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Course Code: 510121

Course Name: Construction Materials, Machines & Techniques

L	T	P	C
3	-	-	3

Course Objectives:

1. To impart knowledge about ingredients of concrete, production of concrete at site and ready mix concrete.
2. To apprise about special concretes for different field requirements.
3. To apprise about various types of equipments/machineries used in construction industry.
4. To develop understanding of construction procedure for piles and well foundations.
5. To impart know-how of formwork and scaffolding.
6. To develop technical know-how of shop and insitu construction/fabrication.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Define** the relevant characteristics of concrete and its ingredients.	Skill development
2.	**Explain** the details of various stages in concrete production.	Skill development
3.	**Design** concrete mix for specific requirements using codal provisions.	Skill development/ employability
4.	**Determine** the suitability of special concretes for specific requirements.	Skill development, entrepreneurship & employability
5.	**Evaluate** the suitability of various equipments for a construction site.	Skill development, entrepreneurship & employability
6.	**Apply** shop and insitu methods and the pre-stressing concepts for a construction project.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Concrete and its ingredients: Ingredients of concrete including mineral admixtures and chemical admixtures; Proportioning of ingredients; Stages in production of concrete i.e. Batching, Mixing, Transporting, Placing compacting and curing. Design of high strength concrete; Production of Ready mix concrete.

Unit-II

Special Concrete: Polymer concrete, Light weight concrete, Heavy weight concrete, Concrete for radiation shielding, No-Fines concrete, Pervious concrete; Ferro cement; Fiber reinforced concrete, Dry lean concrete and Pavement quality concrete; Self compacting concrete.

Unit-III

Construction Equipments: Characteristics, Operation and selection of different types of construction equipments viz. Power shovels, Drag lines, Scrapper, Bulldozer, Tractor, Rippers, Motor graders; Equipments for aggregate processing plant; Ready Mix Concrete Plant; and Hot Mix plant

Unit-IV

Foundations: Construction of piles, Well foundations, Cofferdams and diaphragms; Drilling and blasting, Underpinning, Shoring and shuttering.

Formwork: Different types of formworks, Stationary and slip formwork techniques, Formwork of special

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structures eg. Shells, Bridges, Towers etc; Scaffolding

Unit-V

Steel Construction: Shop and insitu construction techniques, Pre-engineered buildings; Erection of steel structures like bridges, and trusses.

Prefabrication: Application of prefabrication in construction, Modular coordination and standardization; equipments for industrial production of prefabricated components.

Prestressing: Prestressing methods; Materials; Loss of prestress; equipments for industrial production of prestressed components; Production of Railway Sleepers, Poles and Tanks.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Define the relevant characteristics of concrete and its ingredients.

CO 2: Explain the details of various stages in concrete production.

CO 3: Design concrete mix for specific requirements using codal provisions.

CO 4: Determine the suitability of special concretes for specific requirements.

CO 5: Evaluate the suitability of various equipments for a construction site.

CO 6: Apply shop and insitu methods and the pre-stressing concepts for a construction project.

Reference Books:

1. D. G. Gransberg, C. M. Popescu and R. C. Ryan, Construction Equipment Management for Engineers, Estimators, and Owners, Taylor & Francis, New York.
2. R. L. Peurifoy, C. J. Schexnayder, A. Shapira and R. Schmitt, Construction planning, equipment, and methods, 8th ed., McGraw Hill, New York, 2010.
3. A. R. Santha Kumar, Concrete Technology, Oxford University press.
4. A.M. Neville, Properties of concrete, Pearson Publication
5. M.L. Gambhir, Concrete Technology, Tata Mc Graw Hill Pub. Co.
6. Soil Mechanics by Gopal Ranjan, New Age Publishers.
7. Mahesh Verma, Construction Equipment, its planning & Application, Metropolitan Book Co.(P) Ltd.
8. Foundation Design Manual by Narayan V. Nayak, Dhanpat Rai Publications
9. Prestressed Concrete by T.Y. Lin and N.H. Burns, Wiley Publishers
10. Highway Engg by Justo and Khanna, Publisher: Nem Chand and Brothers

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Course Code: 510113

Course Name: Contract Management

L	T	P	C
3	-	-	3

Course Objectives:

1. To understand specification writing, rate analysis and estimating.
2. To understand necessity and methods of valuation.
3. To understand role of Architect, Engineer, Contractor and Owner in a construction project.
4. To know about different acts related to construction.
5. To know about various laws related to construction labour.
6. To know about important conditions of contract in construction.
7. To understand the construction contracts used in infrastructure projects.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Write** the specifications and perform rate analysis of various construction items.	Skill development
2.	**Prepare** estimate of building/road works and valuation.	Skill development
3.	**Differentiate** between rights and responsibilities of Architect, Engineer, Contractor and Owner in a construction project.	Skill development/ employability
4.	**Apply** the provisions of various acts and laws applicable in construction..	Skill development, entrepreneurship & employability
5.	**Draft** tender document for construction project.	Skill development, entrepreneurship & employability
6.	**Identify** the role of project participants and financing of infrastructure projects.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Quantity Surveying: Basic principles of estimating. Construction costs. Different methods and stages of estimating. Specification of construction items and method of statement. Principles of rate analysis and valuation.

Unit-II

Claims and Arbitration: Indian contract act and arbitration act. Variations in work and conditions. Claims and disputes. Liquidated damages. Rights. Responsibilities and duties of client (Owner). Architect. Engineer. Contractor etc. Purchase order as contracts insurance contract and claims.

Unit-III

Legal Frame Work of Construction: Contract labors act 1970 and other acts and laws relating to labors

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management. Wages. Bonus and Industrial disputes.

Unit-IV

Contract Conditions: Important contract clauses. Terms of payments. Retention. Acceptance and final payment. Time of completion. Extension of time. Maintenance period etc.

Unit-V

Construction Contracts: BOT projects, Variation in BOT projects. Infrastructural projects, International contract rules and regulation.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Write the specifications and perform rate analysis of various construction items.

CO2: Prepare estimate of building/road works and valuation.

CO3: Differentiate between rights and responsibilities of Architect, Engineer, Contractor and Owner in a construction project.

CO4: Apply the provisions of various acts and laws applicable in construction.

CO5: Draft tender document for construction project.

CO6: Identify the role of project participants and financing of infrastructure projects.

Reference Books:

1. Construction Engineering and Management by S. Seetharaman, Publisher Umesh Pub.
2. Construction Planning and Management by B. Sengupta, Pub. Tata McGraw-Hill Education
3. Construction and Project Management Theory And Practices by N.K. Jha, Pub. Pearson Education India
4. Construction Contracts by Jimmie Hinze, Publisher Tata McGraw-Hill Education
5. Estimating and Costing by B.N. Datta

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Course Code: 510114

Course Name: Maintenance Management

L	T	P	C
3	-	-	3

Course Objectives:

1. To learn about building services required in a building.
2. To learn about fire fighting systems in buildings.
3. To understand planning and maintenance requirements of lifts in high rise buildings.
4. To understand water management and planning system in a building.
5. To learn maintenance of building services and management of related tasks.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Identify** various services required in a building.	Skill development
2.	**Carry** out planning of fire fighting system for a building.	Skill development
3.	**Develop** a management strategy for maintenance of building services in a building.	Skill development/ employability
4.	**Design** a sustainable building services plan for a building.	Skill development, entrepreneurship & employability

Syllabus:

Unit I

Introduction: Introduction to primary services in a building, Type of services required to keep facility usable, planning of services. Organization structures of services management. Role and administrative functions of supervisors. Outline of the concept of carbon trading and self sustainable zero carbon building. Importance

Unit II

Fire Fighting: Standard fire, fire resistance, classification of buildings. Basic requirement of the works for fighting system, various components of the fire fighting system. Maintenance required of the system, fire fighting in high-rise buildings, commercial/industrial complexes. Public buildings, checklist for fire safety. Provision of NBC.

Unit III

Lifts/Elevators, Escalators: Legal formalities for elevators, various types of lifts, working mechanisms of lift and escalators. Indian standard codes for planning & installations of elevator, inspection & maintenance of lifts.

Unit IV

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Plumbing Services Water Supply System: Basics of Plumbing systems. Requirement of Plumbing works, Agency, Activity flow chart for plumbing work. Quality checking of materials. Water supply and distribution system is high-rise building & other complexes, pumps and pumping mechanisms. Operation & maintenance of fittings & fixtures of water supply & sanitary. Do's & Don'ts for water pipe networks.

Unit V

Maintenance and management of services: Telecommunication network, computer network LAN, Electrical network & appliances. Basics of single phase & three phase electrification, precautions and safety measures during electrification. Indian standard codes for electrical appliances & wiring operations & maintenance of network & appliances. Landscaping & Horticulture. Building maintenance management, applications of computer in service management. Flowcharts of air conditioning & heating. Centralised systems, monitoring and working of the equipments, Checklist of inspection, Performance testing. Water proofing. Damp proofing & Termite proofing. Working procedure & stages of work of water proofing for W.C., Bathrooms, Terrace, sloping roof, Basements, tanks. Use of chemicals for water proofingtreatment.

Course Outcome:

Upon completion of the course, the students will be able to:

CO1: Identify various services required in a building.

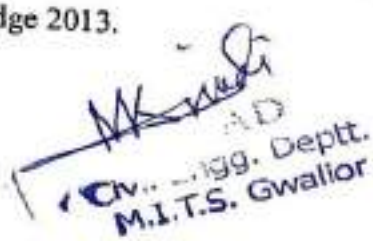
CO2: Carry out planning of fire fighting system for a building.

CO3: Develop a management strategy for maintenance of building services in a building.

CO4: Design a sustainable building services plan for a building.

Reference Books:

1. Building services Design and Management by Jakie Partman, Willey Blackwell 2014.
2. Building Services Engineering by David V .Chadderton, Routledge 2013.



Course Code: 510115

Course Name: Infrastructure Development

L	T	P	C
3	-	-	3

Course Objectives:

1. To make them understand the various aspects like operation, maintenance, sustainability, life cycle cost of infrastructure systems.
2. To make them able to develop infrastructure system plan considering various risks.
3. To make them develop disaster management plan for Infrastructure systems.
4. To illustrate use of I. T. Tools for various phases of Infrastructure system.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Develop** plan for infrastructure considering operation, maintenance, sustainability and life cyclecost.	Skill development
2.	**Identify** various risks in Infrastructure projects.	Skill development
3.	**Illustrate** management and disaster management needs for Infrastructure systems.	Skill development/ employability
4.	**Apply** I. T. Tools in various phases of Infrastructure system.	Skill development, entrepreneurship & employability

Syllabus:

Unit-1

Infrastructure and economic development: Energy needs, sources and management. Different types of build infrastructure systems, challenges and opportunities.

Unit –II

Strategic issues in Infrastructure development: Planning, Design and Construction of Infrastructure. Quality control in Infrastructure development. Role of Public PPP in Infrastructure development.

Unit-III

Performance monitoring: Maintenance, Rehabilitation and Renovation of Infrastructure. Life cycle cost analysis of Infrastructure.

Unit-IV

Risk management in Infrastructure projects: Basic components of risk, components of risk management – risk assessment, risk acceptance, treatment, monitoring and communication.

Unit - V

Disaster management of Infrastructure: Application of IT tools in various phases of Infrastructure development.

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Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: **Develop** plan for infrastructure considering operation, maintenance, sustainability and life cycle cost.

CO2: Identify various risks in Infrastructure projects.

CO3: Illustrate management and disaster management needs for Infrastructure systems.

CO4: Apply I. T. Tools in various phases of Infrastructure system.

Reference Books:

1. Infrastructure Develpoment and Financing in India by N Mani Publisher Rediff books,2012
2. Risk Management in Civil Infrastructure by Mohammed M. Ettouney, Shreenivas Alampalli. Publisher CRC Press Taylor and Francis group.2017.
3. Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation and Renovation by W. Ronald Mudson, Ralph Haas . Publisher Mc Graw-Hill.1997
4. Disaster Resillence Management of Infrastructure System: Computational modeling and Geospatial Technologies by W Waheed Uddin Publisher CRC Press LLC.

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Course Code: 510219

Course Name: Computational Laboratory For Construction Management

L	T	P	C
-	-	4	2

Course Objectives:

1. To know and apply the use of software in construction projects such as MATLAB, Primavera, BIM 4D, MS PROJECT and Excel

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Apply** MATLAB in Construction Projects	Skill development
2.	**Apply** Primavera and MS project in Construction Projects.	Skill development
3.	**Apply** BIM 4D in Construction Projects.	Skill development/ employability/ entrepreneurship

List of Experiments:

1. Introduction to MATLAB and its application.
2. MS Project and its application.
3. Primavera and its application in networking and scheduling.
4. Basics of BIM 4D.
5. Excel and its application.
6. Case study analysis using Primavera, BIM 4D and MS Project.

Course Outcomes:

After completing this course, the students will be able to:

CO1: Apply MATLAB in Construction Projects

CO2: Apply Primavera and MS project in Construction Projects.

CO3: Apply BIM 4D in Construction Projects.

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Course Code: 510220

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	1

Course Objectives:

1) To encourage students to read, study & understand different topics of CTM published in articles, literatures.
2) To help in presenting different topics of CTM and related subjects to supplement theoretical knowledge gained in class.
3) To make student acquire good oral & written communication skills.
4) To promote the habit of lifelong learning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Analyze** contemporary issues in civil engineering/CTM & its allied areas through literature survey.	Skill development
2.	**Distinguish** state of art & relevance of the topic in national & international arena.	Skill development
3.	**Demonstrate** good oral & written communication skills.	Skill development/ employability
4.	**Develop** poster and power point presentations for effective communication.	Skill development, entrepreneurship & employability
5.	**Display** lifelong learning.	Skill development, entrepreneurship & employability

Syllabus:

Any relevant topic related to civil engineering/CTM from within or beyond the syllabus through Swayam / NPTEL/MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in civil engineering/CTM & its allied areas through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

CO 4: Develop poster and power point presentations for effective communication.

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– Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), transforming the existing buildings to sustainable buildings based on GRIHA EB Manual: Criteria and their weightage, site parameters, maintenance and housekeeping, energy, water efficiency, human health and comfort.

Unit-III

Green Construction Practices& Technologies: Comparative analysis between the traditional and sustainable construction practices, Concrete versus steel technology suitability; Life cycle analysis of technologies; Sustainable Construction Technologies; Waste-based /recycled materials and technologies.

Unit-IV

Sustainable Development Goals and Policies: Sustainable consumption and production (Goal 12), Sustainability issues for concrete, Operational energy in building role of materials and thermal conductivity, Recycling of Industrial and Buildings Wastes, Biomass Resources for buildings, Need and framing of Policies and action plans to reduce construction and demolition waste.

Unit-V

Recent trends and Case studies:

Case studies and examples: Study of existing green buildings-Energy auditing; Green building approaches on field through case studies; Performance rating systems; Environmental impact studies of building projects.

Recent Trends: Introduction to softwares used in green buildings, carbon calculators, Role of Building Automation and performance enhancement, Integrated building management system.

Course Outcomes:

After this course, students will be able to:

CO 1: Explain the properties of various types of sustainable materials used in construction industry accordingly.

CO 2: Distinguish the suitability of sustainable and green practices in construction sector.

CO 3: Perform the environmental impact assessment (EIA) for construction projects towards quality.

CO 4: Assess an existing building on the norms available by GRIHA for transforming existing buildings to sustainable buildings.

CO 5: Examine the impact of building materials choices by auditing the resources used to maintain the materials in their building and discussing the economic, environmental, and health impacts.

CO 6: Identify the potential of construction and demolition wastes in order to meet the sustainable development goals.

Reference Books:

1. Green Rating for Integrated Habitat Assessment (GRIHA) guidelines
2. Energy Conservation Building Codes: www.bee-india.nic.in
3. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison, Green Building, Handbook,Volume I, Spon Press, 2003

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4. Kibert, C. "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2005
5. Chaturvedi, Swati, and John Ochsendorf. "Global Environmental Impacts due to Cement and Steel." *Structural Engineering International* (August 2004)
6. Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
7. Fundamentals of Integrated Design for Sustainable Building by Marian Keeler, Bill Burke
8. Renewable Energy and Environment -A Policy Analysis for India, H. Ravindranath, K Usha Rao, B Natarajan, P Monga, Tata McGraw Hill, 2000
9. Gambhir M.L., Neha Jamwal, Building Materials: Products, Properties and Systems, McGraw Hill Education(India) Private Limited, 2014.
10. Varghese P.C., Building Materials, PHI Learning Pvt. Ltd., Delhi, 2015.
11. Advances in Building Materials and Construction, Central Building Research Institute, Roorkee, 2004.
12. Duggal S.K., Building Materials, New Age Publishers, 2012
13. Rangwala, Engineering Materials, Charotar Publishers, 2015

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7. Poject Management and design administration manual by Design construction division.

8. Construction Project Management Handbook: Federal Transit Administration -US

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Course Code: 800208

Course Name: Sustainable Material & Green Building

L	T	P	C
3	-	-	3

Course Objectives:

1. To study the properties of various types of sustainable materials in construction.
2. To learn the code of practice and guidelines for green buildings.
3. To select of different types of sustainable construction practices.
4. To understand the alignment of the current practices with the sustainable development goals.
5. To learn the field problems of sustainability in the construction sector.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the properties of various types of sustainable materials used in construction industryaccordingly.	Skill development
2.	**Distinguish** the suitability of sustainable and green practices in construction sector.	Skill development
3.	**Perform** the environmental impact assessment (EIA) for construction projects towardsquality.	Skill development/ employability
4.	**Examine** the impact of building materials choices by auditing the resources used to maintainthe materials in their building and discussing the economic, environmental, and health impacts.	Skill development, entrepreneurship & employability
5.	**Identify** the potential of construction and demolition wastes in order to meet the sustainabledevelopment goals.	Skill development, entrepreneurship & employability
6.	**Identify** the potential of construction and demolition wastes in order to meet the sustainabledevelopment goals.	Skill development, entrepreneurship & employability

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Syllabus:

Unit-I

Sustainable Materials: Sources, methods of production and environmental Implications of building materials; Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings; Material cycles in construction, life Cycle impacts of materials and products, life cycle assessment of buildings; Resources for Sustainable Building Materials.

Unit-II

Green Buildings: Concept of Green building, Principles of green buildings, Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code; Certification systems

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Course Code: 510213

Course Name: Construction Project Management

L	T	T	C
3	-	-	3

Course Objectives:

1. To know about the basic of project management and project organization.
2. To understand the project planning process, project networks and its analysis through CPM.
3. To understand the method of PERT and Precedence Network analysis for scheduling of const.
4. To plan and manage the resources and discuss the cost control in project's perspective.
5. To discuss the material, inventory and risk management in construction.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Identify** the various approaches of project management and organization structure.	Skill development
2.	**Classify** the various project network techniques and its applicability in project management.	Skill development
3.	**Analysis and schedule** the project using PERT and PN method.	Skill development/ employability
4.	**Determine** the applicability of resources and finding the optimum cost and optimum project duration.	Skill development, entrepreneurship & employability
5.	**Apply** the concepts of material, inventory and risk management tools in construction project.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Project Management: Construction Project and its phases. Importance of construction and construction Industries. Construction Project Management and its Relevance. Stakeholders of construction project. Management Information System and its Application in Construction.

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Project Organization: Construction Organizations and its forms. Structure of Construction Organization. Management Levels. Traits of a Project Manager. Ethical Conduct for Engineers. Factors behind the success of construction projects and construction organizations. Introduction to Claim, Dispute and Project Closure.

Unit – II

Project Planning and Network Analysis: Introduction to Project Planning Process. Types of Project Plans. Network techniques- Gantt Chart, Mile stone Chart, Work Breakdown structure, AOA & AON networks. Event and Activities. Numbering of events. Event times – Earliest events time and latest event time. Slack, critical events. Activity times – Earliest start time, Latest finish time, Float and

critical activities. Network critical path and its significance. Network analysis by CPM – Defining scope of work, determining activities, preparation of network logic program and draft network. Development of structured network using network drawing rules, Numbering of events and computation of critical path. Numericalproblems.

Unit-III

PERT: Introduction to PERT. Difference between CPM and PERT. Uncertainty in project duration estimation. Three time estimate in PERT. Frequency distribution curves for activity duration. Computation of expected time, standard deviation and variance. Critical limit theorm and critical parth determination. Event time, slack and computation of completion probability of project.

Precedence Network (PN): Introduction to PN. Precedence relationship between activities. Precedence Network Analysis – Modeling procedure analysis of time in PN. Use of PN in repetitive works network. Difference between PN and CPM.

Unit-IV

Resource Planning: Planning construction Manpower, Scheduling Construction site workers. Planning Construction Materials quantity estimation. Constrained and unconstrained resource scheduling. Resource usage profile, Resource smoothing, Resource leveling.

Cost Control: Project cost, Direct and indirect, slope of direct cost curve, Total project cost and optimum duration, Contracting the network for cost optimization. Escalate & Variation in prices.

Unit-V

Materials & Inventory Management: Introduction to Material management. Material Procurement Process. Material Management Functions. Inventory management in construction.

Risk and Insurance in Construction: Introduction toRisk and Risk Management in construction. Risk Identification Process. Risk Analysis and Evaluation Process. Risk Treatment Strategies. Different Insurances in Construction Companies.

Course Outcomes:

After successful completion of the course, the students will be able to:

CO1: Identify the various approaches of project management and organization structure.

CO2: Classify the various project network techniques and its applicability in project management.

CO3: Analysis and schedule the project using PERT and PN method.

CO4: Determine the applicability of resources and finding the optimum cost and optimum project duration.

CO5: Apply the concepts of material, inventory and risk management tools in construction project.

Reference Books:

1. Construction Project Management by K.N Jha
2. C.P.M & PERT by L.S. Srinath.
3. Construction Management by Sen & Gupta.
4. Project Planning and control with PERT and CPM by BC Punmia, K. K. Khandelwal.
5. CPM & PERT by Weist& Levy
6. DDOT Construction management Manual.

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Course Code: 510212

Course Name: Construction Cost Management

L	T	P	C
3	-	-	3

Course Objectives:

1. To know about the trade-offs in construction projects.
2. To explore the time cost trade-off.
3. To understand the multi-objective optimization techniques.
4. To discuss the MCDM methods.
5. To apply the value engineering and productivity in construction.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concept of trade-off in construction.	Skill development
2.	**Analyze** the trade-off phenomenon in construction using MCDM.	Skill development
3.	**Workout** time value of money and cost of capital.	Skill development/ employability
4.	**Analyze** break-even point and appraisal of projects.	Skill development, entrepreneurship & employability
5.	**Determine** appropriate means of financing a project.	Skill development, entrepreneurship & employability
6.	**Monitor** the various cost components of construction projects by using accounting procedures.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Trade off Analysis in construction project: Development of Network. Time-cost trade off curves. Non – convex discontinuous and discrete cost time trade – off curves. Crashing of projects. Resource-constrained project scheduling. Multi-objective trade-off problems. Introduction to deterministic, heuristic and meta-heuristics methods for making multi-objective trade-off. Siemen's method of project cost curve.

Unit – II

Multi criteria Decision Making Methods: Analytical Hierarchy Process, and its application in planning and management, Introduction to Fuzzy Set Theory and its Application in MCDM.

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Unit-III

Multi-objective optimization methods: Single and multi-objective optimization problems. Pareto-optimality. Introduction to NSGA. Selection. Crossover. Mutation. Non-dominated Sorting. Differences among GA, MOGA, NSGA, NSGA-II. Particle Swarm Optimization. Particle and its

position. Local best and global best position. Updating the position of particle. Multi-objective PSO.

Unit-IV

Productivity in Construction: Definition of Productivity. Productivity measurements. Productivity of production components, Labors, Equipment and Material Capital Productivity. Need for Productivity Planning – Short term and long term productivity planning, Productivity improvement approaches, Productivity Improvement techniques – Technology based, Material based, Employee based and Product based

Unit-V

Value Engineering: Principles of value engineering in Project Management, Value engineering team, Value engineering technique, Job Plans, Role of value engineering in productivity, Life cycle costing and its applications.

Course Outcomes:

After completing this course, the students will be able to:

CO1: Explain the concept of trade-off in construction.

CO2: Analyze the trade-off phenomenon in construction using MCDM.

CO3: Evaluate the multi-objective trade-off problems using metaheuristic methods.

CO4: Apply the value engineering and LCC in construction projects.

CO5: Evaluate the labour, material and equipment in construction productivity.

