of various welding joints using electric arc welding and gas welding
2.	18B17GE173	Engineering Graphics	CO1. To impart and inculcate proper understanding of the theory of projection. CO2. To improve the visualization skills CO3. To enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient CO4. To impart the knowledge on understanding and drawing of simple residential/office buildings.

Semester: II

SNo	Course Codes	Course Name	Course Outcomes
1.	18B17GE171	Workshop Practices	CO1. Study of various carpentry processes and its applications in carpentry CO2. Study and practice the use of various carpentry tools for different carpentry processes CO3. Study and manufacturing of different wood working joints CO4. Study the principles, classification and application of different welding processes CO5. Study and Manufacturing of various welding joints using electric arc welding and gas welding
2.	18B17GE173	Engineering Graphics	CO1. To impart and inculcate proper understanding of the theory of projection. CO2. To improve the visualization skills CO3. To enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient



			CO4. To impart the knowledge on understanding and drawing of simple residential/office buildings.
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Semester: III

SNo	Course Codes	Course Name	Course Outcomes
1.	18B17GE173	Engineering Mechanics	<p>CO1. Analyse the beam under flexure for different loadings and to draw shear force and bending moment diagram.</p> <p>CO2. Analyse planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.</p> <p>CO3. Determine the resultant force and moment for a given system of forces; Determine the centroid and second moment of area.</p> <p>CO4. Determine different types of stresses induced in a static body. Types of beams and Shear force and bending moment diagram.</p>
2.	18B17CE373	Concrete Technology Laboratory	<p>CO1. Identify Quality Control tests on concrete making materials</p> <p>CO2. Understand the behavior of fresh and hardened concrete</p> <p>CO3. Design concrete mixes as per IS and ACI codes</p> <p>CO4. Understand the durability requirements of concrete</p> <p>CO5. Understand the need for special concretes</p>
3.	18B11CE313	Building Materials and Construction	<p>CO1. Learn about properties and usage of bricks, stones, timber and miscellaneous materials used in construction.</p> <p>CO2. Learn about classification of buildings, walls, brick masonry and stone masonry</p> <p>CO3. Learn the properties and usage of plastering, roofs, floors, doors, damp proofing, stairs etc.</p> <p>CO4. Learn the properties and usage of scaffolding, sound and fireproofing, paints and distempers.</p>
4.	18B11CE312	Surveying	<p>CO1. Perform a boundary survey and preparation of engineering maps.</p> <p>CO2. Basic principles of various methods of surveying, and related problems.</p> <p>CO3. To determine the required areas and volumes of land and materials needed during construction.</p> <p>CO4. Will be able to get correct relative and absolute position on the ground where construction is required.</p> <p>CO5. Basic knowledge of modern survey equipments, Implement procedures for its use</p>



			CO6. and care of field equipment. Apply various corrections in different measurement and methods.
5.	18B11CE314	Water Supply Engineering	CO1. Understand the different sources of raw water and the associated water demands from such sources. CO2. Understand the different treatment processes associated for supplying treated water for different uses and meeting the quality criterion of Indian standards. CO3. Understand the importance of the disinfection process(purification)of treated water supply for domestic purposes. CO4. CO5. Understand the different components of water distribution system including network analysis.
6.	18B17CE372	Surveying Lab	CO1. Calculate horizontal angles, bearing of lines, and measurement of horizontal distance, ranging of line using different instruments in the field. CO2. Able to perform different types of leveling operation to be performed in the field, knowledge of establishing BM. CO3. Able to measure vertical distance vertical angles, horizontal distance. CO4. Able to plot the ground features in the field with the help of plane table survey. CO5. Understanding of using Total Station, Tacheometer, Levels in the field.

Semester: IV

SNo	Course Codes	Course Name	Course Outcomes
1.	18B11CE415	Mechanics of Solids	CO1. At the end of the course students will have knowledge of various stress and strain systems, their relationships and behavior of materials under loads. CO2. The students will develop concept of complex stresses and their treatment to find maximum value of a stress. CO3. Students will develop understanding of how various forcing functions (shear force, bending moment and torque) vary along a structural element and be able to plot the same. CO4. The students will be able to analyze a structural member (beams columns, shafts, etc.) in depth with determination of crucial



			<p>stresses, strains and deformation characteristics.</p> <p>CO5. The students will be able to use the subject knowledge to decide failure locations in a solid body subjected to different types of loading.</p>
2.	18B11CE413	Computer Aided Civil Engineering Drawing	<p>CO1. To be able to understand and interpret Civil Engineering Drawings.</p> <p>CO2. Learn and master basic skills in AutoCAD.</p> <p>CO3. Understand basics of multidisciplinary engineering drawings such as mechanical, electrical, plumbing drawings.</p> <p>CO4. To gain proficiency in planning and developing drawings for small residential buildings.</p> <p>CO5. Comprehend the basics of building information modeling.</p>
3.	18B11CE412	Fluid Mechanics	<p>CO1. Knowledge of basic fundamental of fluid and fluid flow characteristics.</p> <p>CO2. The students will understand basic methods to determine pressure measurement of fluid</p> <p>CO3. They will understand various principles of pipe flow</p> <p>CO4. Understanding of principles of basic fluid flow measurement instruments and techniques.</p> <p>CO5. They will develop understanding of methods of dimensional analysis & modeling criteria.</p> <p>CO6. The students will be able to use the subject knowledge in real life problems</p>
4.	18B11CE414	Water resource engineering	<p>CO1. Knowledge of various components of hydrologic cycle that affect the movement of water in the earth and their estimation techniques.</p> <p>CO2. Ability to estimate stream flow through various stream flow measurements techniques.</p> <p>CO3. Grasping of the concepts of movement of ground water beneath the earth and ability to estimate the yielding capacity of the source.</p> <p>CO4. Knowledge of the basic requirements of irrigation and various irrigation techniques and estimation of water to be supplied for crop requirements.</p> <p>CO5. Understanding of distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals.</p>
5.	18B11CE411	Geotechnical Engineering	<p>CO1. Identify and classify the soil with ability to solve soil mechanics problems using inter relationships and phase diagrams</p> <p>CO2. Characterize soil based on index properties,</p> <p>CO3. understand phenomena of capillarity and</p>



			<p>determine effective stress condition, permeability, seepage within soil mass. Also enabling students to use flow - nets for solving problems related to seepage under hydraulic structures and rectification using filters.</p> <p>CO4. Understand difference between compaction and consolidation, effect of compaction on various soil properties, method and procedure of lab and field compaction. It will also enable students to relate soil structure variation with compaction and comprehend compressibility and index property changes.</p> <p>CO5. Understand consolidation and derive terzaghi's one – dimensional consolidation, shear strength of soil under different drainage conditions with understanding of total and effective stress conditions, determination of consolidation and shear strength using laboratory testing, estimation of settlement using concepts of vertical stress, consolidation and shear strength.</p> <p>CO6. Solve practical problems related about to earth pressure theory like retaining walls and stability of the slopes both graphically and analytically.</p>
6.	18B17CE471	Geotechnical Engineering Lab	<p>CO1. To classify soil by physical observation of the soils, estimated index and engineering characteristics of soils.</p> <p>CO2. To estimate unconfined compressive strength of soil and shear strength parameters by laboratory vane shear test and derive undisturbed and remoulded shear strength of soil.</p> <p>CO3. To perform and calculate free swelling of expansive soils.</p> <p>CO4. To analyze the difference between lab tests and in-situ testing conditions.</p> <p>CO5. To become familiar with new soil testing practices.</p>
7.	18B17CE472	Fluid Mechanics Lab	<p>CO1. Methods of discharge measurements on open channel flow and closed conduit flow</p> <p>CO2. Calibration flow measuring devices used in pipes, channels and tanks</p> <p>CO3. To calculate losses in flow</p> <p>CO4. Verification and characterization of flow (ex. Bernoulli's Theorem, impulse momentum equation, laminar flow etc.) through experiments</p>