Recommended Books:

1. **Golden**, Bruce L., **Wasil**, Edward A., **Harker,** Patrick T. (Eds.) The Analytic Hierarchy Process, Springer.
2. Joseph J. Moder., PROJECT MANAGEMENT with CPM, PERT and Precedence Diagramming.
3. S. Rajasekaran. and G.A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic, and Evolutionary algorithms". Eastern Economic edition.
4. Kalyanamoy Deb, "Multi-objective optimization using evolutionary algorithms". Wiley.
5. Sumanth, D.J, Productivity Engineering and Management, TMH, New Delhi, 1990
6. Sudit, Ephraim F., "Productivity Based Management", Springer 1984
7. Alphonse Dell'Isola, "Value Engineering: Practical Applications for Design, Construction, Maintenance & Operations", R S Means Co., 1997.
8. Richard Park, "Value Engineering: A Plan for Invention", St. Lucie Press, 1999.

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Course Code: 510211

Course Name: Projects Economics & Financing

L	T	P	C
3	-	-	3

Course Objectives:

1. To understand managerial economics.
2. To understand demand analysis and forecasting in construction industry.
3. To understand Time value of money and Cost of Capital.
4. To understand budgeting of construction projects.
5. To understand selection and evaluation of construction projects.
6. To understand project financing and risk.
7. To understand the accounting processes in construction industry.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Apply** principles of managerial economics	Skill development
2.	**Perform** demand analysis in construction sector.	Skill development
3.	**Workout** time value of money and cost of capital.	Skill development/ employability
4.	**Analyze** break-even point and appraisal of projects.	Skill development, entrepreneurship & employability
5.	**Determine** appropriate means of financing a project.	Skill development, entrepreneurship & employability
6.	**Monitor** the various cost components of construction projects by using accounting procedures.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Basic Economic Theories: Principles of managerial economics. Economic theories. Demand analysis and forecasting. Demand elasticity. Cost and production analysis. Production function. Pricing decisions. Policies & practice.

Unit-II

Money: Time value of money. Different methods & comparisons. Cash flow, discounted cash flow, cash flow forecasting. Financial ratios and statements.Cost of Capital.

Unit-III

Capital Budgeting: Working capital. Capital budgeting and performance budgeting. Break even analysis. Project selection. Project appraisals

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Unit-IV

Project Financing: Means of Finance, Financial institutions in India, Policies of financial institutions, Financial assistance, Special schemes, Project risk

Unit-V

Financial Accounting: Book keeping processes of construction industry. Accountancy cycle. Journals. Forms and ledgers etc. for accounting and monitoring labour, equipment and material costs. PWD accounting procedure and types of financial statements in Government.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Apply principles of managerial economics.

CO2: Perform demand analysis in construction sector.

CO3: Workout time value of money and cost of capital.

CO4: Analyze break-even point and appraisal of projects.

CO5: Determine appropriate means of financing a project.

CO6: Monitor the various cost components of construction projects by using accounting procedures.

Reference Books:

1. Project Planning, Analysis, Selection, Financing, Implementation & Review by Prasanna Chandra, Publisher Tata McGraw-Hill Education.
2. Engineering Economics & Analysis, by Donald G Newnan, Publisher Oxford University Press.
3. Economic Theory and The Construction Industry by P. Hillebrandt, Publisher Palgrave Macmillan UK
4. Construction Economics: A New Approach by Danny Myers, Publisher Routledge
5. Construction and Project Management Theory And Practices by K.N. Jha, Publisher Pearson Education India
6. Construction Project Management: Planning, Scheduling and Controlling by K.K. Chitkara, Publisher Tata McGraw-Hill Education

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CO 5: Display lifelong learning.

13. Marshall stability test of bitumen

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Check physical properties of soil, aggregate, and concrete.

CO2: Check strength properties of soil, aggregate, and concrete.

CO3: Differentiate the flow properties and stresses of soil.

CO4: Apply various non-destructive testing method on concrete.

Reference Books:

1. Metha P.K and Monteiro. P.J.M, " CONCRETE", Microstructure, Properties and Materials, Third Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006
2. Shetty .M.S., " Concrete Technology, Theory and Practice", Revised Edition, S. Chand & company Ltd., New Delhi,2006
3. Neville. A.M., " Properties of Concrete", 4th Edition Longman,1995
4. Soil Mech. & Found. Engg., Dr. K. R. Arora, Std. Publishers Delhi, 7th edition 2014
5. Soil Mech. & Foundation, Dr. B. C. Punmia, Laxmi Publications, Delhi, 16th edition2017
6. Soil Mech. & Found Engg., S. K. Garg, Khanna Publishers, Delhi, 1st edition, 2003
7. Soil Testing for Engg., T.W. Lambe, John Wiley & Sons. Inc., 1969

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Course Code: 510120

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	1

Course Objectives:

1) To encourage students to read, study & understand different topics of CTM published in articles, literatures.
2) To help in presenting different topics of CTM and related subjects to supplement theoretical knowledge gained in class.
3) To make student acquire good oral & written communication skills.
4) To promote the habit of lifelong learning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Analyze** contemporary issues in civil engineering/CTM & its allied areas through literaturesurvey.	Skill development
2.	**Distinguish** state of art & relevance of the topic in national & international arena.	Skill development
3.	**Demonstrate** good oral & written communication skills.	Skill development/ employability
4.	**Develop** poster and power point presentations for effective communication.	Skill development, entrepreneurship & employability
5.	**Display** lifelong learning	Skill development, entrepreneurship & employability

Syllabus:

Any relevant topic related to civil engineering/CTM from within or beyond the syllabus through Swayam / NPTEL/MOOC.

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Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in civil engineering/CTM & its allied areas through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

CO 4: Develop poster and power point presentations for effective communication.

7. Safety management by John V.Grimaldi Rollin H.Simonds.

8. ISO 9000 family of standards.

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Course Code: 510119

Course Name: Construction Lab

L	T	P	C
-	-	4	2

Course Objectives:

1. To Study and understanding basic knowledge of building materials, such as their identification and classification, relationships between physical characteristics and mechanical properties experimentally measuring them.
2. To understand the role of water in soil and concrete behavior.
3. To understand the concrete mix design and testing; non-destructive testing methods; Studies on simple building system components

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Check** physical properties of soil, aggregate, and concrete.	Skill development
2.	**Check** strength properties of soil, aggregate, and concrete.	Skill development
3.	**Differentiate** the flow properties and stresses of soil.	Skill development/ employability
4.	**Apply** various non-destructive testing method on concrete.	Skill development, entrepreneurship & employability

List of Experiments:

1. Mix Design of Concrete
2. Permeability Test of Concrete
3. Creep Test of Concrete
4. Measurement of In-situ Strength determination by Rebound Hammer and Moisture content in aggregates, soil and hardened concrete surface using NDT techniques.
5. Unconfined Compression Test
6. Direct Shear Test
7. Static Cone Penetration Test
8. Triaxial Shear Test

   (Unconsolidated Undrained, Consolidated Undrained, Consolidated Drained)
9. Vane Shear Test
10. C.B.R Test of Soil
11. Consolidation Test
12. SPT Test (Demonstration)

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Course Code: 800109

Course Name: Safety & Quality Management

L	T	P	C
3	-	-	3

Course Objectives:

1. To study the basics of quality and safety management.
2. To learn the code of practice in design and construction for quality standards.
3. To understand and evaluate quality and safety management principles and best practices in construction.
4. To understand and evaluate safety management principles in construction;
5. To acquire good basic practices for quality system and progress for quality assurance and quality improvement for construction companies.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the quality management systems and utilize the ISO 9000 family of standards.	Skill development
2.	**Improve** the quality of the project through tools and techniques.	Skill development
3.	**Perform** the environmental impact assessment (EIA) for construction projects towardsquality.	Skill development/ employability
4.	**Analyse** the quality assurance and quality control, quality improvement tools andtechniques;	Skill development, entrepreneurship & employability
5.	**Evaluate** the contract and inspection procedures.	Skill development, entrepreneurship & employability
6.	**Identify** the safety management practices in construction industry.	Skill development, entrepreneurship & employability

Syllabus:

Unit – I

Quality Management: Introduction – Definitions and objectives, Factors influencing construction quality; Responsibilities and authority; Quality plan; Quality Management Guidelines; Quality circles; cost of quality and safety; Quality transition - quality control and inspection; quality assurance; total quality management-principles, tools and techniques; Planning and control of qualityduring design of structures; Tools and techniques for quality management.

Unit – II

Quality Systems: Introduction - Quality system standard, ISO 9000 family of standards. Requirements-Preparing Quality System Documents; Quality related training; Implementing a Quality system; Third party Certification; Quality assurance in construction; Concepts of quality control-Objectives, definitions, and systems.

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Unit – III

Quality Planning: Quality Policy, Objectives and methods in Construction industry; Consumers satisfaction, Ergonomics, Time of Completion, Statistical tolerance, Taguchi'sconcept of quality; Inspection procedures-Processes and products (materials and machinery); Total cost implication.

Quality Assurance and Quality Improvement Techniques:

Objectives of quality assurance; Methods, Techniques and needs of quality assurance; Different aspects of quality Appraisals; Critical, major failure aspects and failure mode analysis; Stability methods and tools; Reliability testing, Reliability coefficient and reliability prediction; Life cycle costing; Value engineering and value analysis; Quality Improvement Tools and Techniques.

Unit – IV

Safety management : Planning for safety provisions, budgeting for safety, safety policy, Safety audit, safety management practices, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety; Construction hazards and safety guidelines; Overall accident investigation process; Risk management; Prevention techniques for construction accidents; Site management with regard to safety recommendations; Training for safety awareness and implementation; Construction safety and health manual.

Unit-V

Recent trends and Case studies: Quality and safety issues in steel construction, concrete construction (including pre-cast, and pre-stressed); computer aided hazard analysis.

Course Outcomes:

After this course, students will be able to:

CO 1: Explain the quality management systems and utilize the ISO 9000 family of standards.

CO 2: Improve the quality of the project through tools and techniques.

CO 3: Perform the environmental impact assessment (EIA) for construction projects towards quality.

CO 4: Analyse the quality assurance and quality control, quality improvement tools and techniques;

CO 5: Evaluate the contract and inspection procedures.

CO 6: Identify the safety management practices in construction industry.

Reference Books:

1. B. G. Dale, Managing quality,4th ed., Blackwell Publishing, Oxford, 2003.
2. D. Reese and J. V. Eidson, Handbook of OSHA construction safety and health, 2 n d ed., CRC Press, Bocaaton, 2006.
3. F. Harris, R. McCaffer and F. Edum-Fotwe, Modern construction management, 6 t h ed., Blackwell Publishing, Oxford, 2006
4. K. Knutson, C. J. Schexnayder, C. M. Fiori and R. Mayo, Construction management fundamentals, 2 nd ed., McGraw Hill, New York, 2008.
5. S. J. Holt, Principles of construction safety, Blackwell Publishing, Oxford, 2008.
6. The Management and Control of Quality: Sixth edition: James R.Evans, William M. Lindsay.

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Course Code: 510116

Course Name: Formwork for Concrete Structures

L	T	P	C
3	-	-	3

Course Objectives:

1. To know about various formworks for concrete structure.
2. To know about various issues in formworks and subsequent solutions.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concept of formworks.	Skill development
2.	**Explain** various types of formworks.	Skill development
3.	**Evaluate** the use of formworks in various structures.	Skill development/ employability
4.	**Assess** the failure issues in formworks.	Skill development, entrepreneurship & employability

Syllabus:

Unit-1 Introduction

Introduction to Sheeting, Shuttering, Centering, Staging, Formwork, Scaffolding and False work, Mould. Formwork as a temporary structure. Requirements for a formwork. Classification (Types) of Formwork. Formwork Materials.

Unit-2 Formwork for building components

Formwork for raft foundation, pile foundation, footings, RCC columns, beams, slabs and wall. Formwork area calculation. Various loads and moments on formwork. Slip form and their types.

Unit-3 Formwork for special structure

Formwork for Highways. Formwork for Bridge structures. Formwork for Multi-Story Building Construction. Formwork for precast concrete. Formwork for pre-stressed concrete. Flying formwork and their advantages, disadvantages and limitations.

Unit-4 MIVAN Formwork

Introduction, materials used in MIVAN formwork, parts of MIVAN formwork, Procedure of MIVAN formwork construction, pin and wedge system in MIVAN formwork, Work cycle of MIVAN formwork, Comparison between MIVAN and traditional formwork, Technical specification of MIVAN formwork, advantages and disadvantages of MIVAN formwork

Unit-5 Issues and failure of Formwork

Causes of Formwork Failure. Common deficiency in design leading to formwork failure. A case study on formwork failure. Avoiding formwork failure. Pre-Award and Post-award Formwork Management Issues.

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- Organisational Climate and Culture - Organisational Change and Development.

Unit – V

Comparative Management Styles and approaches : Japanese Management Practices Organisational Creativity and Innovation - Management of Innovation - Entrepreneurial Management - Benchmarking - Best Management Practices across the world - Select cases of Domestic & International Corporations - Management of Diversity.

Course Outcomes:

After completing this course, the students will be able to:

- **CO1:** **Explain** the environment levels in management.
- **CO2:** **Analyse** the organizational structure and its design.
- **CO3:** **Apply** the stress management and communication in organization.
- **CO4:** **Develop** the leadership quality for updating the organisation structure.
- **CO5:** **Evaluate** the existing management activity in the world.

Recommended Books:

1. Kast & R. Scuwing : Organisation & Management
2. Singh & T. N. Chabra : Management Concepts & Practices
3. George R. Terry : Principles of Management
4. Anthony : Art of Japanese Management
5. Aswathapa K : Organisational Behaviour

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Course Code: 800108

Course Name: Organizational Behaviour & Management

L	T	P	C
3	-	-	3

Course Objectives:

1. To know the environment levels in management.
2. To explore the organizational structure and its design.
3. To understand the stress management and communication.
4. To explore the leadership quality for updating the organisation structure.
5. To compare and explore the existing management activity in the world.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the environment levels in management.	Skill development
2.	**Analyse** the organizational structure and its design.	Skill development
3.	**Apply** the stress management and communication in organization	Skill development/ employability
4.	**Develop** the leadership quality for updating the organisation structure.	Skill development, entrepreneurship & employability
5.	**Evaluate** the existing management activity in the world.	Skill development, entrepreneurship & employability

Syllabus:

Unit – I:

Nature of Management: Social Responsibilities of Business - Manager and Environment Levels in Management - Managerial Skills - Planning - Steps in Planning Process - Scope and Limitations - Short Range and Long Range Planning - Flexibility in Planning ¬Characteristics of a sound Plan - Management by Objectives (MBO) - Policies and Strategies.

Unit-II

Organisation: Organisation Structure and Design - Authority and Responsibility Relationships - Delegation of Authority and Decentralisation - Interdepartmental Coordination - Emerging Trends in Corporate Structure, Strategy and Culture - Impact of Technology on Organisational design - Mechanistic vs Adoptive Structures - Formal and Informal Organisation.

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Unit – III

Perception and Learning - Personality and Individual Differences - Motivation and Job Performance - Values, Attitudes and Beliefs - Stress Management - Communication Types-Process - Barriers - Making Communication Effective.

Unit – IV

Group Dynamics: Leadership - Styles - Approaches - Power and Politics - Organisational Structure

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain the concept of formworks.

CO2: Explain various types of formworks.

CO3: Evaluate the use of formworks in various structures.

CO4: Assess the failure issues in formworks.

Reference Books:

1. Jha, K.N., Formwork for Concrete Structures, First Edition, McGraw Hill. 2012
2. Austin, C.K., Formwork for concrete, Cleaver - Hume Press Ltd., London, 1996
3. Michael P. Hurst, Construction Press, London and New York. 2003

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Course Code: 110311

Course Name: Building Materials & Construction

L	T	P	Credit
2	1	2	4

Course Objectives:

1. To study the properties of concrete ingredients i.e. cement. Sand and coarse aggregate by conducting different tests.
2. To select of different types of admixtures to improve the properties of concrete for different field applications.
3. To conduct the field and laboratory tests on concrete in fresh and hardened state.
4. To provide knowledge about various types of bricks, stones, woods &timber, ferrous&nonferrous construction material & their applications.
5. To provide knowledge on design of foundation, including selection ofappropriate foundation.
6. To understand laying & construction of brick & stone masonry and various methods of damp proofing etc.
7. To provide knowledge about stairs, floors & roofs in various types of buildings.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the basic elements of buildings, engg. materials & construction.	Skill development
2.	**Evaluate** the properties of various materials like cement, aggregate, concrete, admixture,brick, stone etc.	Skill development
3.	**Distinguish** the suitability of building materials in the construction of elements of buildings.	Skill development/ employability
4.	**Evaluate** various types of concrete in building construction accordingly.	Skill development, entrepreneurship & employability
5.	**Apply** various techniques for finishing & protection works of various elements of building.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Types of Foundation& its design: masonry construction, masonry classification, stone v/s brick masonry, joints in stone masonry, brick masonry (bonds in brick masonry, characteristics of bonds, type of bonds), typical structures in brickwork, Damp prevention (causes, effects, control & prevention techniques, material used for damp proofing), Anti termite treatment, water proofing treatment, Arches & lintels, stair & stair case, (types & design of stair case), Types of floor & flooring, Roof & roof covering.

Unit – II

Ingredients of Concrete: Portland cement Chemical composition of cement, Hydration of cement, setting of cement, tests on physical properties of cement. Types of Portland cement – Ordinary Portland cement – Rapid Hardening Portland cement – low heat Portland cement- Sulphate Resisting cement – Portland Blast furnace cement- Super Sulphated cement- Portland Pozzolana

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cement and Pozzolanas: Fly ash; use of pozzolanas, white cement, Expansive cements – High alumina cement.

Aggregates: General classification of aggregates, natural and artificial aggregates, particle shape and texture, bond of aggregate, strength of aggregate, Mechanical properties of aggregate, specific gravity, Bulk density, porosity and absorption of aggregate, moisture content of aggregate, Bulking of sand deleterious substances in aggregates, organic impurities. Soundness of aggregates, Alkali-aggregate reaction, Alkali carbonate reaction, sieve analysis – Grading curves, Fineness modulus, Grading requirements, Grading of fine and coarse aggregates and Gap graded aggregates. Thermal properties ofaggregates.

Admixtures: Introduction, functions of admixtures, classification of admixtures, Accelerators, Retarders, Water Reducing Agents, Super plasticizers.

Unit-III

Fresh and Hardened Concrete: Fresh Concrete, Workability of concrete, factors affecting workability, measurement of workability using slump test, Compaction factor test, Flow test, Vee-Bee Test, Ball penetration test, Nasser's °K- probe test, Segregation and Bleeding of concrete, Mixing of concrete, Vibration of concrete, Different types of mixers and vibrators. Concreting in Hot weather and Cold weather.

Hardened Concrete: Compressive & Flexural strength of concrete, Stress and strain characteristics of concrete, drying shrinkage of concrete, Creep of concrete, Permeability and durability of concrete, Fire resistance of concrete, Thermal properties of concrete. Micro-cracking of concrete, methods of curing, Influence of temperature on strength, Fatigue & Impact strength ofconcrete.

Unit IV

Bricks (classification, characteristics, manufacturing, testing, and types). Stones (classification, Quarrying, seasoning characteristics, testing, selection & uses, preservation), Wood & Timber (Classification, Structure & characteristics, seasoning and its methods, defects & diseases, preservation & various treatment testing), wood products and their applications

Unit V

Mortar (Classification, characteristics, functions of ingredients). Types of mortar and their uses grout, guniting, ferrous material (Pig iron, CI, Mild steel, wrought iron, stainless steel, compositions & proposition). Reinforced steel bars (classification, types, designation), Aluminium (its alloys & uses). Copper (its alloys & uses), Ceramics (classification, properties, commercial forms), Paint varnishes & enamels (types, composition, method of application, defects)

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Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain the basic elements of buildings, engg. materials & construction.

CO2: Evaluate the properties of various materials like cement, aggregate, concrete, admixture, brick, stone etc.

CO3: Distinguish the suitability of building materials in the construction of elements of buildings.

CO4: Evaluate various types of concrete in building construction accordingly.

CO5: Apply various techniques for finishing & protection works of various elements of building.

Text Books:

1. Concrete Technology, M. L. Gambhir, Tata McGraw Hill education Pvt. Ltd., 5th edition 2013
2. Concrete Technology, M.S. Shetty, S. Chand Publications, 2006
3. Building Materials, M.L. Gambhir, Tata McGraw Hill education Pvt. Ltd., 2017
4. Building Construction, B.C. Punmia, A.K. Jain, Laxmi Publishers New Delhi, 2016

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Course Code: 110312

Course Name: Fluid Mechanics - I

L	T	P	Credit
2	1	2	4

Course Objectives:

1) To understand fluid properties and concept of fluid continuum.
2) To understand the concepts of kinematics & dynamics of fluid flow.
3) To apply fluid flow principles to various fluid flow problems.
4) To understand the mechanism of fluid measurement.
5) To understand the method of simulation & dimensional analysis.
6) To understand the concepts of laminar flow.

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Reference Books:

1. Properties of Concrete, Neville, ELBS, Pearson Education, 5th edition 2012
2. Building Material, S.K. Duggal, New Age Publishers, 4th revised edition 2012

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Determine** the properties of cement, sand & aggregate as per IS code.	Skill development
2.	**Determine** the workability of concrete for suitability of concrete mix in differentconstruction works.	Skill development
3.	**Evaluate** compressive strength of various concrete mixes.	Skill development/ employability
4.	**Determine** physical properties of brick by experiment and practice accordingly.	Skill development, entrepreneurship & employability
5.	**Examine** the properties of the cement mortar for various elements of the buildings.	Skill development, entrepreneurship & employability

List of Experiments:

1. Determination of properties of cement.
2. Determination of properties of sand.
3. Determination of properties of aggregate.
4. Determination of Fineness of cement.
5. Determination of consistency of cement.
6. Determination of workability of concrete by slump test.
7. Determination of workability of concrete by compacting factor apparatus.
8. Determination of workability by Vee Bee consistometer.
9. Determination of water absorption of bricks.
10. Determination of efflorescence of brick.
11. Field testing on bricks.
12. Determination of crushing strength of bricks.

Upon completion of practical course, the students will be able to:

CO 1: Determine the properties of cement, sand & aggregate as per IS code.
CO 2: Determine the workability of concrete for suitability of concrete mix in different construction works.
CO 3: Evaluate compressive strength of various concrete mixes.
CO 4: Determine physical properties of brick by experiment and practice accordingly.
CO 5: Examine the properties of the cement mortar for various elements of the buildings

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Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Define various fluid properties & states of fluid.

CO 2: Apply principles of fluid flow & dimensional analysis.

CO 3: Solve fluid flow problems.

CO 4: Analyze characteristics of fluid at rest, fluid at motion & dimensionless numbers.

CO 5: Discriminate different types of fluid flow, measurement techniques & principles.

CO 6: Apply the concepts of laminar flow in solving various fluid flow problems.

Text Books:

1. Fluid Mechanics, Modi & Seth, Standard Book House, Delhi, 21st edition, 2018.
2. Fluid mechanics, Girde & Mirazgaonkar, SCI Tech Publishers, 2019
3. Fluid Mechanics, R.K. Bansal, Laxmi Publishers, 2015

Reference Books:

1. Fluid Mechanics, A.K. Jain, Khanna Publishers, Delhi, 2014
2. Fluid Mechanics, Streeter, McGraw Hill Publishers, 9th edition, 2017

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Differentiate** between different flow measurements devices.	Skill development
2.	**Notice** flow through pipes & fall velocity of particle.	Skill development
3.	**Correct** the instrumental errors.	Skill development/ employability
4.	**Apply** Stoke's law to calculate terminal velocity.	Skill development, entrepreneurship & employability

List of Experiments:

1. Determination of viscosity of fluid by redwood viscometer
2. Determination of metacentric height of floating body
3. Calibration of Venturimeter
4. Determination of Cc, Cd, Cv of Circular Orifice
5. Calibration of Mouthpiece
6. Calibration of Orifice Meter
7. Reynolds experiment for demonstration of stream lined & turbulent flow
8. Determination of Friction Factor for a pipe
9. Verification of Stoke's law.

Course Outcomes:

Upon completion of practical course, the students will be able to:

CO 1: Differentiate between different flow measurements devices.

CO 2: Notice flow through pipes & fall velocity of particle.

CO 3: Correct the instrumental errors.

CO 4: Apply Stoke's law to calculate terminal velocity.