Semester: V

SNo	Course Codes	Course Name	Course Outcomes
1.	18B11CE513	Structural Analysis	<p>CO1. Student will able to differentiate between given problems as it comes under determinate or indeterminate problems.</p> <p>CO2. Student will able to solve simple indeterminate problems by force method and displacement method.</p> <p>CO3. Student will able to know in what kind of problem force method should be used and for what kind of problem displacement method should be used.</p> <p>CO4. Student will come to know how to analyze a structure in which footing were settled due to loose soil.</p> <p>CO5. This course will help the students in reinforced concrete design and steel design as they required moments for designing a structural element.</p>
2.	18B11CE512	Sewage Treatment and Disposal	<p>CO1. Critically analyze the problems arising out of the operation of wastewater treatment plant.</p> <p>CO2. Ability to utilize proper design considerations depending upon the selected treatment method for wastewater and their potential limitations.</p> <p>CO3. Estimate design details for different treatment processes including conventional, low-cost treatment systems and advanced systems.</p> <p>CO4. Ability to learn apply effective disposal methods for treated waste water (sludge handling).</p>
3.	18B17CE572	Environmental Engineering Lab	<p>CO1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.</p> <p>CO2. Determination of various inorganic impurities in wastewater.</p> <p>CO3. Determine physical, chemical and biological characteristics of water and wastewater.</p> <p>CO4. Analyze material balance for different environmental systems.</p> <p>CO5. Assess the quality of water and wastewater.</p>
4.	18B11CE515	Design of Concrete Structures	<p>CO1. To learn different design philosophies and material properties</p> <p>CO2. To design beam, slabs and columns</p> <p>CO3. To design for shear, anchorage, bond and development length.</p> <p>CO4. To learn different types of staircases and their design</p>



			CO5. To learn for the design of torsion
5.	18B11CE511	Highway Engineering	<p>CO1. The students will get a diverse knowledge of highway engineering practices applied to real life problems.</p> <p>CO2. The student will be able to design highway geometrics, vertical profile of road, factors controlling the alignment and explain sight distances, horizontal and vertical curves.</p> <p>CO3. The student will be able to describe properties of highway materials, design flexible and rigid pavements and explain factors to be considered for various type of pavements.</p> <p>CO4. The student will be able to understand the principles of construction and maintenance of highways</p> <p>CO5. The student will be able to design traffic signals, rotary intersections and prepare traffic management plans, traffic signs, define traffic volume, capacity, speed study and density.</p>
6.	18B17CE571	Highway Engineering Lab	<p>CO1. Students will know the principles and procedures of testing Aggregates used in highways</p> <p>CO2. Students will know the principles and procedures of testing bitumen used in highways</p> <p>CO3. Student will know the techniques to characterize various pavement materials through relevant tests.</p> <p>CO4. Students will be able to know the pavement maintenance techniques.</p>
7.	18B11CE514	Foundation Engineering	<p>CO1. Identify the essential steps involved in a geotechnical site investigation and specify appropriate laboratory test procedures for the characterization of soil materials with respect to strength and compressibility.</p> <p>CO2. Identify the principal types of foundations and describe the factors governing the choice of the most suitable type of foundation for a given situation.</p> <p>CO3. Perform: (a) bearing capacity and, (b) settlement analyses for shallow foundations.</p> <p>CO4. Evaluate (a) end bearing capacity and (b) skin friction for a given type of deep foundations and hence estimate their axial load capacity.</p> <p>CO5. Prepare a geotechnical engineering report documenting procedures used and findings from site investigation, laboratory characterization of subsurface materials, analysis performed and final recommendations with regard to the optimum design of the foundations system.</p>



8.	18B1WCE531	Construction Technology and Management	<p>CO1. Understand the roles and responsibilities of a project manager, importance of contract document and tender for construction work.</p> <p>CO2. Prepare schedule of activities in a construction project finding critical path, cost controlling, resource allocation and updating of the network.</p> <p>CO3. Identify the equipment used in construction.</p> <p>CO4. Cost optimization of the construction equipment's, economic life and replacement of the construction equipment's</p> <p>CO5. Understand safety practices in construction industry</p>
9.	18B1WCE532	Solid Waste Management	<p>CO1. Detailed composition of Solid waste both Physical and Chemical</p> <p>CO2. Functional elements for solid waste management.</p> <p>CO3. Familiarity with the techniques and method involved in solid waste management.</p> <p>CO4. Designing of waste containment landfill system for proper treatment of MSW generated</p>
10.	18B1WCE533	Air and Noise Pollution and Control	<p>CO1. Learn the air pollution issues and characterize the elements of air pollution.</p> <p>CO2. Solve and design complex problems related to dispersion and air quality modeling.</p> <p>CO3. Apply relevant techniques and methods for control and prevention of air pollution.</p> <p>CO4. Develop an overview understanding of the strategies, regulations and policies to manage air and noise pollution.</p>

Semester: VI

SNo	Course Codes	Course Name	Course Outcomes
1.	18B11CE611	Concrete Technology	<p>CO1. Identify hydration mechanism and testing of concrete making materials.</p> <p>CO2. Understand the behavior of fresh and hardened concrete.</p> <p>CO3. Understand the influence of chemical and mineral admixture.</p> <p>CO4. Understand the mix design and durability requirements of concrete</p> <p>CO5. Understand the need for special concretes</p>
2.	18B1WCE631	Advanced Structural Analysis	<p>CO1. The students will be able to solve basic determinate and indeterminate problems from matrix method by using hand calculation.</p> <p>CO2. Student will able to visualize the principle on which design software works.</p>



			<p>CO3. Student will able to determine design loads for a given cross section of structure.</p> <p>CO4. Student will come to know why earlier methods used for solving indeterminate structure are discarded in this era.</p> <p>CO5. Student will learn basic concept on which Finite Element Method works.</p>
3.	18B1WCE632	Pavement Analysis and Design	<p>CO1. The students will have the opportunity to develop several designs of pavement structures throughout the semester.</p> <p>CO2. Through discussion of the topic of pavement management, the students gain an appreciation for the constantly changing nature of engineering decision-making and the impacts of various decisions on an infrastructure network.</p> <p>CO3. Students will analyze traffic and geotechnical data from real-life projects and theoretical examples.</p> <p>CO4. The students are required to complete a semester design problem and present their findings to the instructor and other students.</p>
4.	18B1WCE633	Industrial Waste Treatment	<p>CO1. To study the fundamentals of utilization of water by different industries and the different pollutants generated in the industrial wastes.</p> <p>CO2. To understand the fundamentals of prevention and the control of the pollutants generated in the industrial wastes.</p> <p>CO3. To study the fundamentals of the treatment of industrial wastes generated including physico-chemical process and biological processes</p> <p>CO4. To understand the advanced techniques for treatment of industrial wastewater</p> <p>CO5. To involve case studies for the different manufacturing units and their respective treatment processes for different industries</p>
5.	18B11CE612	Design of Steel Structures	<p>CO1. Design bolt and weld connections.</p> <p>CO2. Design tension and compression members.</p> <p>CO3. Design beams and beam columns.</p> <p>CO4. Design built up members and column base.</p> <p>CO5. Design of Plate Girder.</p>
6.	18B1WCE634	Transportation Engineering	<p>CO1. To know about the basics and scope of various components of railway and airport engineering.</p> <p>CO2. To be able to design the basic elements of railway and airport.</p> <p>CO3. To enable the students to apply existing technology to the design, construction, and maintenance of railway physical facilities.</p>