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Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Define** various fluid properties & states of fluid.	Skill development
2.	**Solve** fluid flow problems.	Skill development
3.	**Analyze** characteristics of fluid at rest, fluid at motion & dimensionless numbers.	Skill development/ employability
4.	**Discriminate** different types of fluid flow, measurement techniques & principles.	Skill development, entrepreneurship & employability
5.	**Apply** the concepts of laminar flow in solving various fluid flow problems.	Skill development, entrepreneurship & employability

Syllabus:

Unit I

Review of Fluid Properties: Engineering units of measurement, density, specific weight, specific volume, specific gravity, surface tension, capillary, viscosity, bulk modulus of elasticity, pressure and vapour pressure.

Fluid Statics: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems – gravity dams and Tainter gates), buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Unit II

Kinematics of Flow: Types of flow-ideal & real, steady and unsteady, uniform & non-uniform, one, two and three dimensional flow, path lines, streamlines, streamlines and stream tubes, continuity equation for one and three dimensional flow, rotational &irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flownets-their utility & method of drawing flownets.

Unit III

Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow, momentum equation, forces of fixed and moving vanes, velocity triangles.

Fluid Measurements: Velocity measurement, flow measurement (Orifices, nozzles, mouth pieces, orifice meter, Nozzle meter, venturimeter, weirs and notches).

Unit IV

Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pie theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, etc.)

Unit V

Laminar Flow: Introduction to laminar, transition & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, stokes law, Bach wash processing, Instability of laminar flow to turbulent flow.

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Text Books:

1. Surveying, Vol. – 1, Punmia B.C., Laxmi Publications, 17th edition, 2016
2. Building Material, B. C. Punmia, Laxmi Publications, 2016

Reference Books:

1. Basic Civil Engineering, S. Ramamrutam & R. Narayan, Dhanpat Rai Pub., 3rd edition, 2013
2. Surveying, Duggal, Tata McGraw Hill New Delhi, 4th edition, 2013

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Follow the guidelines for field surveying.

CO2: Follow the working principles of survey instruments for measurements.

CO3: Measure the horizontal distances, difference in elevation and angles of various points

CO4: Interpret survey data and compute areas

CO5: Determine various properties of cement, concrete & bricks.

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Course Code: 100026

Course Name: Basic Civil Engineering Lab

L	T	P	Credit
0	0	2	1

Course Objectives:

1. To perform the chain & tape surveying
2. To perform the survey work using various types of compass.
3. To determine the location of object on ground surface.
4. To determine the properties of cement
5. To determine the properties of concrete
6. To determine the properties of bricks.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Follow** the guidelines for field surveying.	Skill development
2.	**Follow** the working principles of survey instruments for measurements.	Skill development
3.	**Measure** the horizontal distances, difference in elevation and angles of various points	Skill development/ employability
4.	**Interpret** survey data and compute areas	Skill development, entrepreneurship & employability
5.	**Determine** various properties of cement, concrete & bricks.	Skill development, entrepreneurship & employability

List of Experiments:

1. Measurement of distance by chain or tape.
2. Chain and tape survey of givenarea
3. Measurement of direction by prismatic compass & surveyor's compass.
4. Calculation of distance between two in accessible points by prismatic compass
5. Chain & compass traverse
6. Exercise of differential leveling by dumpy level.
7. Exercise of flying levelling by dumpy level.
8. Demonstration oftheodolite.
9. Measurement of horizontal angle by theodolite.
10. Determination of standard consistency of cement by vicat apparatus.
11. Determination of initial setting time & final setting time of cement.
12. Determination of workability of cement concrete by slump cone test.
13. Determination of compressive strength of cement concrete.
14. Determination of compressive strength ofbricks.
15. Determination of water absorption ofbricks.

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Unit -V

Centre of Gravity and moment of Inertia: Centroid and Centre of Gravity, Moment of Inertia of Composite section, Radius of Gyration, Introduction to product of Inertia and Principle Axes. Support Reactions, Shear force and bending moment diagram for cantilever & simply supported beam with concentrated, distributed load and Couple.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain concepts and terminologies of building materials, surveying and mechanics.
CO 2: Apply various methods for surveying and mechanics.
CO 3: Determine the location, area and volume of objects on ground surface.
CO4: Solve the problems of surveying and mechanics by using various methods.
CO5: Analyse the effects of systemof forces on rigid bodies in static conditions.

Text Books:

1. Surveying, Vol. – 1, Punmia B.C., Laxmi Publications, 17th edition, 2016
2. Building Material, B. C. Punmia, Laxmi Publications, 2016
3. A textbook of Engineering Mechanics, D. S. Kumar, Katsons Publications, 2013

Reference Books:

1. Basic Civil Engineering, S. Ramamrutam & R. Narayan, Dhanpat Rai Pub., 3rd edition, 2013
2. Applied Mechanics, Prasad I.B., Khanna Publication 17th edition, 1996
3. Surveying, Duggal, Tata McGraw Hill New Delhi, 4th edition, 2013
4. Engineering Mechanics - Statics &Dynamics, R.C. Hibbler, Pearson Publications, 14th edition, 2015
5. Engineering Mechanics - statics dynamics, A. Boresi & Schmidt, Cengage learning, 1st edition, 2008.
6. Applied Mechanics, R.K. Rajput, Laxmi Publications, 3rd edition, 2016

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Course Code: 100020

Course Name: Basic Civil Engineering & Mechanics

L	T	P	Credit
2	1	0	3

Course Objectives:

1. To understand the utility of various types of building materials.
2. To understand the location, construction detail and suitability of various building elements.
3. To determine the location of object on ground surface.
4. To stabilize the position of various object.
5. To understand the effects of system of forces on rigid body in staticconditions.
6. Analysis of determinate structure (beam & truss)

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** concepts and terminologies of building materials, surveying and mechanics.	Skill development
2.	**Apply** various methods for surveying and mechanics.	Skill development
3.	**Determine** the location, area and volume of objects on ground surface.	Skill development/ employability
4.	**Solve** the problems of surveying and mechanics by using various methods.	Skill development, entrepreneurship & employability
5.	**Analyze** the effects of system of forces on rigid bodies in static conditions.	Skill development, entrepreneurship & employability

Syllabus:

Unit- I

Building Materials: Stones, bricks, cement, timber - types, properties, test & uses, Introduction of concrete properties & Laboratory tests on concrete, curing of concrete and mortar Materials.

Unit- II

Surveying & Positioning: Introduction to surveying, Survey stations, Measurement of distances-conventional and EDM methods, Measurement of directions by different methods, Measurement of elevations by different methods, reciprocal leveling.

Unit- III

Mapping & Sensing: Mapping details and contouring, Plane tables and related devices. Introduction of theodolite.Measurement of areas and volumes, application of measurements in quantity computations, Introduction of remote sensing and its applications.

Unit- IV

Forces and Equilibrium: Graphical and Analytical Treatment of Concurrent and non-concurrent co-planner forces, free body Diagram, Force Diagram and Bow's notations, Application of Equilibrium Concepts: Analysis of plane Trusses, method of joints, method of Sections. Frictional force in equilibrium problems.

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Unit IV

Thermal insulation, Heat transfer in building, Thermal insulation materials, methods of thermal insulation ventilation: natural & artificial, necessity & functional requirement of ventilation, system of ventilation, types of mechanical ventilation, air conditioning, functional requirement of air conditioning, Essentials of air conditioning, acoustic and sound insulation, Behavior of sound acoustical defects. Sabine formula, acoustical design of various spaces, sound insulation methods & materials, illumination (natural & artificial).

Unit V

Design and planning consideration for various types of building i.e. Residential Building, Education buildings, Hospitals & Dispensaries, Hotels, Commercial building, recreational buildings, government offices & other, standards specified by Bye-laws, various aspects of sustainability & energy efficiency applied to various types of Building, green building concept applied to various types of building.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain basics of building planning & design.
CO2: Describe sustainability principle, by laws & characteristics of thermal and sound insulation.
CO3: Apply sustainability concepts & principles in planning & design of buildings.
CO4: Evaluate environmental, sustainable & safety aspects of a building.
CO5: Plan different types of buildings as per by laws &codal provisions.

Text Books:

1. Building Drawing (Built Environment), Sah, Kale and Pathi, Tata McGraw hill, 4th edition, reprint 2007
2. Building Planning, Designing and Scheduling, Gurucharan Singh, Standard Publisher, distribution, 2009
3. Building Design and Drawing, Mallik and Meo, Computech Publication Ltd New Asian; 5th edition 2009

Reference Books:

1. Building Design and drawing, Y.S.Sane, Standard Publisher, 2006
2. National Building Codes (LatestEdition), 2016 by Bureau ofIndian Standards (Third Revision)
3. Building Construction, B.C.Punmia, Laxmi Publication, 11th edition, 2016

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Course Code: 110313

Course Name: Surveying

L	T	P	Credit
2	1	2	4

Course Objectives:

1) To understand the working of theodolite.
2) To understand the determination of heights & distances by tacheometry.
3) To understand various types of curves used inpractice.
4) To provide knowledge on setting out civil engineering works & detailed field surveying.
5) To understand the concepts of hydrographic & photographic surveying.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the techniques used for linear & angular measurements in surveying.	Skill development
2.	**Analyse** different geodetic methods of survey such as triangulation, trigonometric levelling,tachometry, photographic & hydrographic surveying.	Skill development
3.	**Apply** methods in control surveys.	Skill development/ employability
4.	**Apply** tachometry in traverse computations.	Skill development, entrepreneurship & employability
5.	**Apply** various methods for setting curves, area & volume computations.	Skill development, entrepreneurship & employability

Syllabus:

Unit I

Traversing by theodolite, Fieldwork checks, traverse computations, latitude and departures, computations of co-ordinates, plotting & adjustment of traverse. Omitted measurements. Trigonometrical levelling, precise levelling.

Unit II: Tacheometry

Tacheometric systems and principles, stadia system, uses of anallactic lens, tangential system, substance system, instrument constant, field work reduction, direct reading tacheometers, use of tacheometry, accuracy.

Unit III: Curves:

Classification and use, elements of circular curves, setting out curves by offsets and by theodolites, obstacles and special problems, compound curves, reverse curves, transition curves, cubic spiraland lemniscate, vertical curves, computation and setting out.

Unit IV: Control Surveys:

Providing frame work of control points, triangulation principle, forms of framework, reconnaissance survey, selection and making of stations, Control line, baseline measurement & corrections, flexible apparatus and corrections, computation of sides, precisetraversing.

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Unit V: Photographic & Hydrographic Surveying:

Principles of photographic surveying – aerial photography, tilt and height distortions, uses. Hydrographic Surveying - Methods, Elements of Hydrographic Surveying.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain the techniques used for linear & angular measurements in surveying.

CO2: Analyse different geodetic methods of survey such as triangulation, trigonometric levelling, tachometry, photographic & hydrographic surveying.

CO3: Apply methods in control surveys.

CO4: Apply tachometry in traverse computations.

CO5: Apply various methods for setting curves, area & volume computations.

Text Books:

1. Surveying Vol. I, II, III, B.C. Punmia, Laxmi Publications New Delhi, 2016
2. Fundamentals of surveying, S.K. Roy, Prentice Hall of India New Delhi, 2nd edition1999

Reference Books:

1. Surveying theory & Practice, R.E. Devise, McGraw Hill, New York, 4th revised edition 2001
2. Plane & Geodetic surveying Vol. I & II, David Clark & J Clendinning, Constable & C. London, 2017
3. Surveying Vol. I & II, K.R. Arora, Standard book House, New Delhi, 13th edition 2016

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Course Code: 110314

Course Name: Strength of Materials

L	T	P	Credit
2	1	2	4

1) To understand the concepts of simple and compound stresses and strains.
2) To understand the behaviour of elastic materials in bending, shear and torsion.
3) To understand the stability behaviour of long columns under axial load.
4) To understand the power transmission by shift.
5) To understand stresses & strain developed in storage vessels
6) To calculate stresses / strain in statically indeterminate structures.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts of stress, strains, bending, deflection, buckling & torsion.	Skill development
2.	**Explain** various theories for determining stress, buckling of columns & deflections ofstructures.	Skill development
3.	**Apply** various theories for determining stress, buckling of columns & deflections of structures.	Skill development/ employability
4.	**Evaluate** the stresses in bending, shear and torsion.	Skill development, entrepreneurship & employability
5.	**Analyse** various sections for stresses, strain, bending, torsion, buckling & deflections.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Stress and Strains: Concept of Elastic body, stress and strain, Hooke's law various types of stress and strains. Elastic constants and their relation Stresses in compound bars, composite and tapering bars, temperature stresses.

Two-dimensional stress system.Normal and tangential stresses, Principal Planes, Principal Stresses and strains. Mohr's circle of stresses. Strain energy and theories of failure.

Unit - II

Theory of simple bending: Concept of pure bending and bending stress, equation of bending, Neutral axis, Section-Modulus, Bending stress distribution across a section, Shear Stresses in Beams, beams of uniform strength, shear centre.

Unit-III

Torsion of Shafts: Concept of pure torsion, Torsion equation, Determination of shear stress and angle of twist of shafts of circular section, Hollow circular shafts. Combined bending and torsion. Open and closed springs, leaf spring and spiral spring.

Pressure Vessels: Thin cylinders and spheres. Stress due to internal pressure. Change in diameter and volumes.

Unit-IV

Columns and Struts: Euler's buckling load for uniform section, various end conditions. Slenderness Ratio.Merchant Ranking formulae, Eccentric loading on columns.

Unit-V

Deflection of statically determinate structure by Geometrical methods & Introduction of method of virtual work.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain the concepts of stress, strains, bending, deflection, buckling & torsion.

CO 2: Explain various theories for determining stress, buckling of columns & deflections of structures.

CO 3: Apply various theories for determining stress, buckling of columns & deflections of structures.

CO4: Evaluate the stresses in bending, shear and torsion.

CO5: Analyze various sections for stresses, strain, bending, torsion, buckling & deflections.

Text Books:

1. Strength of Materials, Sadhu Singh, Khanna Publishing, 1st edition 2016
2. Strength of Materials, S. Ramamrutham, R. Narayanan, Dhanpat Rai Publishing Company, 18th edition 2014
3. Strength of Materials, R. K. Bansal, Laxmi Publication; 6th edition 2018

Reference Books:

1. Strength of Materials, Timoshenko, Publisher CBS, 3rd edition 2004
2. Strength of Materials, HigdonStyle, Publisher Wiley, 3rd edition 1978
3. Strength of Materials Vol. I& II, B.C. Punmia, Laxmi Publication, 10th edition 2018
4. Mechanics of Materials, R.C. Hibbler, Pearson Publication, 2016
5. Mechanics of Materials, J. M. Gere & B.J. Goodno, Cengage Publisher, 8th edition 2014

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Evaluate** properties of material by impact test.	Skill development
2.	**Evaluate** properties of material by hardness test.	Skill development
3.	**Evaluate** properties of material by tensile test.	Skill development/ employability
4.	**Determine** compressive & flexural strength of materials.	Skill development, entrepreneurship & employability

List of Experiments:

1. Impact Test
2. Brinell Hardness Test
3. Behaviour of columns with Different End Conditions
4. Tensile test
5. Compression test

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6. Flexure test
7. Shear test
8. Spring test
9. Torsion test
10. Verification of Maxwell's Reciprocal Theorem.
11. Bending of Beam (One Point loading only).
12. Bending of Beam (Two Point loading only).

Upon completion of practical course, the students will be able to:

CO1: Evaluate properties of material by impact test.

CO2: Evaluate properties of material by hardness test.

CO3: Evaluate properties of material by tensile test.

CO4: Determine compressive & flexural strength of materials.

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Course Code: 110315

Course Name: Survey Practice Lab

L	T	P	Credit
0	0	2	1

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Follow** the guidelines for field surveying.	Skill development
2.	**Follow** the working principles of survey instruments for measurements.	Skill development
3.	**Measure** horizontal & vertical angle by theodolite for traversing and levelling.	Skill development/ employability
4.	**Determine** tachometric constants for linear measurements by tachometry.	Skill development, entrepreneurship & employability
5.	**A Create** a simple circular curve by using Rankine's method for alignment.	Skill development, entrepreneurship & employability
6.	**Develop** contour map by using tachometer & total station.	Skill development, entrepreneurship & employability

Syllabus:

List of Experiments:

1. Measurement of horizontal and vertical angle by Vernier Theodolite.
2. Theodolite, traversing.
3. Determination of R.L. of a point whose base is accessible & inaccessible by Trigonometrical levelling.
4. Determination of tachometric contents in field.
5. Determination of height & distance by using Stadia method & Tangential tachometry
6. Measurement of base line by using Substance Bar.
7. Setting out of a simple circular curve by using Rankine's method.
8. Setting out of a simple circular curve by using Offset from the chord produced or deflection distance.
9. Profile Levelling & Cross Sectioning of Road
10. Prepare Contour map by using Grid Pattern & Tachometric Method.
11. Resection by Two point problem & Three point problem.
12. Determination of horizontal & vertical position of a point by Total Station.
13. Traversing by Total Station.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Follow the guidelines for field surveying.

CO 2: Follow the working principles of survey instruments for measurements.

CO 3: Measure horizontal & vertical angle by theodolite for traversing and levelling.

CO 4: Determine tachometric constants for linear measurements by tachometry.

CO 5: Create a simple circular curve by using Rankine's method for alignment

CO 6: Develop contour map by using tachometer & total station.

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Course Code: 110316

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	1

Course Objectives:

1) To encourage students to read, study & understand different topics of civil engineering published in articles, literatures.
2) To help in presenting different topics of civil engineering and related subjects to supplement theoretical knowledge gained in class.
3) To make student acquire good oral & written communication skills.
4) To promote the habit of lifelong learning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Analyze** contemporary issues in civil engineering & its allied areas through literature survey.	Skill development
2.	**Distinguish** state of art & relevance of the topic in national & international arena.	Skill development
3.	**Demonstrate** good oral & written communication skills.	Skill development/ employability
4.	**Develop** poster and power point presentations for effective communication.	Skill development, entrepreneurship & employability
5.	**Display** lifelong learning.	Skill development, entrepreneurship & employability

Syllabus:

1. Any relevant topic related to civil engineering from within or beyond the syllabus through Swayam / NPTEL /MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Analyze contemporary issues in civil engineering & its allied areas through literature survey.
CO2: Distinguish state of art & relevance of the topic in national & international arena.
CO3: Demonstrate good oral & written communication skills.
CO4: Develop poster and power point presentations for effective communication.
CO5: Display lifelong learning.

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Course Code: 110317
Course Name: Summer Internship Project - I

L	T	P	Credit
0	0	4	2

Course Objectives:

1) To encourage students to read, study & understand different topics of civil engineering.
2) To make student acquire good oral & written communication skills.
3) To promote the habit of lifelong learning.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Observe** various activities in field.	Skill development
2.	**Examine** the utility of general and specific equipments for construction.	Skill development
3.	**Differentiate** the construction projects individually and in team.	Skill development/ employability
4.	**Develop** the writing and communication skills for various engineering problems.	Skill development, entrepreneurship & employability
5.	**Adapt** lifelong learning for benefit of society.	Skill development, entrepreneurship & employability

Syllabus:

Each candidate shall have to undergo 15 days in-house summer internship at the institute after the completion of their 2nd Semester exams (in summer vacations). Candidate can choose from various modules which are offered by the institute and after successful completion of internship they have to submit detailed report.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Observe various activities in field.
CO2: Examine the utility of general and specific equipments for construction.
CO3: Differentiate the construction projects individually and in team.
CO4: Develop the writing and communication skills for various engineering problems.
CO5: Adapt lifelong learning for benefit of society.

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neutral and total stresses, effect of water table, fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

Consolidation – Introduction, Compressibility and consolidation, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's Theory of consolidation, final settlement of soil deposits, Determination of consolidation settlement and secondary consolidation.

Unit-III Stress Distribution in Soils:

Stresses in soil – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area, influence factors, isobars, Boussinesq's equation, westergaard's analysis. Newmark's influence chart. Contract pressure under rigid & flexible area, computation of displacements from elastic theory.

Unit – IV Shear Strength of Soils:

Mohr Circle and its characteristics, principal planes, relation between major and minor principal stresses. Mohr–Coulomb's theory, types of shear tests, direct shear test, merits of direct shear test, Triaxial compression test, test behaviour of UU, CU and CD tests, pore-pressure measurements, computation of effective shear strength parameters, unconfined compression test, vane shear test, critical void ratio, Liquefaction.

Unit – V Stability of Slopes:

Introduction, Types of slopes and their failure mechanisms, factor of safety, analysis of Infinite and finite slopes, wedge failure, Swedish circle method, friction circle method, stability numbers and charts. Effect of ground water. Selection of shear strength parameters in slope stability analysis. Stability of Earth dams.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Evaluate different properties of rocks & soil and its classification.
CO2: Examine the flow and shear parameters & their effects on various types of soil.
CO3: Determine the stress distribution & shear failure by various methods.
CO4: Evaluate the shear strength parameter of soil by various methods.
CO5: Analyse the stability of slopes using various methods.

Text Books:

1. Soil Mech. & Found. Engg., Dr. K.R. Arora, Std. Publishers Delhi, 7th Edition, 2014
2. Soil Mech. & Foundation, Dr. B.C. Punmia, Laxmi Publications, Delhi, 16th Edition, 2017
3. Soil Mech. & Found Engg., S.K. Garg, Khanna Publishers, Delhi, 1st Edition, 2003
4. Basic & Applied Soil Mechanics, Gopal Ranjan, New Age International Publishers, 2016
5. Parbin Singh., "Engineering and General Geology", S. K. Kataria and Sons, 2009

Reference Books:

1. Modern Geotech Engg. Dr. Aram Singh, IBT Publishers, Delhi, 8th Edition, 2016
2. Geotech Engg., C. Venkatramaiah, New Age International Publishers, 16th Edition, 2018
3. Soil Testing for Engg., T.W. Lambe, John Wiley & Sons. Inc. 1969
4. Bangar, K.M, Principles of Engineering Geology, Standard Publishers Distributors, 1995, New Delhi

List of Experiment's:

1. Moisture Content Determination. Oven Drying Method.
2. Grain Size Analysis – Mechanical Method.
3. Grain Size Analysis – Hydrometer Method.
4. Liquid Limit, Plastic Limit, Shrinkage Limit Tests.
5. In-Place Density tests – Core Cutter Method, Sand Replacement Method.
6. Specific Gravity Tests.

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Course Code: 110411
Course Name: Geotechnical Engineering - I

L	T	P	Credit
2	1	2	4

Course Objectives:

1) The students will get the basic knowledge about natural material like rocks and get acquainted with natural dynamic processes and their actions.
2) The students will know the significance of geological investigations for civil engineering projects and site selection.
3) To inculcate the basic knowledge of soil such as its identification and classification, determination of various engineering properties and its suitability as a foundation/subgrade material.
4) To develop an understanding of the relationships between physical characteristics and mechanical properties of soils by experimentally measuring them.
5) To explain role of water in soil behavior and how soil stresses, permeability and quantity of seepage including flow net are estimated.
6) To determine shear parameters and stress changes in soil due to foundation loads & estimate the magnitude and time-rate of settlement due toconsolidation.
7) To apply the principles of soil mechanics in stability analysis of slopes and settlement calculations.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Evaluate** different properties of rocks & soil and its classification.	Skill development
2.	**Examine** the flow and shear parameters & their effects on various types of soil.	Skill development
3.	**Determine** the stress distribution & shear failure by various methods.	Skill development/ employability
4.	**Evaluate** the shear strength parameter of soil by various methods.	Skill development, entrepreneurship & employability
5.	**Analyze** the stability of slopes using various methods.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I Engineering geology & soil properties

Introduction to geology, mineralogy, petrology – Three-fold classification of rocks and their characteristic features. Structural geology - Types and classification of structures (Joints, Unconformities, Folds and faults) andtheir effect on civil engineering projects.

Introduction – Types of soils, their formation & deposition, basic definitions and relationships - Three phase system. Index properties of soil and their determination. Relationship between volume weight, void ratio-moisture content, moisture content-specific gravity, and unit weight- air voids etc.

Plasticity Characteristics of soil & indices and their determination, use of consistency limits, Classification of soil based on particle size and consistency limits, unified soil classification systems, Indian standard soil classification system, general characteristics of soil in different groups.