			CO4. To learn about the aircraft characteristics, planning and components of airport.
			CO5. To study about the types and components of docks and harbours.
7.	18B1WCE635	Traffic Engineering	CO1. The students will be able to understand the importance of traffic engineering in the field of transportation. CO2. The student will be able to understand the various traffic components, traffic characteristics, traffic studies & analysis CO3. The student will be able to understand the fundamental principles of traffic flow, roadway capacity, level of service. CO4. The student will be able to understand highway safety operations, traffic regulations and control, road markings. CO5. The student will be able to design traffic signals, rotary intersections and prepare traffic management plans.
8.	18B1WCE636	Highway Construction, Maintenance and Management	CO1. Students will come to know about the types, working and importance of pavement in different condition (i.e. level or hilly terrain). CO2. Through discussion of the topic of highway construction, the students gain an appreciation for the methods and different steps involved in pavement construction. CO3. Students will analyze different factors which affect the performance of pavement (i.e. environmental or traffic factor) from real-life projects and theoretical examples. CO4. Students will become familiar with the different methods of pavement maintenance.
9.	18B1WCE637	Advanced Concrete Technology	CO1. To study the basic fundamentals, classifications and applications of polymer concrete, fiber reinforced concrete. CO2. To study the mechanism, effect and optimization of dosage of mineral and chemical admixtures to produce Ultra high strength concrete. CO3. Study and Understand the procedure of mix design for production of ultra high strength concrete by the use of particle packing concepts. CO4. To study the mixing techniques with mineral and chemical admixture to produce polymer concrete and ultra high strength concrete. CO5. To understand the basic fundamentals of self compacting concrete and its testing for different properties.



10.	18B1WCE638	Underground Technology	<p>CO1. Determine the conditions and structures required for underground structure.</p> <p>CO2. Stabilize excavation for underground construction using sheet piles, anchored bulkheads, management of ground water conditions and apply dewatering methods.</p> <p>CO3. Design and understand the construction methodology of deep foundation, analyze side - support systems for underground excavations.</p> <p>CO4. Solve problems related to required ground conditions, side – support system, lining and design tunnels with its various components.</p> <p>CO5. Understand the construction methodologies for side - support system required for underground excavation , coffer dams, caissons, wells, basement and tunnel construction.</p>
11.	18B1WCE639	Open Channel Flow and Hydraulic Machine	<p>CO1. Knowledge of flow characteristics of open channel flow.</p> <p>CO2. Learn the different flow regimes in open channels and their characteristics Predict if hydraulic jumps are to occur during flow, and calculate the fraction of energy dissipated during hydraulic jumps</p> <p>CO3. Methods of discharge measurement, various phenomenon of flow in open channel</p> <p>CO4. Different types of turbines, and its applications, working principles, efficiencies and problems associated with turbines</p> <p>CO5. Knowledge of pumps, its applications, working principles, efficiencies and problems associated with pumps</p>
12.	18B17CE671	Computer Aided Planning and Costing	<p>CO1. To acquire knowledge in material quantity estimation and costing by applying mathematical methods such as Long Wall/ Short Wall method and Centre-line method.</p> <p>CO2. To learn quantity estimation and costing for various materials used in residential buildings, masonry tanks, culverts bridges etc.</p> <p>CO3. Gain practical experience in using MS Excel and estimator software for making worksheets of various estimates.</p> <p>CO4. To make the estimates for earthwork for making embankments and cuts for plain and mountainous region roads.</p> <p>CO5. To develop proficiency in making the bar-bending schedules.</p> <p>CO6. To study legal issues related to construction and prepare detailed reports.</p> <p>CO7. To acquire knowledge in material quantity</p>



			estimation and costing by applying mathematical methods such as Long Wall/ Short Wall method and Centre-line method.
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Semester: VII