Unit-II Soil Water and Consolidation:

Permeability of soil: Darcy law and its validity, Determination of permeability in laboratory and in field using various methods like constant head method, pumping tests etc. factors affecting permeability of soil, Seepage analysis – introduction, stream & potential functions, flow nets, uses of a flow net, Introduction to effective,

7. Permeability Tests, Variable Head Method.
8. Compaction Test.
9. Unconfined Compression Test.
10. Direct Shear Test.
11. Triaxial Shear Test (UU)
12. Vane Shear Test.
13. Plate Load Test (Demonstration)
14. Consolidation Test.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Check** physical properties of soil.	Skill development
2.	**Check** strength properties of soil.	Skill development
3.	**Differentiate** the flow properties and stresses of soil.	Skill development/ employability
4.	**Check** shear strength of soil.	Skill development, entrepreneurship & employability

Upon completion of practical course, the students will be able to:

CO 1: Check physical properties of soil.
CO 2: Check strength properties of soil.
CO 3: Differentiate the flow properties and stresses of soil.
CO 4: Check shear strength of soil.

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Course Code: 110412

Course Name: Theory of Structure - I

L	T	P	Credit
2	1	0	3

Course Objectives:

1) To develop an understanding of the behavior of structure under serviceability load.
2) To understand the mechanics of the material behavior of different type of structures.
3) To understand the concepts of analysis of indeterminate structures by various classical methods.
4) To make student aware of different methods of structural analysis.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Classify** different type of structures based on support conditions.	Skill development
2.	**Explain** various methods & principles for analysis of structures.	Skill development
3.	**Apply** various methods & principles for structural analysis.	Skill development/ employability
4.	**Analyze** various structures using various methods, principles & theorems.	Skill development, entrepreneurship & employability
5.	**Evaluate** different methods of structural analysis.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Deflection of beams: Double Integration method. Area Moment Method and Slope - Deflection Method. Beam of variable cross section, M/EI diagram, Conjugate Beam Method.

Unit-II

Virtual work and Energy Principles: Principles of Virtual work applied to deformable bodies. Maxwell's Reciprocal theorems, Energy theorems, Application to pin jointed frames only.

Unit – III

Indeterminate Structures –I: Static and Kinematics indeterminacy, Analysis of Fixed and continuous beams by Theorem of three moments, Effect of sinking and rotation of supports.

Unit-IV

Indeterminate Structures – II: Analysis of beams and analysis of frames (with and without sway) by slope Deflection method.

Unit-V

Moment Distribution Method: Moment distribution method for analysis of beams and analysis of frames (without sway) Three hinged arches of different shapes, Eddy's Theorem. Two Hinged and Fixed Arches.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Classify different type of structures based on support conditions.
CO 2: Explain various methods & principles for analysis of structures.
CO 3: Apply various methods & principles for structural analysis.

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CO 4: Analyse various structures using various methods, principles & theorems.

CO 5: Evaluate different methods of structural analysis.

Text Books:

1. Basic Structural Analysis, Reddy C. S., Tata McGraw Hill Publishing Company, 2017
2. Theory of Structures, S. Ramamrutham, R. Narayanan, Dhanpat Rai Publications, 9th edition, 2014
3. Theory of Structures, B.C. Punmia, Laxmi Publications, 2017

Reference Books:

1. Structural Analysis – A Unified classical and matrix Approach, Ghali A & Neville M, Chapman and Hall, New York, 6th edition, 2009
2. Intermediate structural analysis, Wang C.K., McGraw Hill, New York, 1984
3. Structural Analysis, Aslam Kassimali, C. L. Publisher, 2014
4. Structural Analysis, R. C. Hibbler, Pearson Publication, 2017

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Unit -IV

Highway Construction Materials: Aggregates and their types, physical and engineering properties, Fillers, Bitumen, Characteristics, Emulsions and cutbacks, Basic tests on all materials.

Design of Flexible & Rigid Pavements: Introduction, flexible pavement, factors affecting design and performance, stress in flexible pavement, design of flexible pavement as per IRC, rigid pavements – components & functions, factors affecting design & performance of CC pavements, stress in rigid pavement, type of joints, dowel bar, tie bar and its functionalities.

Unit – V Evaluation and Maintenance of Pavements

Pavement distress in flexible and rigid pavements, Pavement evaluation, structural evaluation, evaluation by deflection measurements, Strengthening of pavements, Types of maintenance, Importance of highway drainage, Surface and sub-surface drainage arrangements.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the principles of highway planning & their geometrical design.

CO 2: Evaluate physical properties of suitable highway engineering materials with drainage provisions.

CO 3: Apply the concepts of traffic engineering in transportation planning.

CO 4: Design pavements as per regulations.

CO 5: Formulate the layers of pavement along with provisions of its drainage & maintenance.

Text Books:

1. Highway Engineering, S.K. Khanna & C.E.G. Justo, Nemchand Pub., 10th edition, 2018
2. Highway Engineering, Gurucharan Singh, Standard Publishers, 5th edition, 2006
3. Principles & Practices of Highway Engineering, L R Kadiyali, N B Lal, Khanna Publishers, 2016

Reference Books:

1. Principles of Pavement Design, E.J. Yoder & M.W. Witzech, Wiley India, 2nd edition, 2011
2. Highway Engineering, O' Flaherty, Butterworth-Heinemann, 4th edition, 2002
3. Principles of Practice of Highway Engg., Sharma & Sharma, Asia Publishing House, 1965
4. Analysis and Design of Pavements, Haung, Pearson, 2nd edition, 2004

List of Experiments:

1. Aggregate Crushing Value Test
2. Determination of Aggregate Impact Value
3. Determination of Los Angeles Abrasion Value
4. Determination of flakiness index and elongation index of aggregates.
5. Determination of California Bearing Ratio Value
6. Determination of Penetration Value of Bitumen
7. Determination of Viscosity of Bituminous Material
8. Determination of Softening Point of Bituminous Material
9. Determination of Ductility of the Bitumen
10. Determination of Flash Point and Fire Point of Bituminous Material
11. Determination of Bitumen Content by Centrifuge Extractor
12. Determination of Stripping Value of Road Aggregate
13. Determination of Marshall Stability Value for Bitumen.

Course Outcomes:

Upon completion of the practical course, the students will be able to:

CO 1: Select suitable aggregate material by testing the physical properties.

CO 2: Determine properties of bitumen and its grade.

CO 3: Determine CBR value of material for subgrade and subsequent layers of pavement.

CO 4: Design job mix formula for bituminous surface using Marshal Stability test

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Course Code: 110413

Course Name: Transportation Engineering

L	T	P	Credit
2	1	2	4

Course Objectives:

1) To study the planning aspects of roads & highway.
2) To study the geometric design aspects of highway and road.
3) To know about pavement material and design.
4) To understand the construction process and methods of roads & highway.
5) To study about traffic characteristics and design of intersections.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the principles of highway planning & their geometrical design.	Skill development
2.	**Evaluate** physical properties of suitable highway engineering materials with drainageprovisions.	Skill development
3.	**Apply** the concepts of traffic engineering in transportation planning.	Skill development/ employability
4.	**Design** pavements as per regulations	Skill development, entrepreneurship & employability
5.	**Formulate** the layers of pavement along with provisions of its drainage & maintenance.	Skill development, entrepreneurship & employability

Syllabus:

Unit – I Highway Development and Planning

Highway Development in India — Necessity for Highway Planning – Different Road Development Plans; Classification of Roads. Road Network Patterns — Highway Alignment- Factors affecting Alignment- Engineering Surveys.

Unit – II Highway Geometric Design

Importance of Geometric Design – Design controls and Criteria – Highway Cross Section Elements – Sight Distance Elements – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance – Design of Horizontal Alignment – Design of Super elevation and Extra widening – Design of Transition Curves – Design of Vertical alignment - Gradients- Vertical curves.

Unit – III Traffic Studies

Spot Speed Studies and Volume Studies, Speed and Delay Studies purpose, causes of delay, methods of conducting speed and delay studies, Origin and destination Studies (O & D): Various methods, collection and interpretation of data, Traffic Capacity Studies: Volume, density, basic practical and possible capacities, level of service, Parking Studies: Methods of parking studies, design of intersections at grade & grade separated.

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Course Code: 110414

Course Name: Water Resources Engineering

L	T	P	Credit
2	1	0	3

Course Objectives:

1) To understand the water requirements of various types of crops.
2) To understand the different types of irrigation systems.
3) To plan the reservoir systems as per the requirements.
4) To understand the concepts of Khosla's and Bligh's theory & its applications.
5) To understand the concepts of Lacey's and Kennedy theory for design of canalsystems.
6) To develop an understanding of various components of hydrological cycle, their behaviors & factors affecting it & solve problems on measurement on rainfall, infiltration, evaporation.
7) To understand concepts of Hydrometry & ground water hydrology.
8) To discuss the importance of estimation of runoff, analysis of rainfall data and various hydrographs and analyze various problems off runoff using various hydrograph theories.
9) To develop an understanding of various methods of flood estimation in general & flood frequency.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concept of hydrology and hydrograph	Skill development
2.	**Apply** basic principles for measurement & forecasting of rainfall & runoff.	Skill development
3.	**Analyze** runoff hydrograph by various methods.	Skill development/ employability
4.	**Analyze** various requirements for an efficient irrigation project.	Skill development, entrepreneurship & employability
5.	**Design** different components of irrigation system using different theories.	Skill development, entrepreneurship & employability
6.	**Plan** an efficient, economical & safe irrigation system.	Skill development, entrepreneurship & employability

Syllabus:

Unit – I

Hydrology: Definition, Hydrological Cycle, Precipitation, Evaporation, Infiltration, Runoff, Estimation of Runoff, Empirical Formulae, Rainfall-Runoff relationships, Hydrometry, Methods of Stream Gauging, Rating Curves, Ground Water: Elements of Ground water Hydrology, Well Hydraulics, Equations of Ground Water flow, Solutions and applications.

Unit - II

Hydrographs & Hyetographs, Hydrographs analysis, Unit Hydrographs, Methods of constructing, Unit Hydrographs, S-curve Hydrograph, Synthetic unit Hydrograph, Flood and its estimation by different methods.

Unit-III Irrigation Water Requirement and Soil Water Crop Relationship: Irrigation, Definition, Necessity, Advantages and disadvantages, Type and methods, Irrigation development.

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Soil: Types and their occurrence, Suitability for irrigation purposes, Wilting, Coefficient and field capacity, Optimum water supply, Consumptive use and its determination. Irrigation methods - surface and subsurface, Sprinkler and drip irrigation.

Duty of water, factors affecting duty and methods to improve duty, Suitability of water for irrigation, Crops and crop seasons, Principal crops and their water requirement, Crop ratio and crop rotation, Intensity of irrigation, Water logging-causes, effects & its prevention.

Unit – IV Reservoir Planning and Canal Irrigation

Types of reservoir, Reservoir planning, Estimation of storage capacity by mass curve analyses, Economical height of dam, Reservoir sedimentation, Canal systems, Planning and layout of canal systems, Regime concept and tractive force method of channel design, Channel losses, Design of unlined and lined canals, Kennedy's and Lacey's silt theories, Typical canal section, Water-logging: Causes and effects, Remedial measures, Salinity, Land reclamation and Drainage.

Unit – V Diversion works and Canal Regulation Structures

Elements of diversion works, Type of weirs and barrages, Weir design for surface and sub-surface flow, Bligh's, Lane's and Khosla's theories, Silt excluders and Silt ejectors.

Canal regulation structure like Head & Cross regulations, falls, Escapes, Outlets, Their Need, Functions sketches.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concept of hydrology and hydrograph

CO 2: Apply basic principles for measurement & forecasting of rainfall & runoff.

CO 3: Analyse runoff hydrograph by various methods.

CO 4: Analyse various requirements for an efficient irrigation project.

CO 5: Design different components of irrigation system using different theories.

CO 6: Plan an efficient, economical & safe irrigation system.

Text Books:

1. Engineering. Hydrology, K. Subhramanya, Tata McGraw Hill Publ. Co. 4th edition, 2013
2. Hydrology & Water Resources Engineering, S. K. Garg, Khanna Publishers, 2016
3. Irrigation Engineering & Hydraulic Structures, Santosh Kumar Garg, Khanna Publishers, 2017
4. Irrigation, Water Power & Water Resources Engg., K.R. Arora, Standard Publishers Distributors, 2010

Reference Books:

1. Engineering. Hydrology, J. NEMEC, Prentice Hall, 1972
2. Hydrology for Engineers, Linsley, Kohler, Paulnus, Tata Mc GrawHill, 2014
3. Engineering Hydrology, H. M. Raghunath, New Age International Publishers, 5th edition, 2015.
4. Irrigation, Water Resources & Water Power, Dr. P.N. Modi, Standard Book House, 9th edition, 2014
5. Irrigation Engineering by Varshney & Gupta, Vol I & II, Nemchand Publishers, 2007.

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Course Code: 100415

Course Name: Civil Drawing Lab

L	T	P	Credit
0	0	2	1

Course Objectives:

1) To draw plan, elevation & section of various components of a building.
2) To prepare sketches of various components of building like doors, windows etc.
3) To expose students to use software's like AutoCAD in civil engineering drawing.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Attempt** to draw different components of a building.	Skill development
2.	**Produce** plan, elevation & section of various components of a residential and institutionalbuilding.	Skill development
3.	**Use** AutoCAD software in civil engineering drawing.	Skill development/ employability
4.	**Prepare** drawing sheets of various types of buildings like residential, institutional, commercialetc	Skill development, entrepreneurship & employability

Syllabus:

List of Experiments:

1. One drawing sheet containing Foundations and Footing using AutoCAD
2. One drawing sheet containing Doors, Windows, Ventilators using AutoCAD
3. One drawing sheet containing Lintels, Trusses and Arches etc. using AutoCAD
4. One drawing sheet containing detailed planning of one room residential building
5. One drawing sheet containing detailed planning of multi rooms residential building
6. Drawing sheets one each of residential building using AutoCAD
7. One Drawing sheet of Institutional building using AutoCAD
8. One Drawing sheet of Commercial building using AutoCAD
9. One Drawing sheet of Hospital building using AutoCAD
10. Sketches of various building components i.e. floors, roof & roof covering
11. Sketches of various building components i.e. staircase

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Attempt to draw different components of a building.

CO2: Produce plan, elevation & section of various components of a residential and institutional building.

CO3: Use AutoCAD software in civil engineering drawing.

CO4: Prepare drawing sheets of various types of buildings like residential, institutional, commercial etc

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Course Code: 110501
Course Name: Estimating Costing & Contracting

L	T	P	Credit
3	1	0	4

Course Objectives:

1) To work out the quantities of various items of civil works like buildings, culverts including steel girders etc.
2) To compute earthwork.
3) To understand detailed specifications and carry out analysis of rates.
4) To understand various methods of carrying out estimation.
5) To understand valuation process &fixation of rent.
6) To understand contracting procedures.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the fundamentals of quantity estimation, costing & contracting.	Skill development
2.	**Apply** methods to estimate area, volume & cost.	Skill development
3.	**Evaluate** mathematical & numerical models for rate & quantity estimation.	Skill development/ employability
4.	**Determine** rates & value	Skill development
5.	**Classify** different rates of items, contracts & measurement techniques.	Skill development

Syllabus:

Unit I Introduction of Estimating:

Purpose and importance of estimates, principles of estimating, methods of taking out quantities of items of work.Mode of measurement, measurement sheet and abstract sheet, bill of quantities. Types of estimate, plinth area rate, cubical content rate, preliminary, original, revised and supplementary estimates for different projects.

Unit II: Details of Items:

Specifications of materials and works: Types of Specifications, General specifications for Class A, B & C type of building, Detailed specifications of important items of work.

Rate Analysis: Task for average artisan, various factors involved in the rate of item, material and labour requirement for various trades, preparation for rates of important items of work, current schedule of rates (C.S.R)

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Unit III: Estimates

Preparing detailed estimates of various types of buildings, R.C.C Works, Culverts, earthwork calculations for roads and Canals, contingencies and work charge establishment, use of computational tools for preparing estimates.

Unit IV: Valuation

Purposes, depreciation, sinking fund, scrap value, year's purchase, gross and net income, dual rate of

interest, methods of valuation, rent fixation of buildings

Unit V: Contracting

Contract, Types of engineering contract, essentials documents of engineering Contract, Conditions of contract, Earnest Money Deposit, Security Deposit, Responsibility of Engineer, Contractor & Client.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the fundamentals of quantity estimation, costing & contracting.

CO 2: Apply methods to estimate area, volume & cost.

CO 3: Evaluate mathematical & numerical models for rate & quantity estimation.

CO 4: Determine rates & value.

CO 5: Classify different rates of items, contracts & measurement techniques.

Text Books:

1. Estimating & costing in civil engineering, B.N. Dutta, UBS Publishers, 28th revised edition 2016
2. Estimating & Costing, S.C. Rangwala, Charotar Publishing House, 17th edition 2017

Reference Books:

1. Estimating & Costing for Civil Engg., G.S. Birdie, Dhanpat Rai Publications, 6thedition 2014
2. Estimating & Costing specification & valuation in civil engineering. M. Chakraborti, 2006

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4. RCC Design, Neelam Sharma, Katson Publishers, 2014

Reference Books:

1. Reinforced Cement Concrete, P. Dayaratnam, Medtech Publishers, 5th edition, 2017.
2. Reinforced Concrete Design, S.N. Sinha, Tata McGraw Hill, 3rd edition, 2017
3. Plain and Reinforced Concrete, O.P. Jain and Jai Krishna, Nem Chand Pub.,8th edition, 2008
4. Reinforced Cement Concrete, Winter & Nelson, McGraw Hill, 11th edition, 1991

Course Code: 110502 (For 2019 admitted Batch)

Course Name: Structural Design & Drawing (R.C.C.)

L	T	P	Credit
3	1	0	4

Course Objectives:

1) To understand various design philosophies for RC components.
2) To study the desired properties of steel and concrete for use in Reinforced concrete.
3) To learn design of RC elements for flexure and deflection.
4) To learn design of RC elements for shear and bond as per relevant IS codes.
5) To learn design of RC elements subjected to compression.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Apply** the concepts of different design philosophies for deriving basic expressions used in RCdesign.	Skill development
2.	**Determine** the capacity of RC elements using IS456 guidelines.	Skill development
3.	**Analyze** the RC elements for determining design variables as per IS456 & IS 875 recommendations.	Skill development/ employability
4.	**Design** the RC elements as per IS 456 provisions.	Skill development/ employability
5.	**Develop** the design sketches for RC elements as per IS456; IS13920 and SP34 provisions.	Skill development/ employability

Syllabus:

Unit-I

Design principles: Materials; Introduction to IS 456; Design philosophies: Working stress, Ultimate load and Limit state design

Singly reinforced beam sections: Analysis and design of singly reinforced rectangular beams: Lintel, Cantilever, Simply supported beams; Design for deflection.

Unit-II Design of Beams:

Design for Shear; Design for bond; Doubly-reinforced and Flanged sections; Design of Continuous beams

Unit-III Design of Slabs:

Slabs spanning in one direction: Cantilever, Simply supported and Continuous slabs; Slabs spanning in two directions; Circular slabs.

Unit-IV Columns & Footing:

Design of short columns subjected to axial loads, axial load and bending moments (section with no tension); Design of long columns; Introduction to IS 13920; Design of isolated and combined footings.

Unit-V Staircases:

Design of Staircases with waist slab: straight flight, dog legged, and open well staircase with different support conditions; Design of Tread-riser (without waist slab) staircase.

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Text Books:

1. Reinforced Concerete Limit State Design, A.K. Jain, Nem Chand Pub., 7th edition, 2012.
2. Reinforced Concrete, Pillai & Menon, Tata McGraw Hill, New Delhi, 3rd edition, 2017
3. Limit State Design, P.C. Varghese, Prentice Hall of India, New Delhi, 2nd edition, 2008

Text Books:

1. Reinforced Concerete Limit State Design, A.K. Jain, Nem Chand Pub.,7th edition, 2012
2. Reinforced Concrete, Pillai & Menon, Tata McGraw Hill, New Delhi, 3rd edition,2017
3. Limit State Design, P.C. Varghese, Prentice Hall of India, New Delhi, 2nd edition,2008
4. RCC Design, Neelam Sharma, Katson Publishers, 2014

Reference Books:

1. Reinforced Cement Concrete, P. Dayaratnam, Medtech Publishers, 5th edition, 2017.
2. Reinforced Concrete Design, S.N. Sinha, Tata McGraw Hill, 3rd edition, 2017
3. Plain and Reinforced Concrete, O.P. Jain and Jai Krishna, Nem Chand Pub.,8th edition,2008
4. Reinforced Cement Concrete, Winter & Nelson, McGraw Hill, 11th edition, 1991

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Course Code: 110502 (For 2018 Admitted Batch)

Course Name: Structural Design & Drawing (R.C.C.)

L	T	P	Credit
3	1	0	4

Course Objectives:

1) To understand the behavior of reinforced concrete components & systems subjected to gravity loads.
2) To study the stress strain behavior of steel and concrete.
3) To understand the concept of working stress & limit state method.
4) To provide knowledge on limit state design of beams, design for flexure, shear, torsion, bond & anchorage as per relevant IScodes.
5) To provide knowledge on design of slabs, columns, footings & staircases as per relevant IS codes.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Compare** various design principles as applicable for design of RCC structures.	Skill development
2.	**Apply** the concepts of working stress method & limit state method on RCC structures.	Skill development
3.	**Apply** recommendations of SP 34 for detailing	Skill development
4.	**Analyse** a given section of RCC structural elements using limit state method.	Skill development/ employability
5.	**Design** different elements of RCC structures like beam, slab, column, footing, staircase using IS codes.	Skill development/ employability

Syllabus:

Unit-I Basic Principles of Structural Design:

Mechanism of load transfer, Introduction to working stress limit state and ultimate load methods of design. Introduction of IS Codes 456, 13920.

Design of Beams: Analysis and design of singly reinforced rectangular beams, Lintel, Cantilever, Simply supported and continuous beams.

Unit-II Design of Beams:

Doubly reinforced and Flanged Beam. Design for Shear and design for bond.

Unit-III Design of Slabs:

Slabs spanning in one direction, (Cantilever, Simply supported and Continuous slabs); Slabs spanning in two directions, Circular slabs.

Unit-IV Columns & Footing:

Short and long columns. Columns subjected to axial loads and bending moments (section with no tension). Isolated and combined footings, Strap footing. Raft foundation.

Unit-V Staircases:

Staircases with waist slab having equal and unequal flights with different support conditions, Tread-riser staircase.

HEAD

Course Code: 110503

Course Name: Fluid Mechanics - II

L	T	P	Credit
2	1	2	4

Course Objectives:

1) To develop an understanding of fluid flows patterns and learnto use boundary layer theory and drag.
2) To apply theories of laminar & turbulent flow to solve typical pipe flow problems in the field.
3) To apply boundary layer theory to estimate drag &lift for various shapes of the objects.
4) To classify the types of flows in open channel and also to design open channel sections in a most economical fashion with minimum wetted perimeter and learn about critical flows.
5) To study about non uniform flows in open channel and longitudinal slopes in open channel and also to learn about the characteristics of hydraulic jump.
6) To understand design philosophy of various types of pumps &turbines.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Differentiate** different types of fluid flow & fluid machinery.	Skill development
2.	**Describe** principles of analysis of fluid flow problem.	Skill development
3.	**Explain** basic principles for measurement of different forces acting on fluid body.	Skill development
4.	**Analyse** pipe flow, open channel flow problems & various characteristics of hydraulic machines.	Skill development &employability
5.	**Design** open & closed conduit systems.	Skill development &employability

Syllabus:

Unit-I

Turbulent Flow: Laminar and turbulent boundary layers and laminar sub layer, hydro dynamically rough boundaries, velocity distribution in turbulent flow, Resistance of smooth and artificially roughened pipes, Commercial pipes, aging of pipes.

Pipe Flow Problems: Losses due to sudden expansion and contraction, losses in pipe fittings and valves, Concepts of equivalent length, Hydraulic and energy gradient lines, Siphon, Pipes in series, in parallel, Branching of pipes.(Hardy Cross method)

Pipe Network: Water hammer (only quick closure case) transmission of power.

Unit - II Forces on immersed bodies:

Introduction, Force Exerted by a flowing fluid on a stationary body, Expression for Drag & Lift, Drag on a sphere, Terminal velocity of a Body, Drag on a cylinder. Introduction to Development of Lift on a Circular Cylinder and an Airfoil

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Unit – III Uniform Flow in open Channels:

Channel geometry and elements of channel section, Velocity distribution, Energy in open channel flow, Specific energy, Types of flow, Critical flow and its computations, Uniform flow and its computations, Chezy's and Manning's formulae, Determination of normal depth and velocity,

Normal and critical slopes, Economical sections.

Unit - IV Gradually varied flow

Basic assumptions and dynamic equations of gradually varied flow, characteristics analysis and computations of flow profiles, rapidly varied flow-hydraulic jump in rectangular channels and its basic characteristics, Surges in open channels, Energy Dissipators.

Unit - V Introduction to Fluid Machinery: Turbines & Pumps

Turbines: Classifications, definitions, Similarity laws, Specific speed and unit quantities, Pelton turbine – their construction and settings, Speed regulation, Dimensions of various elements. Action of jet, Torque, Power and efficiency for ideal case, Characteristics curves. Reaction turbines construction & setting, Draft tube theory, Runaway speed, Simple theory of design and characteristic curves, Cavitation.

Pumps: Principle of working & criteria for selection of different types of pump, viz. Centrifugal, Reciprocating.

Text Books:

1. Fluid Mechanics, Modi & Seth, Standard Book house, Delhi, 21st edition, 2017
2. Open Chanel Flow, K. Subramanya, Tata McGraw Hill, New Delhi, 5th edition, 2019

Reference Books:

1. Open Channel Flow, Rangaraju, Tata Mc Graw Hill Publishing Comp. Ltd., New Delhi, 1st edition, 2001
2. Fluid Mechanics, A.K. Jain, Khanna Publishers, Delhi, 1988
3. Fluid Mechanics, Hydraulics & Hydraulic Mechanics, K.R. Arora, Standard Publishers, 2009
4. Open Channel Hydraulics, Chow V.T., McGraw Hill, New York, 57th edition, 2009

List of Experiments:

1. To determine the performance characteristics of Pelton Wheel.
2. To determine the performance characteristics of Francis Turbine.
3. To determine the performance characteristics of Kaplan Turbine.
4. Calibration of multistage (Two) Pump & Study of characteristics of variable speed pump.
5. To determine the coefficient of discharge for rectangular notches.
6. To determine the coefficient of discharge for triangular notches.
7. To determine the characteristics of the Reciprocating pump at variable speed.
8. To prepare the calibration curve for rotameter.

Upon completion of the course, the students will be able to:

CO 1: Differentiate between turbines & pumps.

CO 2: Select the efficient turbines by studying the performance characteristics of various turbines.

CO 3: Distinguish the performance characteristics of various pumps.

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Course Code: 110509

Course Name: Environmental Engineering

L	T	P	Credit
2	1	2	4

Courses Objectives:

Students will be able to understand

1) The structure of drinking water supply systems, including water transport, treatment and distribution.
2) Water quantity and water quality criteria and standards, and their relation to public health.
3) Operation and maintenance of water supply system components.
4) How to estimate water requirement of a city.
5) How to design water treatment plant for urban & rural areas.
6) How to design water distribution network including pipe appurtenances.
7) To impart basic knowledge on sewerage system including estimation of sewage quantity and design of sewer.
8) To provide a broad knowledge on sewage composition and its characteristics.
9) To provide information on disposal standard of effluents and also about various methods of sewage disposal.
10) To provide broad knowledge on various techniques of sewage treatment including and advanced treatment process.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts of water supply and waste water engineering.	Skill development
2.	**Determine** the requirements for safe supply of water and safe disposal of sewage.	Skill development
3.	**Apply** suitable techniques for water & waste water treatment.	Skill development
4.	**Analyse** a given water supply scheme and a given sewerage system.	Skill development &employability
5.	Design a water supply system based upon the needs of society and sewage system for safe disposal of sewage.	Skill development &employability

Syllabus:

Unit-I

Water demand (types, variation, factors affecting it), Design period, Population forecasting methods, Intake structures (location, types), Characteristics of water, Water borne diseases, IS Standard of drinking water.

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Unit-II

Water treatment plant flow diagram, Design, construction and working of Screens, Grit, sedimentation tank, Clariflocculator, Filters (Slow sand filters, Rapid sand gravity filters and Pressure filters), Methods of disinfection, Hardness (causes and types), Methods of water softening, Removal of colour, odour and taste from water, Removal of iron and manganese, Algae removal,

Fluoridation and De-fluoridation.

Unit-III

Distribution system (requirements, layout and methods of distribution), Distribution reservoir (types and its capacity determination), Fixing size of pipes, Analysis of pipe networks (Hardy cross method and Equivalent pipe method), Appurtenances used in distribution networks, Water supply & plumping system used in buildings, Rural water supply.

Unit – IV

Sewerage schemes & sewerage system and their importance, Collection & conveyance of sewage, Fluctuation in sewage flow, Design of sewer, Sewer appurtenances, Pumps & pumping stations, Characteristics and analysis of sewage (physical, chemical, biological parameters), BOD & COD, Methods of sewage disposal i.e. on land or by dilution, Self-purification capacity of river/stream.

Unit-V

Treatment of sewage (preliminary, primary, secondary and tertiary treatment), Design and working principles of screens, Grit chamber, Primary settling tank, Sewage filtration, Activated Sludge Process, Oxidation pond, Aerated lagoon, Anaerobic lagoon, Septic tank &Imhoff tank, Rotating Biological Contactor, Removal of Nitrogen and Phosphorus, Source and treatment of sludge, Sludge thickening and digestion, Sludge drying beds, Sludge disposal, Sewage treatment plants using MBBR and SBR technology.

Text Books:

1. Water Supply Engg., B. C. Punmia, Laxmi Publication (P) Ltd. New Delhi, 2016
2. Water Supply Engg. (Vol. I), S. K. Garg, Khanna Publishers, New Delhi, 2017
3. Sewage disposal and pollution Engg. (Vol. II). S.K. Garg, Khanna Publishers, New Delhi, 2017

Reference Books:

1. Water Supply & Sanitary Engg., G.S. Birdie, Dhanpat Rai Publishing Company,2014
2. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, 6th edition,2008
3. Environmental Engineering, Peavy, Rowe & Tchobanoglous, McGraw Hill Publication,2017
4. Manual of Water Supply and Treatment by CPHEEO, GOI, 2009
5. Manual on Sewerage & Sewerage Treatment by CPHEEO, GOI, 2013.

List of Experiments:

1. Determination of pH of a given water sample and waste water sample.
2. Determination of Total Solids, Dissolved Solids and Suspended Solids of water and waste water sample.
3. Determination of Chloride concentration in water and waste water sample.
4. Determination of turbidity of water and waste water sample using turbidity meter.
5. Determination of acidity and alkalinity of the water and waste water sample.
6. Determination of Hardness of the water sample and waste water sample.
7. Determination of D.O. of the water and waste water sample.
8. Determination of optimum dose of coagulants required for the treatment of a given water sample.
9. Determination of MPN of the given water sample and waste water sample.

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10. Determination of BOD of a given water and waste water sample.
11. Determination of COD of a given waste water sample.
12. Determination of sulfate and nitrate of given water and waste water sample.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Follow sampling procedure & other guidelines for sampling & analysis of water and wastewater samples.

CO 2: Check various water and waste water quality parameters.

CO 3: Improve the water and waste water quality by suggesting suitable corrective measures.

CO 4: Train others on various ways of improving the quality of water and waste water.

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Course Code: 110505

Course Name: Transportation Engineering

L	T	P	Credit
2	1	2	4

Course Objectives:

1) To study the planning aspects of roads & highway.
2) To study the geometric design aspects of highway and road.
3) To know about pavement material and design.
4) To understand the construction process and methods of roads & highway.
5) To study about traffic characteristics and design of intersections.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the principles of highway planning & their geometrical design.	Skill development
2.	**Evaluate** physical properties of suitable highway engineering materials with drainage provisions.	Skill development
3.	**Apply** the concepts of traffic engineering in transportation planning.	Skill development &employability
4.	**Design** pavements as per regulations.	Skill development &employability
5.	**Formulate** the layers of pavement along with provisions of its drainage & maintenance.	Skill development &employability

Syllabus:

Unit – I Highway Development and Planning

Highway Development in India — Necessity for Highway Planning – Different Road Development Plans; Classification of Roads. Road Network Patterns — Highway Alignment- Factors affecting Alignment- Engineering Surveys.

Unit – II Highway Geometric Design

Importance of Geometric Design – Design controls and Criteria – Highway Cross Section Elements – Sight Distance Elements – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance – Design of Horizontal Alignment – Design of Super elevation and Extra widening – Design of Transition Curves – Design of Vertical alignment - Gradients- Vertical curves.

Unit – III Traffic Studies

Spot Speed Studies and Volume Studies, Speed and Delay Studies purpose, causes of delay, methods of conducting speed and delay studies, Origin and destination Studies (O & D): various methods, collection and interpretation of data, Traffic Capacity Studies: Volume, density, basic practical and possible capacities, level of service, Parking Studies: Methods of parking studies, design of intersections at grade & grade separated.

Unit -IV

Highway Construction Materials: Aggregates and their types, physical and engineering properties, Fillers, Bitumen, Characteristics, Emulsions and cutbacks, Basic tests on all materials.

Design of Flexible & Rigid Pavements: Introduction, flexible pavement, factors affecting design and performance, stress in flexible pavement, design of flexible pavement as per IRC, rigid pavements – components & functions, factors affecting design & performance of CC pavements, stress in rigid pavement, type of joints, dowel bar, tie bar and its functionalities.

Unit – V Evaluation and Maintenance of Pavements

Pavement distress in flexible and rigid pavements, Pavement evaluation, structural evaluation, evaluation by deflection measurements, Strengthening of pavements, Types of maintenance, Importance of highway drainage, Surface and sub-surface drainage arrangements.

Course Outcomes:

Text Books:

1. Highway Engineering, S.K. Khanna & C.E.G. Justo, Nemchand Pub., 10th edition, 2018
2. Highway Engineering, Gurucharan Singh, Standard Publishers, 5th edition, 2006
3. Principles & Practices of Highway Engineering, L R Kadiyali, N B Lal, Khanna Publishers, 2016

Reference Books:

1. Principles of Pavement Design, E.J. Yoder & M.W. Witzech, Wiley India, 2ndedition, 2011
2. Highway Engineering, O' Flaherty, Butterworth-Heinemann, 4thedition, 2002
3. Principles of Practice of Highway Engg., Sharma & Sharma, Asia Publishing House, 1965
4. Analysis and Design of Pavements, Haung, Pearson, 2nd edition, 2004

List of Experiments:

1. Aggregate Crushing Value Test
2. Determination of Aggregate Impact Value
3. Determination of Los Angeles Abrasion Value
4. Determination of flakiness index and elongation index of aggregates.
5. Determination of California Bearing Ratio Value
6. Determination of Penetration Value of Bitumen
7. Determination of Viscosity of Bituminous Material
8. Determination of Softening Point of Bituminous Material
9. Determination of Ductility of the Bitumen
10. Determination of Flash Point and Fire Point of Bituminous Material
11. Determination of Bitumen Content by Centrifuge Extractor
12. Determination of Stripping Value of Road Aggregate
13. Determination of Marshall Stability Value for Bitumen.

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Upon completion of the course, the students will be able to:

CO 1: Select suitable aggregate material by testing the physical properties.

CO 2: Determine properties of bitumen and its grade.

CO 3: Determine CBR value of material for subgrade and subsequent layers of pavement.

CO 4: Design job mix formula for bituminous surface using Marshal Stability test.

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Course Code: 110506

Course Name: Minor Project - I

L	T	P	Credit
0	0	2	1

Course Objectives:

1) To develop an appreciation of civil engineering problems & have a feel of real life situations in planning & execution of projects.
2) To impart training of handling various types of civil engineering problems by use of conventional methods as well as software's.
3) To utilize the expertise in engineering to solve industry's technological problems.
4) To become innovative and professional in technology development, and system implementation.
5) To be able to function in their profession with social awareness and responsibility.
6) To be able to interact with their peers in industry and society as engineering professionals and leaders & inculcate a habit of working in a group.
7) Enable students to prepare professional reports for design projects and data presentation skill and to use computers and some computergraphics.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Recognize** various engineering problems and techniques to solve them.	Skill development
2.	**Reproduce** the solution of the problems upon the need of society.	Skill development
3.	**Cooperate** to work within group.	Skill development &employability
4.	**Develop** the writing and communication skills for various engineering problems.	Skill development &employability
5.	**Display** lifelong learning.	Skill development &employability

Syllabus:

Each candidate shall work on an approved project of a public building or any other civil engineering work and shall submit design and a set of drawings.

OR

Shall submit a detailed report of experimental work / software package on any specific problem of importance.

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Course Code: 110507

Course Name: Summer Internship Project - II

L	T	P	Credi
0	0	6	3

Course Objectives:

1) To make student acquire good oral & written communication skills.
2) To promote the habit of lifelong learning.
3) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Develop** the writing and communication skills for various engineering problems.	Skill development
2.	**Adapt** lifelong learning for benefit of society.	Skill development, Entrepreneurship & Employability

Syllabus:

Each candidate shall have to undergo 15 days in house summer internship related to soft skills at the institute after the completion of their 4th Semester exams (in summer vacations) and after successful completion of internship they have to submit detailed report.

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Course Code: 110508

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	1

Course Objectives:

1) To encourage students to read, study & understand different topics of civil engineering published in articles,literatures.
2) To help in presenting different topics of civil engineering and related subjects to supplement theoretical knowledge gained inclass.
3) To make student acquire good oral & written communicationskills.
4) To promote the habit of lifelonglearning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Analyze** contemporary issues in civil engineering & its allied areas through literature survey.	Skill development
2.	**Distinguish** state of art & relevance of the topic in national & international arena.	Skill development
3.	**Demonstrate** good oral & written communication skills.	Skill development &employability
4.	**Develop** poster and power point presentations for effective communication.	Skill development &employability
5.	**Display** lifelong learning.	Skill development &employability

Syllabus:

Any relevant topic related to civil engineering from within or beyond the syllabus through Swayam / NPTEL/MOOC.

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Course Code: 110602
Course Name: Structural Design & Drawing (Steel)

L	T	P	Credit
3	1	0	4

Course Objectives:

1) To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections.
2) To understand the behavior of steel structural components subjected to gravityloads.
3) To study the design of bolted and welded connections.
4) To study the behaviour and design of compression and tension members using simple and built-up sections.
5) To understand behaviour of flexural members and the design laterally restrained & unrestrained beams.
6) To design plate girders &stiffeners.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the principles of steel structural design using relevant IS Codes.	Skill development
2.	**Evaluate** structural behaviour of different steel structural elements.	Skill development
3.	**Analyse** a given section of steel structural element using IS codes.	Skill development &employability
4.	**Design** different elements of steel structure under various loading conditions using relevant IScodes.	Skill development &employability
5.	**Design** a structure/ component to meet desired needs within realistic constraints such as economy, safety, viable construction & its sustainability as per codal provisions.	Skill development &employability

Syllabus:

Unit-I

Various loads, Partial Load factors, Structural properties of steel, Design of structural connections – Bolted and Welded connections, eccentric connection. Round tubular sections, grades, uses and sectional properties, connections in tubular structures, Codal provision.

Unit-II

Design of Tension members. Codal provision. Lug angles & Tension splices.

Unit-III

Design of Compression member, Design of columns-simple and compound, Lacings & Battens. Design of footings for steel structures, Slab base, gusseted base. Codal provision.

Unit-IV

Design of built up beams, web buckling and crippling, curtailment of flanges. Design of Laterally supported and unsupported beams, web buckling and crippling.Codal provision.

Unit-V

Design of plate girder.Curtailment of flanges, Design of stiffeners (bearing, Vertical and horizontal).

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Codal provision.

Text Books:

1. Limit State Design of Steel Structures, S. K. Duggal, McGraw Hill Publication, 3rd edition, 2017

Reference Books:

1. Design of Steel Structures, S. S. Bhavikatti, International Publishing House,2014
2. Design of Steel Structures, N. Subramanian, Oxford University Press India,2008

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Course Code: 110612

Course Name: Solid Waste Management

L	T	P	Credit
3	1	0	4

Course Objectives:

1) To provide broad knowledge on various aspects of planning & implementation of a solid waste management system in a city/town.
2) To understand the principles applied in solid wastemanagement.
3) To understand various ways to collect, treat & disposal of waste.
4) To understand various ways of energy recovery from waste.
5) To provide an insight into the principles of hazardous & other forms of waste management

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the principles & concepts of waste management.	Skill development
2.	**Apply** various techniques in collecting the waste.	Skill development
3.	**Apply** various techniques of reducing the waste.	Skill development &employability
4.	**Apply** various techniques in disposal of waste.	Skill development &employability
5.	**Plan** an effective & efficient waste management system	Skill development &employability

Syllabus:

Unit I:

Introduction to Waste Management, Objective of Solid Waste Management, Principle of Municipal Solid Waste Management, Functional Elements of Solid Waste Management, Salient features of various Indian legislations for waste management (SWM rules, HWM rules, BMW rules etc), Current Scenario of Waste Management in India – Introduction to SBM, Classification of solid waste, composition, Physical, chemical & biological properties of municipal solid waste, Quantity of solid waste, Sampling & analysis of solid waste.

Unit II:

Handling of waste at source, source segregation, Collection, conveyance, separation & recycling of solid waste: Types of collection system, Collection routes, equipment's, transfer station, transport methods, material separation & recycling of MSW.

Unit III:

Disposal of solid waste by Land fill method; Classification, type, method, site consideration composition and control of gases, Leachate control inland fills, surface water management, landfill operation & care. Remediation of old landfill sites.

Unit IV:

Processing of solid waste: Thermal conversion technologies, Incineration, Pyrolysis gasification, environmental control system. Biological & Chemical conversion technologies, aerobic composting, anaerobic digestion, other biological and chemical transformation.

Unit V:

Introduction to hazardous waste, handling, treatment & disposal of hazardous waste. Introduction to Biomedical waste management process - disposal of Biomedical waste with special focus on current scenario

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of covid-19 waste, E-Waste & Plastic Waste management.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the principles & concepts of waste management.

CO 2: Apply various techniques in collecting the waste.

CO 3: Apply various techniques of reducing the waste.

CO 4: Apply various techniques in disposal of waste.

CO 5: Plan an effective & efficient waste management system

Text Books:

1. Text Book of Solid Wastes Management, Iqbal H. Khan and Naved Ahsan, CBS Publishers, 1st edition 2012
2. Integrated Solid Waste Management, Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, McGraw Hill Yew York, 1993

Reference Books:

1. Environmental Engineering, Rowe, Peavy & Tchobanogolous, Tata McGraw Hill Publications, 2017
2. CPHEEO, Manual on Municipal Solid Waste management, Central Public Health and Environmental Engineering organization, Government of India, New Delhi,2016
3. Solid waste Engineering, Vesilind P.A., Worrel H. W. and Reinhard, Thomson Learning Inc, 2003

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Course Code: 110613
Course Name: Construction Planning & Management

L	T	P	Credit
3	1	0	4

Course Objectives:

1) To make student conversant with the concepts and importance of the subject of construction planning & management.
2) To provide a broad knowledge on how to make bar chart, work break structure of a project, schedules.
3) To provide a broad knowledge on how to analyze a problem using various techniques of project management like CPM, PERT & optimization of time & cost of a project.
4) To provide an insight into various types of machinery used in construction works & various concepts of man & material management.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts of construction planning & management process.	Skill development
2.	**Describe** various techniques used in construction planning & management.	Skill development
3.	**Apply** techniques of project planning & management.	Skill development &employability
4.	**Analyze** various problems of time & cost optimization using network techniques like CPM &PERT.	Skill development &employability
5.	**Plan** effectively for manpower & material management in a project along with suitable safetymeasures.	Skill development &employability

Syllabus:

Unit I

Modern management techniques: An overview of planning process, planning through Bar Charts and Milestone charts, Network techniques, Basic concept of network preparations, CPM and PERT techniques with network analysis.

Unit II

Construction management: Principles of construction management, Planning for Job Layout, Advantages of Job Layout, Scheduling Techniques of Construction Project.

Unit III

Construction equipment's: Factors affecting selection, investment and operating cost, Efficiency and capacity rating of various equipment's, study of equipment's required for various jobs such as earthwork, dredging, conveyance, concreting, hoisting, pile driving, compaction and grouting. Equipment Management.

Unit IV

Time & Cost Optimization using Network Techniques: Time computations using CPM & PERT, Probability of achieving completion time, Project cost, Direct & Indirect cost, Cost vs. Time curves, Total

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project cost & optimum duration, Contracting the network for cost optimization, Time cost optimization

Unit V

Site Organization & Manpower management: Introduction of site organization, types of organization, organization chart & manuals, Manpower Management, Labour laws (Compensation Act etc.) & Human relations, Welfare facilities, Safety Management.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of construction planning & management process.

CO 2: Describe various techniques used in construction planning & management.

CO 3: Apply techniques of project planning & management.

CO 4: Analyze various problems of time & cost optimization using network techniques like CPM & PERT.

CO 5: Plan effectively for manpower & material management in a project along with suitable safety measures.

Text Books:

1) K. K. Chitkara, Construction Project Management, McGraw Hill International Publishers. ,

2) B. C. Punmia & K. K. Khandelwal, Project Planning & Control with PERT & CPM, Laxmi Publishers.

3) U.K. Shrivastava, Construction Planning & Management.

4) Neeraj Kumar Jha, Construction Project Management, Pearson Publishers.

Reference Books:

1) Gahlot & Dhir, Construction Management, New Age International Publishers.

2) L.S. Srinath, PERT & CPM – Principles & Applications, East West Press.

3) Sengupta & Guha, Construction Management & Planning, McGraw Hill Publishers.

4) Peurify, Construction Equipment.

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Course Code: 110614

Course Name: Railway, Airport & Tunnel Engineering

L	T	P	Credit
3	1	0	4

Course Objectives:

1) To understand the requirements of airport, runway & taxi – way.
2) To understand the requirement of lighting & signal & traffic control at airports.
3) To understand the geometrical elements of railway track.
4) To understand the properties of good ballast.
5) To understand the track alignment, super elevation, turnout, yards.
6) To understand the principles of signalling & interlocking.
7) To understand the construction of tunnels.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the elements of airport planning, bridges & tunnels.	Skill development
2.	**Design** runway & taxiway system as per regulations.	Skill development
3.	**Explain** various elements of railway tracks, signalling, yards, bridges & tunnels.	Skill development & employability
4.	**Illustrate** various gauge, signals, fasteners, turnouts, crossing etc.	Skill development & employability
5.	**Apply** construction methods of railway tunnels.	Skill development & employability

Syllabus:

Unit-I Introduction to Railway Engineering

Tractive resistance & Permanent way, Principles of Transportation, Transportation by Road, Railways, Airways, Waterways, their importance and limitations. Route surveys and alignment, railway track, development and gauges. Hauling capacity and tractive effort.

(i) Rails- types, welding of rails, wear & tear of rails, rail creep ultrasonic Testing of Rails.
(ii) Rail fastenings- types – Fishplates, spikes bearing plates, chairs, keys, check and guard rails, Elastic Rail Clips (ERC), Vossloh fastening.
(iii) Sleepers, types & comparison, requirement of a good sleeper, sleeper density, Turnouts.
(iv) Ballast –Requirement of good ballast, various materials used as ballast, quantity of ballast, Ballast Cleaning.

Different methods of plate laying, material trains, calculation of materials required, relaying of track.

Unit-II

Track alignment, Geometrical Design, Gradient & gray compensation, Super Elevation, Equilibrium, Cant and Cant deficiency, relationship of super elevation, gauge, speed & radius of curves, speed on curves, Limits of super elevation, Cant deficiency, Negative super elevation, curves, transition curves, necessity of points and crossing. Turnouts, Points of switches, Types of switches, crossing, calculation of turnouts, sleepers at points &crossing. Types of Track junctions. Types, locations, general equipments, layouts, marshalling yards. Definition, layout details, designs of simple turnouts.

Stations and Yards: Site selection for a Railway stations, Requirements of railway stations, junction

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station &terminals, location, layout & details, Types of signals in stations and yards, principles of signaling and inter-locking, Modern development in railways, Modernization of track for high speed, Maintenance of track, Track drainage.

Unit – III Airport Planning, Runway & Taxiway

Airport site selection. air craft characteristic and their effects on runway alignments, wind rose diagrams, basic runway length and corrections, classification of airports. Geometrical elements: taxi ways and runways, pattern of runway capacity.

Unit – IV Airport, Obstructions, Lightning & Traffic control

Zoning regulations, approach area, approach surface-imaginary, conical, horizontal. Rotating beacon, boundary lights, approach lights, runway and taxiway lighting etc. instrumental landing system, precision approach radar.