SNo	Course Codes	Course Name	Course Outcomes
1.	18B1WCE731	Finite Element Method and Its Applications to Civil Engineering	<p>CO1. Understand the basic aspects of finite element methods, engineering problem solution formulation, discretization, and type of elements along with their application.</p> <p>CO2. Develop an engineering solution for 1-D (spring) element using finite element approaches and application of these methods on spring assemblage.</p> <p>CO3. Develop an engineering solution for axial (truss) element and truss assemblage using finite element approaches in linear, plane and space coordinate system.</p> <p>CO4. Develop an engineering solution for flexural (beam) element and assemblage using finite element approaches in linear, plane and space coordinate system with and without axial extensibility.</p> <p>CO5. Understand the basic characteristic of constant stress/strain element and able to apply in general civil engineering problems.</p>
2.	18B1WCE732	Environmental Management and Impact Assessment	<p>CO1. Recognize the need for EIA of potential projects.</p> <p>CO2. Demonstrate familiarity with regulations pertaining to EIA.</p> <p>CO3. Demonstrate the use of methodologies in assessment of impacts of potential projects.</p> <p>CO4. Comprehend risk management</p>
3.	18B1WCE733	Advanced Foundation Engineering	<p>CO1. Ability to learn the basic requirements of consultancy like preliminary survey, report writing and how the site for the construction is investigated, the testing techniques before the design and the equipments required for the sampling and testing.</p> <p>CO2. Acquisition of complete knowledge of various foundation design procedures, elastic analysis of foundations and the application of types of foundations.</p> <p>CO3. Development of a thorough understanding of deep foundations which will involve the design and analysis of laterally loaded piles and well foundations.</p> <p>CO4. Understanding of foundation design in</p>



			<p>expansive soils and stabilization of the slopes and cuts using materials like geotextiles, geogrids and geonet.</p> <p>CO5. Ability to design and analyze the foundation system for a machine and to apply the dynamics for analysis of motion of machine foundations.</p>
4.	18B1WCE734	Earthquake Engineering	<p>CO1. To expose the students to earthquake hazards and earthquake engineering principles, earthquake disaster management.</p> <p>CO2. To impart to the latest earthquake resistant design philosophies, codal design and design philosophies beyond code, so that the students can independently tackle earthquake engineering problems and they can handle the earthquake hazard mitigation projects.</p> <p>CO3. To introduce basic principles and importance of earthquake in civil engineering applications.</p> <p>CO4. To understand the behaviour of a structure or a system under earthquake exaction.</p> <p>CO5. To analyse the influence of active and passive control system on structure experiencing earthquake loading.</p> <p>CO6. To expose the students to earthquake hazards and earthquake engineering principles, earthquake disaster management.</p>
5.	18B1WCE735	Design of Prestressed Concrete Structures	<p>CO1. Understand the concepts of pre-stressing in concrete structures and identify the materials for pre-stressing.</p> <p>CO2. Analysis of different types of Pre-stressed Concrete sections</p> <p>CO3. Estimate losses of pre-stressing.</p> <p>CO4. Design of pre-tensioned and post tensioned girders for flexure and shear</p> <p>CO5. Design continuous pre-tensioned and post tensioned beams</p>
6.	18B1WCE736	Dam and Reservoir Design	<p>CO1. Select the suitable site for construction of different dams and suggest the type of dam required as per the topographical, functional, economical and ecological considerations.</p> <p>CO2. Know about the various components of a dam, their functions and types.</p> <p>CO3. Calculate the reservoir capacity based on demand (outflow) and supply (inflow) patterns.</p> <p>CO4. Calculate the forces and stresses coming on gravity and earthen dams due to static and dynamic forces prevalent in nature</p> <p>CO5. Analyze the dam for its safety against various forms of failure and suggest the preventive</p>



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Semester: VIII

SNo	Course Codes	Course Name	Course Outcomes
1.	18B1WCE831	Advanced Reinforced Concrete Design	CO1. Analysis and design of beams and slabs by working stress method CO2. Yield line Theory of slabs and Methods of Analysis CO3. Design of underground and elevated water tanks CO4. Design cantilever and counterfort retaining walls CO5. Analysis and design of Foundation
2.	18B1WCE832	Advanced Highway Material and construction	CO1. Students will come to know about the scope, application potential, evaluation, and performance expectation of the new highway materials CO2. The students will gain an appreciation for the innovative application concepts of the conventional or the modern materials CO3. Students will analyze how to use and the benefits of modern materials in highway construction CO4. Students will become familiar with the new technology used in highway construction
3.	18B1WCE833	Hydropower Engineering	CO1. Knowledge of Various types of HP plants, turbines and its selection criteria. CO2. Principles and design of various types of hydraulic structures required in HP Scheme. CO3. Understanding of Economics of Power Generation. CO4. They will develop understanding of special features of mini, micro hydel plants.