Unit-V Tunnels

Selection of route, Engineering surveys, alignment, shape and size of tunnel, bridge action, pressure relief phenomenon, Tunnel approaches, Shafts, pilot shafts , Construction of tunnels in soft soil, hard soil and rock, Different types of lining, methods of lining. Mucking operation, Drainage and ventilation, Examples of existing important tunnels in India and abroad.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the elements of airport planning, bridges & tunnels.
CO 2: Design runway & taxiway system as per regulations.
CO 3: Explain various elements of railway tracks, signalling, yards, bridges & tunnels.
CO 4: Illustrate various gauge, signals, fasteners, turnouts, crossing etc.
CO 5: Apply construction methods of railway tunnels.

Text Books:

1. Airport Planning & Design, S. K. Khanna & M. G. Arora, Nem chand Publishers, 6th edition, 1999
2. Railway Engineering, Arora & Saxena, Dhanpat Rai & Sons, 2010

Reference Books:

1. Airport Planning, Froesch, Charles, Andesite Press, 2017
2. The Planning & Design of Airports, Horonjeff Robert, MHE, 5th edition, 2010
3. Railway Engineering, S.C. Rangwala, Charotar Publication House, Anand, 2012
4. Railway Tack, K.F. Antia, New Book Company, 5th edition, 1960

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Course Code: 900121

Course Name: Sustainable Materials & Green Buildings

L	T	P	C
2	1	-	3

Course Objectives:

1. To expose the students to the concepts of sustainability in the context of building and conventional engineered building materials, such as Concrete, Bricks, and achieving the same through lower Carbon cements, Superior brick kilns and Recycled aggregate minimizing consumption of natural resources including water
2. To study the concepts of VOC and indoor air quality.
3. Exposing the student to concepts of embodied, Operational and Life Cycle Energy, Minimizing Energy consumption by optimal design, use of BIPV.
4. The course also intends to make student aware of ECBC, LEED, GRIHA etc.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Apply** the concepts of sustainability in the context of building and conventionalengineered building materials.	Skill development
2.	**Explain** the Concepts of VOC and indoor air quality.	Skill development
3.	**Apply** the concepts of embodied, Operational and Life Cycle Energy, MinimizingEnergy consumption by optimal design, use of BIPV.	Skill development & employability
4.	**Apply** the guidelines of ECBC, LEED, GRIHA while planning a building.	Skill development & employability
5.	**Use** renewable energy sources in buildings.	Skill development & employability

Syllabus:

Unit-I

Embodied energy, Operational energy in Building and Life cycle energy. Ecological foot print, Bio-capacity and calculation of planet equivalent.

Unit-II

Role of Material: Carbon from Cement, alternative cements and cementitious material, Alternative fuel for cements for reduction in carbon emission. Sustainability issues for concrete. Role of quality, minimization of natural resource utilization, High volume fly ash concrete, geo-polymer concrete etc. concrete with alternative material for sustainability.

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Unit-III

Reduction in water consumption in concrete, Recycled aggregate, Energy for grinding crushing of cement aggregate etc. and reduction. Operational energy in building role of materials and thermal conductivity. Clay Bricks, Types kilns, Comparative energy performance emission performance

and financial performance, Indoor air quality.

Unit-IV

Paints, Adhesive and sealants for use in building, Volatile organic content (VOC) emission issues and indoor air quality for Sustainability and Health hazard. Operational energy reduction and net zero building, Optimization for design of building for energy efficiency and example of optimization through use of Evolutionary genetic algorithm.

Unit-V

Radiation budget, Surface water balance, Effects of trees and microclimatic modification through greening, Use of Building Integrated Photo Voltaic (BIPV) and other renewable energy in buildings, basic concepts and efficiency. Energy codes ECBC requirement, Concepts of OTTV etc, Green Performance rating, requirements of LEED, GRIHA.

Course Outcome:

Upon completion of the course, the students will be able to:

CO1: Apply the concepts of sustainability in the context of building and conventional engineered building materials.

CO2: Explain the Concepts of VOC and indoor air quality.

CO3: Apply the concepts of embodied, Operational and Life Cycle Energy, Minimizing Energy consumption by optimal design, use of BIPV.

CO4: Apply the guidelines of ECBC, LEED, GRIHA while planning a building.

CO5: Use renewable energy sources in buildings.

Text Book:

1. Sustainable Construction: Green Building Design and Delivery, John wiley & sons, 2005.
2. Building Reuse: Sustainability, Preservation, and the Value of Design by Kathryn Rogers Merlino, University of Washington Press, 2018.

Reference Books:

1. Natural Design, Organic Architecture: Lessons for Building Green by Frank Lloyd Wright, Rizzoli; Illustrated edition

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Course Code: 900120

Course Name: Building Services & Maintenance

L	T	P	C
2	1	-	3

Course Objectives:

1. To learn about building services required in a building.
2. To learn about fire fighting systems in buildings.
3. To understand planning and maintenance requirements of lifts in high rise buildings.
4. To understand water management and planning system in a building.
5. To learn maintenance of building services and management of related tasks.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Identify** various services required in a building.	Skill development
2.	**Carry** out planning of fire fighting system for a building.	Skill development
3.	**Develop** a management strategy for maintenance of building services in a building.	Skill development & employability
4.	**Design** a sustainable building services plan for a building.	Skill development & employability

Syllabus:

Unit I

Introduction: Introduction to primary services in a building, Type of services required to keep facility usable, planning of services. Organization structures of services management. Role and administrative functions of supervisors. Outline of the concept of carbon trading and self sustainable zero carbon building. Importance

Unit II

Fire Fighting: Standard fire, fire resistance, classification of buildings. Basic requirement of the works for fighting system, various components of the fire fighting system. Maintenance required of the system, fire fighting in high-rise buildings, commercial/industrial complexes. Public buildings, checklist for fire safety. Provision of NBC.

Unit III

Lifts/Elevators, Escalators: Legal formalities for elevators, various types of lifts, working mechanisms of lift and escalators. Indian standard codes for planning & installations of elevator, inspection & maintenance of lifts.

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Unit IV

Plumbing Services Water Supply System: Basics of Plumbing systems. Requirement of Plumbing work, Agency, Activity flow chart for plumbing work. Quality checking of materials. Water supply and

distribution system is high-rise building & other complexes, pumps and pumping mechanisms. Operation & maintenance of fittings & fixtures of water supply & sanitary. Do's & Don'ts for water pipe networks.

Unit V

Maintenance and management of services: Telecommunication network, computer network LAN, Electrical network & appliances. Basics of single phase & three phase electrification, precautions and safety measures during electrification. Indian standard codes for electrical appliances & wiring operations & maintenance of network & appliances. Landscaping & Horticulture. Building maintenance management, applications of computer in service management. Flowcharts of air conditioning & heating. Centralised systems, monitoring and working of the equipments, Checklist of inspection, Performance testing. Water proofing. Damp proofing & Termite proofing. Working procedure & stages of work of water proofing for W.C., Bathrooms, Terrace, sloping roof, Basements, tanks. Use of chemicals for water proofing treatment.

Course Outcome:

Upon completion of the course, the students will be able to:

CO1: Identify various services required in a building.

CO2: Carry out planning of fire fighting system for a building.

CO3: Develop a management strategy for maintenance of building services in a building.

CO4: Design a sustainable building services plan for a building.

Reference Books:

1. Building services Design and Management by Jakie Partman, Willey Blackwell 2014.
2. Building Services Engineering by David V .Chadderton, Routledge 2013.

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Course Code: 100007

Course Name: Disaster Management

L	T	P	C
3	-	-	3

Course Objectives:

i) To understand basic concepts in Disaster Management
ii) To understand Definitions and Terminologies used in Disaster Management
iii) To understand Types and Categories of Disasters
iv) To understand the Challenges posed by Disaster
v) To understand Impact of Disasters key skills

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Identify** disaster prevention and mitigation approaches.	Skill development
2.	**Classify** global and national disasters, their trends and profiles.	Skill development
3.	**Determine** the impacts of various disasters.	Skill development & employability
4.	**Apply** Disaster Risk Reduction in management.	Skill development & employability
5.	**Infer** the linkage between disasters, environment and development.	Skill development & employability

Syllabus:

Unit 1: Introduction to disaster management, concepts and definitions: disaster, vulnerability, risk severity, frequency and details, capacity impact, prevention, mitigation.

Unit 2: Disasters – Disasters classification, demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends, hazard and vulnerability profile of India.

Unit 3: Disaster Impacts – Disaster impact (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues, impact of natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides etc.), impact of manmade disasters (industrial pollution, artificial flooding in urban areas, urban disasters, transportation accidents etc.).

Unit 4: Disaster Risk Reduction (DRR)- Disaster management cycle- its phases; prevention, mitigation, preparedness, relief and recovery; structural and non- structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response. Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders: Policies and legislation for disaster management. DRR programmes in India and the activities of National Disaster Management Authority.

Unit 5: Disasters, Environment and Development – Factors affecting vulnerability such as impact of development projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

Course Outcomes:

After successful completion of the course, the students will be able to

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CO1: Identify disaster prevention and mitigation approaches.
CO2: Classify global and national disasters, their trends and profiles.
CO3: Determine the impacts of various disasters.
CO4: Apply Disaster Risk Reduction in management.
CO5: Infer the linkage between disasters, environment and development.

Text Books:

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
3. Srivastava H.H. & Gupta G.D., Management of Natural Disasters in developing countries, Daya Publishers Delhi, 2006.

Reference Books:

1. http://ndma.gov.in (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in / (National Disaster Management in India)
3. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
4. National Disaster Management Policy, 2009, GOI.
5. Inter Agency Standing Committee (IASC) (Feb. 2007), IASC Guidelines on Mental Health and Psychosocial Support in Emergency Setting. Geneva: IASC

Course Code: 110607

Course Name: Minor Project - II

L	T	P	Credit
0	0	4	2

Course Objectives:

1) To develop an appreciation of civil engineering problems & have a feel ofreal life situations in planning & execution of projects.
2) To impart training of handling various types of civil engineering problems by use of conventional methods as well as software's.
3) To utilize the expertise in engineering to solve industry's technological problems.
4) To become innovative and professional in technology development, and system implementation.
5) To be able to function in their profession with social awareness and responsibility.
6) To be able to interact with their peers in industry and society as engineering professionals and leaders & inculcate a habit of working in a group.
7) Enable students to prepare professional reports for design projects and data presentation skill and to use computers and some computer graphics.

Course outcomes focused on employability/entrepreneurship/skill development

S.No.	Course Outcomes (Co's)	Mapping
1.	**Recognize** various engineering problems and techniques to solve them.	Skill development
2.	**Reproduce** the solution of the problems upon the need of society.	Skill development
3.	**Cooperate** to work within group.	Skill development & employability
4.	**Develop** the writing and communication skills for various engineering problems.	Skill development & employability
5.	**Display** lifelong learning.	Skill development & employability

Syllabus:

Each candidate shall work on an approved project of a public building or any other civil engineering work and shall submit design and a set of drawings.

OR

Shall submit a detailed report of experimental work / software package on any specific problem of importance.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Recognize various engineering problems and techniques to solve them.
CO 2: Reproduce the solution of the problems upon the need of society.
CO 3: Cooperate to work within group.
CO 4: Develop the writing and communication skills for various engineering problems.
CO 5: Display lifelong learning.

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Course Code: 110713

Course Name: Advanced Structural Design (R.C.C.)

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To understand the behavior of RC structures like Retaining wall, Water tanks, Highway Bridges and prestressed concrete beams.
2) To apply the codal provision for estimation of loads on Retaining wall, Water tanks, Highway Bridges and prestressed concrete beams sections
3) To know analysis of Retaining walls, Water tanks, Highway Bridges and prestressed concrete beam sections subjected to realistic loads.
4) To learn design of Retaining walls, Water tanks, Highway Bridges and prestressed concrete beam sections using Codal provisions.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the structural behaviour of water retaining structures; earth retaining structures; bridges and Prestressed concrete structures.	Skill development
2.	**Determine** design forces in water retaining structures; earth retaining structures; highway bridges; andPrestressed sections.	Skill development
3.	**Analyse** the water retaining structures; earth retaining structures; highway bridges and Prestressedsections for realistic loadings.	Skill development/ employability
4.	**Design** economic and safe water retaining structures; earth retaining structures; highway bridges andPrestressed sections as per Codal provisions.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Design of Water Tanks:

General design requirements; Design of circular tanks resting on ground; Design of rectangular tanks resting on ground; Design of under ground tanks.

Unit-II

Over Head Water tanks and Flat Slabs:

Overhead Tank: Intze type (Membrane analysis only), Design of Staging

Design of Flat slabs: (i) Direct design method and (ii) Equivalent frame method; Design Shear.

Unit-III

Earth Retaining Structures:

Types of retaining walls, Stability of retaining walls, Design of Cantilever type retaining wall; Design of Counterfort type retaining walls.

Unit-IV

Design of Bridges:

IRC loading for highway bridges, Design of Slab bridges for IRC Loads; Design of T-beams bridges for IRC Loads.

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Unit-V

Prestressed Concrete:

Prestressing concepts, materials; systems of prestressing; prestress losses. Introduction to working & limit state design method for prestress beam sections.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain the structural behaviour of water retaining structures; earth retaining structures; bridges and Prestressed concrete structures.

CO2: Determine design forces in water retaining structures; earth retaining structures; highway bridges; and Prestressed sections.

CO3: Analyse the water retaining structures; earth retaining structures; highway bridges and Prestressed sections for realistic loadings.

CO4: Design economic and safe water retaining structures; earth retaining structures; highway bridges and Prestressed sections as per Codal provisions.

Reference Books:

1. Plain and Reinforced Concrete by O.P. Jain and Jai Krishna Vol. I & II, Nem Chand & Bros, Roorkee
2. Reinforced Concrete Limit State Design by Ashok K. Jain, Nem Chand & Bros, Roorkee.
3. Reinforced Concrete Design by S. U. Pillai and D. Menon, Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. Essentials of Bridge Engineering by D.J. Victor, Oxford and IBH publishers.
5. Design of Bridges by N.K. Raju, CBS Publishers
6. Prestressed Concrete by N.K. Raju, CBS Publishers
7. Advanced Reinforced Concrete Design by P. C. Varghese, Prentice Hall of India publisher
8. Prestressed concrete by T.Y. Lin & N.H. Burns, Wiley publisher

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Course Code: 110714
Course Name: Hydraulic Structure

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To study the different aspects of design of hydraulic structures.
2) To build the necessary theoretical background for the selection of a suitable site for a dam and a suitable dam for a given site location.
3) To emphasize on the basic design principle of the gravity dam & earthen dam
4) To carry out the stability & seepage analysis of various types of dams.
5) To provide knowledge on various hydraulic structures such as energy dissipaters, spillways &gates & understand their designs.
6) To understand the design of cross drainage structures for uninterrupted water supply in naturalchannels and manmade canals.
7) To provide a basic knowledge on various types of hydropower plants and their components.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Identify** different components of hydro project.	Skill development
2.	**Explain** basic principles of designing hydropower plant & cross drainage works.	Skill development
3.	**Solve** problems of dam analysis, energy dissipators & cross drainage works.	Skill development/ employability
4.	**Evaluate** suitability of types of hydraulic structures.	Skill development, entrepreneurship & employability
5.	**Design** various elements of hydraulic structures.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I Gravity dams:
Design Criteria, forces acting on gravity dams, elementary profile, low and high gravity dams, stability analysis, evaluation of profile by method of zoning, practical profile, foundation treatment, construction joints, galleries in gravity dams.

Unit-II Earth and Rock fill dams:
Earth Dams: Types, causes of failure and design criteria, soils suitable for earth dam construction, construction methods, foundation requirements, typical earth dam sections, estimation of seepage through and below the dam, seepage control, stability of slopes by slip circle method, pore pressures, sudden draw down, steady seepage and construction pore pressure condition.
Rock fill dams: Types, merits and demerits, conditions favourable for their adoption

Unit-III Cross drainage works:
Types, selection of suitable type, design criteria, fluming of canal- Mitra & Chaturvedi methods. Design of Different types of CD works.

Unit-IV Spillways, Energy dissipators and gates:
Ogee spillway and its design, details of syphon, shaft, chute and side channel spillways, emergency spillways. Principles of energy dissipation, Energy dissipators based on tail water rating curve and jump

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height curves, Spillway crest gates – vertical lift and radial gates, their design principles and details.

Unit-V Hydropower Plants:
Hydropower development, assessment of power potential, types of hydropower plants, general features of hydro-electric schemes, selection of turbines, draft tubes, surge tanks, penstocks, power house dimensions, development of micro hydel stations, tidal plants, pumped storage plants and their details.

Course Outcomes:
Upon completion of the course, the students will be able to:
CO1: Identify different components of hydro project.
CO2: Explain basic principles of designing hydropower plant & cross drainage works.
CO3: Solve problems of dam analysis, energy dissipators & cross drainage works.
CO4: Evaluate suitability of types of hydraulic structures.
CO5: Design various elements of hydraulic structures.

Reference Books:

1. Engineering for Dams (Volumes I, II & III) by Creager, Justin & Hinds
2. Hydroelectric Hand Book by Creager
3. Hydraulic Structures by Varshney
4. Irrigation & Water Power Engg. By Punmia& Pandey
5. Water Power Engineering by Dandekar
6. Irrigation Engineering & Hydraulic Structure by S.K. Garg.

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Course Code: 110715

Course Name: Advanced Structural Analysis

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To understand the analytical procedure related to the analysis of building frame by some classicalmethods viz. Kani's methods and approximate methods of analysis.
2) To study the multi storey frames subjected to gravity loads and lateral loads
3) To understand matrix method and its application for computer based analysis of structure.
4) To understand the influence line concepts for indeterminate structures
5) To develop the skill to deals with the problems of moving loads in the structures & their analysistechniques.
6) To understand the concepts of plastic analysis of structures.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	Determine response of structures by classical methods	Skill development
2.	**Explain** basic principles of designing hydropower plant & cross drainage works.	Skill development
3.	**Solve** problems of dam analysis, energy dissipators & cross drainage works.	Skill development/ employability
4.	**Evaluate** suitability of types of hydraulic structures.	Skill development, entrepreneurship & employability
5.	**Design** various elements of hydraulic structures.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Moment distribution method in analysis of frames with sway, Analysis of box frames, analysis of beams and frames by Kani's methods.

Unit-II

Analysis of tall frames, Calculation of various loads including wind and earthquake loads, Introduction to Code provisions for lateral loads. Approximate analysis of multistorey frames for vertical and lateral loads.

Unit-III

Force method of structural analysis: Application of force method in analysis of rigid connected and pin connected structures

Unit-IV

Rolling Loads and Influence Lines: Influence Lines for Statically determinate and indeterminate structures, Muller Breslau Principle

Unit-V

Displacement method of structural analysis. Introduction to use of softwares for analysis: Modeling, analysis and post processing.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Determine response of structures by classical methods

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CO 2: Use approximate methods for analysis of statically indeterminate structures

CO 3: Determine response of structures by matrix force method

CO 4: Evaluate and draw the influence lines for reactions, shears, and bending moments in beams and girders due to moving loads

CO 5: Model and analyze structural systems (building) with the aid of softwares

Reference Books:

1. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Company, New Delhi.
2. Structural Analysis 5ed. (2015) by Aslam Kassimali, Cengage.
3. Structural Analysis, 10th Edition by Russell C. Hibbeler, 2018, Pearson.
4. Matrix Analysis of Structures, SI Edition, by Aslam Kassimali, 2021 CL Engineering
5. Weaver W & Gere J.M. Matrix Methods of Framed Structures, CBS Publishers & Distributors, Delhi

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Course Code: 900201

Course Name: Integrated Waste Management for Smart City

L	T	P	Credit
2	1	0	3

Course Objectives:

1) To provide broad knowledge on various aspects of planning & implementation of waste management system in a smart city/town.
2) To understand the principles applied in waste management.
3) To understand various ways to collect, treat & disposal of waste.
4) To understand various methods of energy recovery from waste.
5) To understand various aspects of hazardous waste management, E-waste management, biomedical waste management etc.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the principles & concepts of waste management.	Skill development
2.	**Apply** various techniques of handling the waste.	Skill development
3.	**Apply** various techniques of energy recovery from waste.	Skill development/ employability
4.	**Plan** an effective & efficient waste management system.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Introduction to waste management, classification of solid waste, objective of solid waste management, principles of integrated waste management, 3R policy, various laws & rules of waste management (MSW Rules, hazardous waste management rules, E-waste rules etc.), role of various agencies in planning of waste management system, swachh bharat mission and smart cities program – implementation, current status, challenges and future trend of waste management.

Unit II:

Municipal solid waste – generation, composition, characterization, handling of waste at source, collection of waste – collection system, collection routes, collection equipments, transportation of waste, transfer stations, segregation and recycling of waste, disposal of waste through landfills – types of landfills, planning & operation of landfills, leachate management & control of gases in landfills, environmental monitoring of landfills.

Unit III:

Energy recovery from municipal solid waste - thermal conversion technologies, incineration, pyrolysis, gasification, environmental control system, biological & chemical conversion technologies, aerobic composting, anaerobic digestion, refuse derived fuels, other biological and chemical transformation methods.

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Unit IV:

Hazardous waste management – characteristics, source, health effects, physiochemical treatment methods of hazardous waste, disposal of hazardous waste, Biomedical waste management –

sources, health effects, issues in India, challenges, handling of biomedical waste.

Unit V:

E-waste management – sources, heath effects, issues in India, challenges, handling of E-waste. Plastic waste management – types of plastics, sources of plastic waste, impacts of plastic waste, plastic waste management practices. Management of construction & demolition wastes.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the principles & concepts of waste management.

CO 2: Apply various techniques of handling the waste.

CO 3: Apply various techniques of energy recovery from waste.

CO 4: Plan an effective & efficient waste management system.

Text Books:

1. Text Book of Solid Wastes Management, Iqbal H. Khan and Naved Ahsan, CBS Publishers, 1st edition 2012
2. Integrated Solid Waste Management, Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, McGraw Hill Yew York, 1993

Reference Books:

1. Environmental Engineering, Rowe, Peavy & Tchobanogolous, Tata McGraw Hill Publications, 2017
2. CPHEEO, Manual on Municipal Solid Waste management, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 2016
3. Solid Waste Engineering, Vesilind P.A., Worrel H. W. and Reinhard, Thomson Learning Inc, 2003

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Course Code: 900202
Course Name: Project Planning & Control

L	T	P	Credit
2	1	0	3

Course Objectives:

1) To know about techniques of project planning.
2) To develop the network of project's activities.
3) To understand the precedence network technique.
4) To discuss the resource utilization in project.
5) To understand the project cost control.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Know** the project planning and project network.	Skill development
2.	**Analyze** the network by CPM & PERT.	Skill development
3.	**Analyze** the project using precedence network.	Skill development/ employability
4.	**Analyze** the effect of resource planning on project.	Skill development, entrepreneurship & employability
5.	**Evaluate** the cost of project during planning.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Project Planning:

Introduction to Project Planning Process. Types of Project Plans-Project feasibility plan, Project preliminary plan. Introduction to network techniques – CPM, PERT and Precedence network.

Project Work Breakdown – Levels of Project work breakdown. Identification of construction activities by work breakdown structure. Activity duration and methods of estimating activity duration – One time estimate three time estimates, trapezoidal distribution estimate. Duration estimation procedure.

Unit - II

Project Network Analysis:

Elements of Network, development of network, Numbering of events, Event times – Earliest events time and latest event time.Slack, critical events. Activity times – Earliest start time, Latest finish time, Float and critical activities. Network critical path and its significance. Network analysis by CPM – Defining scope of work, determining activities, establishing work package logic, preparation of network logic program and draft network. Numerical problems.

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Unit-III

Precedence Network Analysis:

Precedence Network Analysis – Modeling procedure analysis of time in PN. Use of PN in repetitive works network.Difference between PN and CPM. Application of Network techniques and their limitations.

Unit-IV

Resource Planning:

Resources, Types of resources – renewable and non-renewable resources, Resource Histogram, Method of Resource allocation – resource smoothing and resource levelling.

Unit-V

Project Cost Control:

Direct and indirect cost, slope of direct cost curve, Total project cost and optimum duration, contracting the network for cost optimization. Escalate & Variation in prices.

Course Outcomes

Upon completion of the course, the students will be able to:

CO 1: Know the project planning and project network.
CO 2: Analyze the network by CPM & PERT.
CO 3: Analyze the project using precedence network.
CO 4: Analyze the effect of resource planning on project.
CO 5: Evaluate the cost of project during planning.

Recommended Books:

1. Project planning and Control with PERT and CPM by Dr. B.C. Punmia, K.K. Khandelawal
2. CPM & PERT by L.S. Srinath
3. Construction Management by Sen & Gupta
4. CPM & PERT by Weist & Levy

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Course Code: 900213
Course Name: Urban Planning &Transportation Systems

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To introduce the scope and nature of Urban Planning and Transportation Systems as disciplines.
2) To understand the objectives, domains and principles of town planning.
3) To study the urbanization trends in India - Issues, concerns and experiences; City planning process and implementation framework in Indian context
4) To differentiate between types of plans and concepts in planning.
5) To understand how urbanization and why migration takes place in an urban region.
6) To understand the traditional and current planning processes and techniques involved in the urban and transportation planning.
7) To understand the urban governance, policies and strategies of the government to tackle issues of an urban environment.
8) To understand the impact of technology in both urban and transportation planning.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts for planning a city and land-use patterns.	Skill development
2.	**Differentiate** various theories used in urban planning.	Skill development
3.	**Analyze** various requirements for transportation systems.	Skill development/ employability
4.	**Design** approaches in addressing the issues and concerns of urban environment throughplanning.	Skill development, entrepreneurship & employability
5.	**Plan** strategies for any project with an urban planning perspective as a member and/or leaderin a team of planning projects.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I Introduction to planning discipline

Defining planning as a discipline, it's multidisciplinary nature, role of a planner, Objectives and Principles of Urban planning.

Fields of planning - Urban, regional, environmental, transport and infrastructure.

Evolution of settlements- Settlement size, pattern and structure as a function of sociocultural, economic, military and religious factors in historical cities.

Concepts of different types of cities like garden city, linear city etc.

Contributions of eminent planners: Lewis Mumford, Ebenezer Howard, Patrick Geddes, Sir Arthur Clarence Perry, Charles Correa, Le-Corbusier.

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Unit-II Urbanization

Definition of urbanization, rural-urban migration, various definitions of town and country planning, goals and objectives of planning, socio-economic impacts of growth of urban areas, significance of Census and Demographics, impacts of urbanization, impact of Government Policies on urbanization, urban structure and form - land use distribution, different Land use planning norms.

Overview of Urban Governance Definition, concepts, components, government and governance,

hierarchy and structure, forms of governance, process of inclusion and exclusion, 73rd and 74th Constitution Amendment Acts.

Unit-III Transportation Systems

Evaluation of urban structure: Transport system, infrastructure and management, transport systems and their types, urban road hierarchy, planning, and management criteria for road and junction improvements, arterial improvement techniques.

Transport survey and studies: study area definitions, survey and their types, sampling methods,survey techniques.

Transportation Planning Process and analytical techniques: Techniques for urban structures analysis, Urban travel characteristics,

Transport and environment: Traffic noise, factor affecting noise statement measures, standards, air pollution standards, traffic safety, accident reporting and recording systems, factors affecting road safety, transport planning for different target groups.

Unit-IV Planning in Indian Context

Introduction to types of plans with choice of appropriate scale- development plans, master plan, city development plan, structure plan, district plan, action area plan, subject plan, comprehensive planning, zonal plans etc., hierarchy of plans: regional plan, sub-regional plan, sector plans and spatial plans, town planning schemes, contents of base maps at various scales, notations, measurement of areas.

Database for planning and socio - economic surveys: data requirements for urban and regional planning, sources of primary and secondary data, questionnaire design, measurement scale and their application, sampling techniques; Objectives, types, and significance of planning surveys.

Role of URDPFI guidelines in Town planning, Urban Development Policies and Programmes at various levels.

Graphic presentation of statistical and spatial data.

Unit-V Current trends in urban planning and transportation systems

Indian scenario - Issues and Policies, Global scenario, Future trends of urbanization.

Review of existing traffic management schemes in Indian cities.

Impact of technology on urban forms and planning, role of disruptive innovations and disaster mitigation in urban planning, advanced transportation systems with their merits and demerits, Intelligent transport system (ITS) its types and applications.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain the concepts for planning a city and land-use patterns.

CO2: Differentiate various theories used in urban planning.

CO3: Analyze various requirements for transportation systems.

CO4: Design approaches in addressing the issues and concerns of urban environment through planning.

CO5: Plan strategies for any project with an urban planning perspective as a member and/or leader in a team of planning projects.

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Text Books:

1. A.B. Gillion and Simon Eisner, "The Urban Pattern", CBS Publishers and Distributors, Delhi.
2. Rishma A., "Town Planning in Hot Cities", Mir Publishers, Moscow.

74th

Course Code: 110701

Course Name: Software Application for Solving Civil Engineering Problems

L	T	P	Credit
0	0	4	2

Course Objectives:

1) To practice various software's used in civil engineering design & analysis.
2) To practice MATLAB & QGIS.
3) To practice various other software's and its applications in civil engineering works.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Design** various beams, slabs & multistorey building's using various software's.	Skill development
2.	**Design** water supply & sewer networks using various software's.	Skill development
3.	**Practice** MS Excel in estimation works.	Skill development/ employability
4.	**Produce** land use land cover maps and geo contour maps using various software's	Skill development, entrepreneurship & employability
5.	**Practice** Primavera and MS-Project softwares.	Skill development, entrepreneurship & employability

List of Experiments:

1. Design and analysis of reinforced concrete beam using STADD software.
2. Design and analysis of reinforced concrete slab using STADD software.
3. Design MATLAB code to develop load-response curve for different load conditions for a beam designed of experiment 1.
4. Application of QGIS in preparation of vector map of major city and preparation of land use and land cover maps.
5. Determination of critical network for a construction project using PRIMEVERA/ MS-Project.
6. To prepare an estimation of Multi-storey building and Road using MS-Excel.
7. Design water supply networks through Hardy Cross method. (Loops, EPANET and other software's).
8. Design Sewer networks using Hidra software.
9. Development of Geo-contor map by total station.
10. Estimation of axel load (msa) through IRC 37: 2015 using MS Excel.
11. Design and analysis of multi-storey building using E-tabs software.

In addition to above, various available open source software's will be used.

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Course Outcomes

Upon completion of the course, the students will be able to:

3. Ward S (2002), "Planning the 20th Century City" John Wiler & Sons.
4. R. Ramachandran, "Urbanisation and Urban Systems in India", Oxford Publications.
5. K. C. Shivrama Krishnan, "Revisioning Indian Cities", Sage Publications.
6. ITPI reader
7. Bruton, M.J., "Introduction to Transportation Planning," Hutchinson Publication, London.
8. Kadiali, L.R., "Traffic and Transportation Planning", Khanna Publishers, Delhi.

Reference Books:

1. Broadbent, Geoffery: "Emerging Concepts in Urban Space Design", Van Nostand Reinhold, 1990.
2. Edmund Bacon, "Design of Cities", Penguin, 1976.
3. Francis Tibbalds, "Making people-friendly towns: improving the public environment in towns and cities", Longman, 1992.
4. Rob Krier, "Urban Space", Random House Incorporated, 1979.
5. Jonathan Barnett, "Urban design as public policy: practical methods for improving cities", Architectural Record Books, 1974.
6. Papacoster, C.S.And Prevendons,"Transportation Engineering and Planning" Prentice Hall of India.
7. Introduction to transport planning by Michael J Bruton
8. Principal of Urban transport system planning by Hutchinson

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Course Code: 110702

Course Name: Summer Internship Project - III

L	T	P	Credit
0	0	4	2

Course Objectives:

1) To develop an appreciation and importance of civil Engineering in developing the infra structure.

2) To develop an understanding regarding the various engineering principals to be used in the field Construction activities.

3) To emphasize on the use of the modern tools and plants used in the construction industry.

4) To build the necessary practical background and exposure to the field problems.

5) To develop a technical skill to prepare project documents.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Observe** various activities of civil construction works.	Skill development
2.	**Examine** the utility of general and specific equipments for construction.	Skill development
3.	**Differentiate** the construction projects individually and in team.	Skill development/ employability
4.	**Develop** the writing and communication skills for various engineering problems.	Skill development, entrepreneurship & employability
5.	**Adapt** lifelong learning for benefit of society.	Skill development, entrepreneurship & employability

Syllabus:

1. Each candidate shall go for 1 month (4 week) on field training at different organizations / sites of his / her choice after completion of their 6th Semester exams (in summer vacations) and shall submit a detailed report after completion of training.

2) Candidates will be taken to nearby places where civil engineering works are being carried out during the semester and they shall have to submit a detailed report of their visit.

Course Outcomes:

Upon completion of the course, the students will be able to:

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CO1: Observe various activities of civil construction works.

CO2: Examine the utility of general and specific equipments for construction.

CO3: Differentiate the construction projects individually and in team.

CO4: Develop the writing and communication skills for various engineering problems.

CO5: Adapt lifelong learning for benefit of society.

CO 1: Design various beams, slabs & multistorey building's using various software's.
CO 2: Design water supply & sewer networks using various software's.
CO 3: Practice MS Excel in estimation works.
CO 4: Produce land use land cover maps and geo contour maps using various software's.
CO 5: Practice Primavera and MS-Project softwares.

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Course Code: 100008

Course Name: Intellectual Property Rights

L	T	P	Credit
2	0	0	2

Course Objectives:

1. To acquaint the learners with the basic concepts of Intellectual Property Rights.

2. To develop expertise in the learners in IPR related issues and sensitize the learners with emerging issues in IPR and the rationale for the protection of IPR.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	Imbibe the knowledge of Intellectual Property and its protection through various laws	Skill development
2.	Apply the knowledge of IPR for professional development	Skill development
3.	Develop a platform for protection and compliance of Intellectual Property Rights &knowledge	Skill development/ employability
4.	Create awareness amidst academia and industry of IPR and Copyright compliance	Skill development, entrepreneurship & employability
5.	Deliver the purpose and function of IPR and patenting.	Skill development, entrepreneurship & employability

Syllabus:

UNIT I: Introduction: Introduction to IPRs, Basic concepts and need for Intellectual Property – Meaning and practical aspects of Patents, Copyrights, Geographical Indications, IPR in India and Abroad. Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II: Intellectual Property Rights: The IPR tool kit, Patents, the patenting process, Patent cooperation treaties: International Treaties and conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT III: Intellectual Property Protections: IPR of Living Species, protecting inventions in biotechnology, protections of traditional knowledge, biopiracy and documenting traditional knowledge, Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection. Case studies: The basmati rice issue, revocations of turmeric patent, revocation of neem patent.

UNIT IV: Exercising and Enforcing of Intellectual Property Rights: Rights of an IPR owner, licensing agreements, criteria for patent infringement. Case studies of patent infringement, IPR – a contract, unfair competitions and control, provisions in TRIPs.

UNIT V: Rôle of Patents in Product Development & amp: Commercialization, Recent changes in IPR laws impacting patents and copy rights, intellectual cooperation in the science and allied industry. Patentable and non-patentable research. Case studies

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Reference Books:

1. P.B. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy. Tata Mc Graw Hill, 2001.

2. Steve Smith, The Quality Revolution.1st ed., Jaico Publishing House, 2002.

3. Kompal Bansal and Praishit Bansal. Fundamentals of IPR for Engineers, 1st Edition, BS Publications,

Course Code: 110703

Course Name: Creative Problem Solving

L	T	P	Credit
0	0	2	1

Course Objectives:

1) To create an interest in students to provide solutions to various on field problems of civil engineering.
2) To provide solutions to various on field problems of civil engineering.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Identify** various on field problems.	Skill development
2.	**Practice** various methods to solve problems.	Skill development
3.	**Produce** solutions to various problems.	Skill development/ employability
4.	**Demonstrate** various problems solving skills.	Skill development, entrepreneurship & employability

List of Experiments

1. Traffic Survey of Major Road's in the city.
2. Design of Traffic Signal.
3. Performance evaluation of new building materials.
4. Determination of residual life of structure.
5. Identification of occupational diseases.
6. Identification of solid waste collection problems in a locality and subsequent proposal of the solutions to those problems.
7. Determination of surface roughness index of road.
8. Use of waste materials for construction of pavement layers.
9. Creation of data bank of water resources in the city.
10. Industrial visit and joint solution of problems in industry.

Course Outcomes

Upon completion of the course, the students will be able to:

CO 1: Identify various on field problems.
CO 2: Practice various methods to solve problems.
CO 3: Produce solutions to various problems.
CO 4: Demonstrate various problems solving skills.

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2012.

4. Prabhuddha Ganguli. Intellectual Property Rights. 1st Edition, TMH, 2012.

5. R Radha Krishnan & S Balasubramanian. Intellectual Property Rights. 1st Edition, Excel Books, 2012.

6. M Ashok Kumar & Mohd. Iqbal Ali. Intellectual Property Rights. 2nd Edition, Serial Publications, 2011.

7. Vinod V. Scople, Managing Intellectual Property. Prentice Hall of India PvtLtd, 2012.

8. Deborah E. Bouchoux. Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. Cengage Learning, 3rd ed. Edition, 2012.

9. Prabuddha Ganguli. Intellectual Property Rights: Unleashing the Knowledge Economy. McGraw Hill Education, 2011. Edited by Derek Bosworth and Elizabeth Webster.

10. The Management of Intellectual Property. Edward Elgar Publishing Ltd.,2013.

11. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.

12. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.

13. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House.

Course Outcomes:

At the end of this course, the student will be able to

CO1. Imbibe the knowledge of Intellectual Property and its protection through various laws

CO2. Apply the knowledge of IPR for professional development

CO3. Develop a platform for protection and compliance of Intellectual Property Rights & knowledge

CO4. Create awareness amidst academia and industry of IPR and Copyright compliance

CO5. Deliver the purpose and function of IPR and patenting.

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Course Code: 110801 Course Name: Internship/ Project

L	T	P	Credit
0	0	6	3

Course Objectives:

1) To develop an appreciation of civil engineering problems & have a feel of real life situations in planning &execution of projects.
2) To impart training of handling various types of civil engineering problems by use of conventional methodsas well as software's.
3) To utilize the expertise in engineering to solve industry's technological problems.
4) To become innovative and professional in technology development, and system implementation.
5) To be able to function in their profession with social awareness and responsibility.
6) To be able to interact with their peers in industry and society as engineering professionals and leaders &inculcate a habit of working in a group.
7) Enable students to prepare professional reports for design projects and data presentation skill and to usecomputers and some computer graphics.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Observe** various activities of civil engineering works.	Skill development
2.	**Recognize** various engineering problems and techniques to solve them.	Skill development
3.	**Reproduce** to solution of the problems upon the need of society.	Skill development/ employability
4.	**Develop** the writing and communication skills for various engineering problems.	Skill development, entrepreneurship & employability
5.	**Adapt** lifelong learning for benefit of society.	Skill development, entrepreneurship & employability

Syllabus:

Each candidate shall work on an approved project of a public building or any other civil engineering work /experimental work / software package on any specific problem of importance and shall submit a detailed report of the same

OR

Each candidate shall go for internship at different organizations / sites of his /her choice and shall submit a detailed report after completion of internship. (kindly check with the detailed internship policy & guidelines ofthe institute)

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Observe various activities of civil engineering works.
CO 2: Recognize various engineering problems and techniques to solve them.
CO 3: Reproduce to solution of the problems upon the need of society.
CO 4: Develop the writing and communication skills for various engineering problems.
CO 5: Adapt lifelong learning for benefit of society.

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Course Code: 530218

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	2

Course Objectives:

1) To encourage students to read, study & understand different topics of Environmental Engineering published in articles, literatures.
2) To help in presenting different topics of Environmental Engineering and related subjects to supplement theoretical knowledge gained in class.
3) To make student acquire good oral & written communication skills.
4) To promote the habit of lifelong learning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Analyze** contemporary issues in Environmental Engineering & its allied areas through literaturesurvey.	Skill development
2.	**Distinguish** state of art & relevance of the topic in national & international arena.	Skill development
3.	**Demonstrate** good oral & written communication skills.	Skill development/ employability
4.	**Develop** poster and power point presentations for effective communication.	Skill development, entrepreneurship & employability
5.	**Display** lifelong learning.	Skill development, entrepreneurship & employability

Syllabus:

Any relevant topic related to Environmental Engineering from within or beyond the syllabus through Swayam / NPTEL/MOOC.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in Environmental Engineering & its allied areas through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

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CO 4: Develop poster and power point presentations for effective communication.

CO 5: Display lifelong learning.

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Course Code: 530217

Course Name: Advanced Environmental Engineering Lab

L	T	P	Credit
0	0	4	4

Course Objectives:

1) To acquire knowledge of sampling of air samples, solid waste samples & waste water samples.
2) To acquire skills to determine various characteristics of waste water.
3) To acquire skills to determine various characteristics of solid waste.
4) To acquires skills to determine various air pollutants.
5) To acquire skills to determine noise levels.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Follow** sampling procedure & other guidelines for sampling & analysis of waste water, air & solid waste samples.	Skill development
2.	**Check** various waste water quality parameters.	Skill development
3.	**Analyze** various solid waste characteristics.	Skill development/ employability
4.	**Analyze** the level of pollutants in air.	Skill development, entrepreneurship & employability
5.	**Analyze** noise levels in an area / city.	Skill development, entrepreneurship & employability

Syllabus:

1. Introduction to waste water sampling procedure.
2. Introduction to air sampling procedure.
3. Introduction to solid waste sampling procedure.

List of Experiments:

1. Determination of Solids (TS, TSS, VSS, FS) in waste water sample.
2. Determination of settling velocity of suspended solids in waste water sample.
3. Determination of D.O. in waste water sample.
4. Determination of B.O.D. in waste water sample.
5. Determination of C.O.D. in waste water sample.
6. Determination of Nitrates in waste water sample.
7. Determination of Oil & Grease in waste water sample.
8. Determination of Heavy Metals in waste water sample.

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9. Analysis of solid waste sample (Proximate & Elemental).
10. Determination of calorific value of solid waste sample.
11. Determination of SPM, SO_x & NO_x in air using RSPM/HVS.
12. Monitoring of ambient & traffic noise levels using noise level meters.
13. Study of Stack Monitoring Kit.
14. Characterization of wastes from different industries.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Follow sampling procedure & other guidelines for sampling & analysis of waste water, air & solid waste samples.

CO 2: Check various waste water quality parameters.

CO 3: Analyze various solid waste characteristics.

CO 4: Analyze the level of pollutants in air.

CO 5: Analyze noise levels in an area / city.

Reference Books:

1. BIS 3025: Methods of Sampling & Test for Water & Waste Water.
2. BIS 10158, 9234, 9235: Analysis of Solid Wastes.
3. BIS 5182: Measurement of Air Pollution.
4. APHA Standard Methods for Examination of Water & Waste water, 2012.
5. Sawyer C.N., McCarty P. L., and Parkin G.F., Chemistry for Environmental Engineers, McGraw-Hill, New Delhi, 1994.
6. Water Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi, 2017.

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Course Code: 800209

Course Name: Global Climatic Changes & Disaster Management

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To understand the effects of climate change.
2) To get knowledge of various protocols & policies on global climate changes.
3) To understand various natural disasters.
4) To understand various techniques of disaster monitoring.
5) To plan for management of disasters and emergency situations.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the basic concepts of climate change, the causes of climate change and its effecton environment.	Skill development
2.	**Determine** the important climate variables and the predictions of the changes in theclimate system.	Skill development
3.	**Analyse** policy issues and mitigation strategies in response to climate change and otherdisasters.	Skill development/ employability
4.	**Design** an emergency water supply and sewage system.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I

Climate, weather and Climate Change; Overview of Earth's Atmosphere; Layers of Atmosphere; Greenhouse Gases, Acrosols, Impact of CO_2 increase on climate change, Temperature, Radiation and Variation; Heat- Balance of Earth Atmosphere System; Temporal Variation of Air temperature; Hydrologic cycle; Climate Variability like Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

Recent Climate Change impact at local and global scale, Ecological Impacts of Climate change: Anthropogenic activities and climate change, Rising of sea level and consequences, Impact on biodiversity and extinction of endemic species, Changing of food chain, Agricultural shifts. Impact of climate change on health.

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Unit-II

Policy and Legislative issues in Climate Change: The UNFCCC, The Montreal Protocol, From Kyoto to Copenhagen, Towards COP21, ICMR, ICAR & IARI.

Introduction to Climate Modeling (GCM and RCM Models) IPCC Scenarios, difference between climate change and climate variability Carbon trading and clean development mechanism, Role of countries and citizens in containing in global warming. The Role of Technology Roadmaps and Roundtables,

Unit-III

Overview of disaster, major natural disasters – flood, tropical cyclone, droughts, landslides, heat waves, earthquakes, fire hazards, tsunami, etc. – Factors for disaster – climatic change and global sea rise, erosion, environmental degradation, large dams and earthquakes, road building and landslides, Chemical and Biological weapons – case studies.

Unit-IV

Techniques of monitoring and design against the disasters, Management issues related to Disaster, Mitigation through capacity building, legislative responsibilities of disaster management; Disaster mapping, assessment, pre-disaster risk and vulnerability reduction, post disaster recovery and rehabilitation; disaster related infrastructure development. Disaster management plan, national crisis management committee, state crisis management group.

Unit-V

Water supply preparedness and protection, emergency water supply strategy, rural and urban emergencies. Assessment of damage. Emergency water supply schemes – Sources, quality, treatment, storage and distribution, operation and maintenance. Sanitation – Human waste and health, strategy for excreta disposal in emergencies, techniques for excreta disposal, disposal of wastewater, management of refuse.

Courses Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the basic concepts of climate change, the causes of climate change and its effect on environment.

CO 2: Determine the important climate variables and the predictions of the changes in the climate system.

CO 3: Analyse policy issues and mitigation strategies in response to climate change and other disasters.

CO 4: Design an emergency water supply and sewage system.

Reference Books:

6. Climate Change and India – Vulnerability Assessment and Adaptation; Edited by P. R. Shukla, Subodh K. Sharma, N. H. Ravindranath, Amit Garg, Sumana Bhattacharya, Universities Press, 2003
7. Global Warming – The Complete Briefing, third edition; John Honghton, Cambridge University Press, 2004,
8. Climate Change- Causes Effects and Solutions; John T. Hardy, Wiley
9. Alexander D, Principles of emergency planning and management, Oxford University Press, 2002.
10. Hallow G. and Bullock J. Introduction to Emergency Management: Elsevier, 2002.
11. Anil Markandya, Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge, 2002.
12. Jepma, C.J., and Munasinghe, M., Climate Change Policy - Facts, Issues and Analysis, Cambridge University Press, 1998.
13. R.B. Singh, Disaster Management, Rawat Publication, New Delhi, 2000
14. H.K. Gupta, Disaster Management, University's Press, India, 2003
15. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management, IIPA, New Delhi, 2001

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Course Code: 530213

Course Title: Environmental Impact Assessment & Ethics

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To develop an understanding about the requirements of environment impact assessment in modern day.

2) To provide a broad knowledge on the process of environmental impact assessment.

3) To provide a broad knowledge on various methods used in impact assessment.

4) To provide a practical knowledge on how to carry out environmental impact assessment process through various case studies.

5) To provide an insight into various existing environmental laws in India

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Illustrate** the concepts of EIA.	Skill development
2.	**Apply** various methodologies for carrying out EIA. & laws used in EIA studies.	Skill development
3.	**Analyse** impacts on various components of environment.	Skill development/ employability
4.	**Apply** various laws & ethical practices in environmental management.	Skill development, entrepreneurship & employability
5.	**Plan** for mitigation of impact & accordingly monitor the mitigation measures throughenvironmental audit.	Skill development, entrepreneurship & employability

Syllabus:

Unit I: Environment and its components, Concept of Ecological imbalances, Carrying capacity and Sustainable development, EIA: Definitions, Necessity of EIA, Historical Evolution of EIA: Indian EIA rules 1994 & 2006, Environmental clearance process, Procedure for carrying out EIA in India, Post project monitoring, EIA documentation, EMP, EIS, Life Cycle Assessment, Risk Assessment.

Unit II: Environmental Impact Assessment Methodologies: Characteristics of EIA Methods, Ad-hoc method, Checklist, Matrices, Networks, Overlays, Environmental Quality Index, Predictive Models, Comparative study of EIA Methodologies.

Unit III: Prediction and assessment of impact on water & air environment: Basic information of air & water quality, Data requirements for impact assessment, Existing standards for air & water quality (surface & subsurface), Identification of impacts, Prediction & assessment of impacts, Mitigation measures. Case Studies - Environmental Impacts of Road, Rail, Dam and thermal power projects or any other major projects on water & air environment.

Unit IV: Prediction and assessment of impact on cultural & socio-economic environment: Basic

information on cultural resources like archaeological, historical structures, Cultural system, Basic information of socio-economic environment, Description of existing socio-economic environment, Identification of impacts, Prediction & assessment of impacts, Mitigation measures, R & R study.

Unit V: Environmental Legislations: List of prevalent environmental acts in India, Brief about provisions in Water Act 1974, Air Act 1981, EPA 1986, International Environmental Laws & Protocols like Montreal Protocol, Rio Earth Summit, Kyoto Protocol, Objective of Ethics, Importance of Ethics, Code of Ethics, Environmental ethics in India, Environmental Audit: Introduction, Necessity, Types, and Process of audit.

Course Outcomes:
Upon completion of the course, the students will be able to:

CO1: Illustrate the concepts of EIA.

CO2: Apply various methodologies for carrying out EIA. & laws used in EIA studies.

CO3: Analyse impacts on various components of environment.

CO4: Apply various laws & ethical practices in environmental management.

CO5: Plan for mitigation of impact & accordingly monitor the mitigation measures through environmental audit.

Text Books:
1) Y. Anjaneyulu & Valli Manickam, Environmental Impact Assessment Methodologies, B S Publishers.

2) R. R. Barthwal, Environmental Impact Assessment, New Age International Publishers.

Reference Books:
1) L.W. Canter, Environmental Impact Assessment, Mc Graw Hill International Publishers International Edition.

2) O. V. Nandimath, Handbook of Environmental Decision Making in India: An EIA Model, Oxford University Press.

3) Ministry of Environment and forest, Government of India Environmental Impact Assessment Notification, New Delhi, 2006.

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Course Code: 530212

Course Name: Advance Treatment Process – II (Water Supply Engg.)

L	T	P	Credit
3	0	0	3

Courses Objectives:

1) To understand the concepts of planning a distribution system & subsequently design the water distribution system.
2) To understand the operation & maintenance of water supply systems.
3) To determine the water quality parameters and also have knowledge on various standards of water quality.
4) To understand the concepts of various water treatment techniques.
5) To be able to plan & design water treatment plant for a city.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts of water distribution systems including its operation & maintenance.	Skill development
2.	**Design** a water distribution scheme for an area / city.	Skill development
3.	**Evaluate** the water quality of an area / city with the help of available standards & guidelines.	Skill development/ employability
4.	**Explain** the concepts of various water treatment techniques.	Skill development, entrepreneurship & employability
5.	**Design** a water treatment scheme for an area / city.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Water supply, Components of distribution system, Principles and design of distribution system, Equivalent pipe method, Hardy Cross and Section method, Electrical network analogy method, Construction and maintenance of distribution system, Corrosion and methods of control, Computer applications in distribution network analysis.

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Unit II:

Quality of water: Factors affecting water quality in various sources, Protection of water quality, Classification of natural water with reference to the best use, Bacteriological quality of water, Effect on health, Standards of water for various uses, Water quality index, Minimal National Standards (MINAS), their significance in relation to Industrial pollution control.

Unit III:

Preliminary Treatment and Sedimentation: Degree of treatment required, various operation and flow sheet, Preliminary treatment methods such as screening, coagulation, perikinetic and orthokinetic,

flocculation, Coagulants and coagulants aids, Polyelectrolyte, Sedimentation, Class I and Class II clarification, Column settling test, zone and compression settling, Design of sedimentation tank – various types and their working, Tube settlers and their design.

Unit IV:

Filtration and Disinfection: Slow and rapid sand filters, Theory of filtration, Design, Operation, Performance and evaluation of filters, Pressure filter, Multi-media filter, Diatomaceous earth filter, Disinfection of water kinetics, Amount of chemicals required for disinfection, Free and combined chlorine, Fixed end disinfector.

Unit V:

Non – Conventional treatment units: Water softening, Methods of softening, Application of Membrane process, Reverse osmosis, Electro-dialysis, Various practices, Removal of fluorides, iron and manganese, Taste and odour removal, Industrial water conditioning, Langliear saturation index, Management of water treatment plant residues, Design of complete treatment scheme.

Courses Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of water distribution systems including its operation & maintenance.

CO 2: Design a water distribution scheme for an area / city.

CO 3: Evaluate the water quality of an area / city with the help of available standards & guidelines.

CO 4: Explain the concepts of various water treatment techniques.

CO 5: Design a water treatment scheme for an area / city.

Text Books:

1. Water Supply Engg., S. K. Garg, Khanna Publishers New Delhi, 2017
2. Environmental Engineering, Peavy, Rowe & Tchobanoglous, McGraw Hill Publication, 2017

Reference Books:

1. Water Supply & Sanitary Engg., G.S. Birdie, Dhanpat Rai Publishing Company, 2014
2. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, 6th edition, 2008
3. Manual of Water Supply and Treatment by CPHEEO, GOI, 2009
4. Water Supply Engg., B. C. Punmia, Laxmi Publication (P) Ltd. New Delhi, 2016
5. Water Supply & Sanitary Engineering By S.K. Husain (Oxford & IBH Publishing Co. New Delhi, India)

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Course Code: 530211

Course Name: Air Pollution & Noise Pollution

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide a broad knowledge on various sources & effects of air pollution.
2) To understand the techniques to control air pollution and apply them.
3) To provide knowledge on air quality standards, monitoring of air quality.
4) To provide a basic knowledge on sources, effects of noise pollution & also how to reduce the pollution.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts of air & noise pollution.	Skill development
2.	**Illustrate** the effects of air & noise pollution on environment.	Skill development
3.	**Apply** various techniques to measure air & noise pollution.	Skill development/ employability
4.	**Solve** air and noise pollution problems by devising solutions to the identified problems	Skill development, entrepreneurship & employability
5.	**Apply** various techniques used in reducing the environmental pollution.	Skill development, entrepreneurship & employability

Syllabus:

Unit I Introduction:

Definition of Air Pollution, Sources and classification of air pollutants – Man made – Natural sources – Type of air pollutants – Pollution due to automobiles, Units of measurements of pollutants, Air quality criteria - emission standards – National ambient air quality standards – Air pollution indices – Air quality management in India, Air pollution survey, Air pollution from major industrial operations, Air pollution in Indian cities, Major Air pollution episodes, Air Act.

Unit II Effects of Air Pollution:

Analysis of air pollutants – Chemical, Instrumental and biological methods, Air pollution and its effects on human beings, plants and animals – Economic effects of air pollution – Effect of air pollution on meteorological conditions – Changes on the Meso scale, Micro scale and Macro scale, Global Warming, Acid Rain, Ozone Layer Depletion, Indoor Air Pollution & Occupational Diseases.

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Unit III Sampling, Meteorology and Air Quality Modeling:

Sampling and measurement of particulate and gaseous pollutants – Ambient air sampling – Stack sampling. Environmental factors – Meteorology – temperature lapse rate and stability – Adiabatic lapse rate – Wind Rose – Inversion – Wind velocity and turbulence – Plume behavior – Dispersion of air pollutants- Air Quality Modeling.

Unit IV Air Pollution Control Measures:

Control – Source correction methods – Control equipments – Particulate control methods – Bag house filter – Settling chamber – cyclone separators – inertial devices – Electrostatic precipitator – scrubbers

– Control of gaseous emissions – Absorption – Absorption equipments – adsorption and combustion devices (Theory and working of equipments only), odour and its control, stack monitoring kit, auto exhaust analyser.

Unit V Noise Pollution & its Control

Sources of noise – Units and Measurements of Noise – Noise Standards, Noise rating system, Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non - auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person – Control of other types of Noise Sound Absorbent, Sound level meter.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of air & noise pollution.

CO 2: Illustrate the effects of air & noise pollution on environment.

CO 3: Apply various techniques to measure air & noise pollution.

CO 4: Solve air and noise pollution problems by devising solutions to the identified problems

CO 5: Apply various techniques used in reducing the environmental pollution.

Text Books:

1. Air pollution & Control, M. N. Rao & H. V. N Rao, Tata McGraw Hill Publications., 2017
2. Air Pollution and Control Technologies, Dr. Y. Anjaneyulu, Allied publishers Pvt. Ltd., 2002.

Reference Books:

1. Sewage Disposal & Air Pollution Engineering, S.K. Garg, Khanna Publishers, 31st edition, 2008
2. Environmental Pollution Control Engineering, C. S. Rao, New Age Intl Pub., 3rd edition, 2018
3. Environmental Engineering, Rowe, Peavy & Tchobanogolous, Tata McGraw Hill Publication, 2017

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Course Code: 530119

Course Name: Self Learning / Presentation

L	T	P	Credit
0	0	2	2

Course Objectives:

1) To encourage students to read, study & understand different topics of Environmental Engineering published in articles, literatures.
2) To help in presenting different topics of Environmental Engineering and related subjects to supplement theoretical knowledge gained in class.
3) To make student acquire good oral & written communication skills.
4) To promote the habit of lifelong learning.
5) To prepare students develop adequate soft skills to be able to present their topic effectively to listeners.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Analyze** contemporary issues in Environmental Engineering & its allied areas through literature survey.	Skill development
2.	**Distinguish** state of art & relevance of the topic in national & international arena.	Skill development
3.	**Demonstrate** good oral & written communication skills.	Skill development/ employability
4.	**Develop** poster and power point presentations for effective communication.	Skill development, entrepreneurship & employability
5.	**Display** lifelong learning.	Skill development, entrepreneurship & employability

Syllabus:

Any relevant topic related to Environmental Engineering from within or beyond the syllabus through Swayam / NPTEL/MOOC.

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Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Analyze contemporary issues in Environmental Engineering & its allied areas through literature survey.

CO 2: Distinguish state of art & relevance of the topic in national & international arena.

CO 3: Demonstrate good oral & written communication skills.

CO 4: Develop poster and power point presentations for effective communication.

CO 5: Display lifelong learning.

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Course Code: 530118

Course Name: Environmental Engineering Lab

L	T	P	Credit
0	0	4	4

Course Objectives:

1) To acquire knowledge of various types of sampling, its procedure including its preservation.
2) To acquire skills to determine various physical, chemical & biological characteristics of water.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Follow** sampling procedure & other guidelines for sampling & analysis of water samples.	Skill development
2.	**Check** various water quality parameters.	Skill development
3.	**Improve** the water quality by suggesting suitable corrective measures.	Skill development/ employability
4.	**Train** others on various ways of improving the quality of water.	Skill development, entreprencurship & employability

Syllabus:

Introduction to Sampling Procedure, Types of Sampling, Collection of Samples & Preservation of Sample.

List of Experiments:

1. Determination of physical characteristics of water sample (pH, Turbidity, Total Solids (Suspended & Dissolved Solids), Electrical Conductivity)
2. Determination of Acidity & Total Alkalinity of water sample.
3. Determination of Total Hardness, Calcium Hardness, Magnesium Hardness of water sample.
4. Determination of Chloride of water sample.
5. Determination of Sulphate of water sample.
6. Determination of Available Chlorine in bleaching powder & Residual Chlorine of water sample.
7. Determination of Nitrate & Phosphate of water sample.
8. Determination of Optimum Dosage of Coagulants using Jar Test.
9. Determination of MPN of water sample.
10. Application of Plate Count Method for bacterial growth.
11. Study on Gram Staining Technique.

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Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Follow sampling procedure & other guidelines for sampling & analysis of water samples.

CO 2: Check various water quality parameters.

CO 3: Improve the water quality by suggesting suitable corrective measures.

CO 4: Train others on various ways of improving the quality of water.

Reference Books:

1. Water Supply Engineering, S.K. Garg, Khanna Publishers, New Delhi, 2017.
2. Sawyer C.N., McCarty P. L., and Parkin G.F., Chemistry for Environmental Engineers, McGraw-Hill, New Delhi, 1994.
3. BIS 3025 Methods of Sampling & Test for Water & Waste Water, BIS 1622.
4. APHA Standard Methods for Examination of Water & Waste water, 2012.

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Course Code: 800110

Course Name: Sustainable Waste Management System

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To develop an understanding about the concepts of sustainability & sustainable development.

2) To understand the concepts of water conservation techniques.

3) To understand the concepts of wetlands & other natural wastewater treatment system.

4) To provide knowledge on various low cost sanitation methods & other sustainable waste management techniques.

5) To provide an insight into sustainable design of buildings.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Illustrate** the concepts of sustainability & sustainable development.	Skill development
2.	**Apply** principles of hydraulics for design of sewer lines.	Skill development
3.	**Apply** various natural methodologies of wastewater treatment like wetlands.	Skill development/ employability
4.	**Apply** various low cost sanitation & other waste management techniques.	Skill development, entrepreneurship & employability
5.	**Plan** for sustainable and green design of buildings.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Introduction: Concept of sustainability in water and waste management, sustainable development, guidelines and strategies for implementing sustainable development, Pollution prevention & Cleaner production in achieving sustainability, Environmental indices - Bio remediation.

Unit II:

Water Conservation: Rainwater Harvesting – Roof water harvesting – Technology – Quality – Health issues – Groundwater recharge – Techniques – Case studies – Wastewater reuse and reclamation.

Unit III:

Natural Wastewater Treatment Systems: Centralized Vs decentralized – Natural and constructed wetlands – Different types – Mechanisms – Performance – Design – Case studies – Land treatment systems.

Unit IV:

Low-Cost Sanitation: Dry sanitation methods – Pit latrines – VIP latrines – Aquaprivy – Septic tank.

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Organic Solid Waste Management Techniques: Composting/ Vermicomposting – Biogas technology – Plasma technology

Unit V:

Green Design: Green buildings - benefits and challenges; public policies and market-driven initiatives; Effective green specifications; Energy efficient design; Passive solar design; Green power; Green materials and Leadership in Energy and Environmental Design (LEED)

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Illustrate the concepts of sustainability & sustainable development.

CO2: Apply various methodologies of water conservation in field.

CO3: Apply various natural methodologies of wastewater treatment like wetlands.

CO4: Apply various low cost sanitation & other waste management techniques.

CO5: Plan for sustainable and green design of buildings.

Reference Books:

1. Cites R.W., Middlebrooks E.J., Reed S.C., Natural wastewater Treatment Systems, CRC Taylor and Francis, 2006.
2. Cairncross S., Feachem R. Environmental Health Engineering in the Tropics; John Wiley & Sons 1993.
3. Bajwa, G.S. Practical Handbook on Public Health Engineering, Deep Publishers, Simla, 2003.
4. White, I.D. Mottershed, D.N and Harrison, S.L., Environmental Systems – An Introductory Text, Chapman Hall, London, 1994.
5. Martin, A.M., Biological Degradation of Wastes, Elsevier Appl. Science, New York, 1991.
6. Mili Majumdar, Energy Efficient Buildings in India, TERI

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Course Code: 530116

Course Name: Environmental Hydraulics

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To understand the concepts of fluid mechanics and apply them in pipe flow calculations.

2) To understand the principles of open channel flow and apply them in sewer system design.

3) To apply concepts of hydrology in estimation of storm water and its design.

4) To understand concepts of ground water hydraulics.

5) To understand concepts of pollutant transfer and estimation of pollution load in water bodies.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Apply** fluid mechanics principles in analysis and design of pipe flow.	Skill development
2.	**Apply** principles of hydraulics for design of sewer lines.	Skill development
3.	**Apply** principles of surface water hydrology for design of storm water sewer.	Skill development/ employability
4.	**Estimate** groundwater quantity and pollution load on groundwater and surface water.	Skill development, entrepreneurship & employability
5.	**Apply** the principles of hydraulics in design of pumping stations and estimation of pollution loadon rivers.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Introduction to concepts of fluid flow – continuity equation, energy principle, momentum principle, frictional head loss, flow through pipes, major and minor energy losses in pipes, hydraulic gradient and total energy line, flow through pipe in series, parallel, equivalent pipe, water hammer pressure, design of water distribution pipe network using hardy cross method and equivalent pipe method.

Unit II:

Open channel flow and its classifications, critical flow computations, sub critical flow, super critical flow, uniform flow, gradually varied flow, most efficient/economical sections in channel, specific energy, hydraulic jump, hydraulic elements of sewer & design of sewers.

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Unit III:

Introduction to Hydrology, Hydrological cycle, Precipitation measurement and analysis of data, runoff and its estimation, hydrograph – unit hydrograph, s-curve hydrograph, synthetic hydrograph, rational method, estimation of storm water quantity and design of storm water sewers.

Unit IV:

Ground water estimation & well hydraulics – confined & unconfined aquifers, governing equations for yield of well (Thiem's & Dupuit's), well loss & specific capacity, ground water recharge. Transport &

transformation of contaminants in groundwater: processes, governing equations, and initial and boundary conditions, solution of simple cases.

Pumps and their classification, pump performance curves, selection of pumps, head, power & efficiency of pumps, economical diameter of rising main, pumping station and their designs.

Unit V:

Introduction to Pollutant transport process in surface water, standards for pollutant disposal in surface water, factors affecting pollutant transport and mixing in river – dilution, dispersion, oxidation, reduction etc., zone of pollution in river, mixing mechanism in river, sag curve, streeter phelps equation. Introduction to various software's for design of pipe networks & sewer lines.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Apply fluid mechanics principles in analysis and design of pipe flow.

CO 2: Apply principles of hydraulics for design of sewer lines.

CO 3: Apply principles of surface water hydrology for design of storm water sewer.

CO 4: Estimate groundwater quantity and pollution load on groundwater and surface water.

CO 5: Apply the principles of hydraulics in design of pumping stations and estimation of pollution load on rivers.

Text Books:

1. Sewage Disposal & Air Pollution Engineering, S. K. Garg, Khanna Publishers, 2016
2. Water Supply Engineering, S.K. Garg, Khanna Publishers, 2016
3. Hydraulics & Fluid Mechanics, P.N. Modi & S.M. Seth, Standard Publishers, 2017

Reference Books:

1. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, New Delhi
2. CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of Urban Development, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 2013.
3. CPHEEO, Manual on Water Supply and Treatment, Ministry of Urban Development, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 1999.
4. Fluid Mechanics, A.K. Jain, Khanna Publishers, 2004.

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Course Code: 530115

Course Title: Environmental Auditing & Management System

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide broad knowledge on various aspects of environmental management system.
2) To understand the principles of environmental auditing and complete process.
3) To apply the concepts of LCA in environmental management.
4) To understand the EMS approach and ISO.
5) To understand various concepts of social accountability.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Illustrate** the process of environmental auditing.	Skill development
2.	**Demonstrate** the environmental audit process in industry and other projects.	Skill development
3.	**Explain** the concepts of environmental management system approach through ISO guidelines.	Skill development/ employability
4.	**Apply** various environment management methodologies like LCA, social accountability.	Skill development, entrepreneurship & employability
5.	**Develop** EMS in organizations and improve the existing EMS system.	Skill development, entrepreneurship & employability

Syllabus:

Unit I: Concepts of Environmental Audit, objectives of audit, types of audit, features of effective auditing, audit criteria, elements of audit process, planning and organizing audits, pre-visit data collection, audit protocol, onsite audit, data sampling, inspection, evaluation and presentation, exit interview, audit report, action plan, management of audits, waste management contractor audits, environmental statement.

Unit II: Environmental audit in Industrial projects, case studies of environmental audits, Life cycle assessment approach (LCA), life cycle costing, eco labeling, stages in LCA of product, procedures for LCA, applications of LCA, sustainable approach towards environment management, green building & green energy concepts and management.

Unit III: Environmental Management Systems Approach (EMS): Introduction, principles & elements of successful environmental management, basic concepts of EMS approach, ISO principles, essential elements of an EMS & ISO 14001, benefits of an environmental management system, creating an EMS in line with ISO 14000.

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Unit IV: Environmental Management Planning, EMS development and implementation project and plan, measurement and evaluations required for an EMS, environmental management reviews and

improvements, legal and regulatory concerns, Integrating ISO 9000 & ISO14000, EMAS.

Unit V: Social Accountability: requirements, social accountability (SA) 8000 certification, elements of social management system, social policy, planning, implementation, business benefits, corporate social responsibility (CSR), different models.

Course Outcomes:
Upon completion of the course, the students will be able to:

CO1: Illustrate the process of environmental auditing.

CO2: Demonstrate the environmental audit process in industry and other projects.

CO3: Explain the concepts of environmental management system approach through ISO guidelines.

CO4: Apply various environment management methodologies like LCA, social accountability.

CO5: Develop EMS in organizations and improve the existing EMS system.

Text Books:

1) A. K. Shrivastava, Environmental Auditing, APH Publishing, 2003.

2) T.V. Ramachandra, Vijay Kulkarni, Environmental Management, TERI Press, 2009

3) Richard Welford, Corporate Environmental Management, Universities Press (India), 1996

4) Christopher Sheldon, Environmental Management Systems, Routledge Edition, 2006

5) Mitlon P Dentch, ISO 14001:2015 Implementation Handbook, ASQ, 2017

Reference Books:

1) R. D. Tripathi, An Introduction to Environmental Audit, Alfa Publication.

2) Vasanthakumar, N.Bhat, Total Quality Environmental Management : An ISO 14000 Approach, Praeger publishers, 1998

3) Alan S. Morris, ISO 14000, Environmental Management Standards, Wiley International, 2003.

4) Syed Imtiaz Haider, Environmental Management System ISO 14001:2004, CRC Press, 2010

5) Deborah Leipziger, Social Accountability SA8000, Viva Books Private Limited, 2010

6) B Banerjee, Corporate Environmental Management, PHI Publications, 2009.

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Course Code: 530114

Course Name: Industrial Waste Management

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide broad knowledge on various methods of sewage disposal, their effects on water pollution & also provide information on various disposal standards.
2) To learn the basics of sewage composition & its characteristics.
3) To provide knowledge on various waste water treatment techniques.
4) To provide broad knowledge on common effluent treatment plants, wastewater reuse, waste audit.
5) To provide information about various existing waste treatment & management techniques of various industries.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** basic concepts of industrial waste management.	Skill development
2.	**Evaluate** the effects of industrial waste on streams as per the standards.	Skill development
3.	**Determine** the requirements for safe disposal of sewage.	Skill development/ employability
4.	**Apply** suitable techniques for reduction & treatment of industrial waste & sludge.	Skill development, entrepreneurship & employability
5.	**Explain** waste management techniques of different industries.	Skill development, entrepreneurship & employability

Syllabus:

Unit-I:

Effects of wastes on streams and sewage treatment plant, natural purification of streams, oxygen sag curve, allowable organic load on streams, classification of stream, stream standards and effluent standards requirement of water for different purposes.

Unit-II:

Sampling of waste waters, Grab, Composite and Integrated samples, analysis of waste water, Biochemical Oxygen Demand, Chemical Oxygen Demand and pH value of waste water, Toxicity of waste by Bioassay method.

Pre-treatment of Wastes: Volume and strength reduction, source reduction of wastes, salvage of materials, recovery of by products, reuse of waste water.

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Unit-III:

Equalization, Neutralization, Removal of suspended solids, removal of inorganic and organic dissolved solids, sludge treatment & disposal, Advance methods of treatment such as Adsorption, Reverse Osmosis, Ion Exchange Process, Electro Dialysis, etc.

Unit-IV:

Industrial Waste water and environmental impacts, Industrial waste survey, Industrial and common effluent treatment plants, zero effluent discharge systems, Waste management approach, Waste Audit - Evaluation of pollution prevention options.

Unit-V:

Brief study of industrial processes and treatment methods of waste water from common industries such as Textile, Dairy, Paper and pulp, Tannery, Distillery, petrochemicals, pharmaceuticals, fertilizers, cement & food processing.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO1: Explain basic concepts of industrial waste management.

CO2: Evaluate the effects of industrial waste on streams as per the standards.

CO3: Determine the requirements for safe disposal of sewage.

CO4: Apply suitable techniques for reduction & treatment of industrial waste & sludge.

CO5: Explain waste management techniques of different industries.

Text Books:

1. Industrial Waste Water Treatment – A.D. Patwardhan, PHI, Delhi
2. Waste Water Engg. – Treatment Disposal & Reuse – Metcalf & Eddy – Tata Mc Graw Hill, New Delhi
3. Industrial Water Pollution Control – W.W. Eckenfelder, McGraw Hill, 1999.

Reference Books:

1. Wastewater Treatment – M.N. Rao & Dutta, Oxford & IBH Publishing House, New Delhi.
2. Waste Water Treatment – Arceivala – Tata Mc Graw Hill, New Delhi, 2006.
3. Industrial Waste Water Management hand book – N.S. Azad, Tata Mc Graw Hill, New Delhi
4. Pollution Control in Process Industries – Mahajan, Tata McGraw Hill, Delhi, 1984
5. Liquid Waste of Industries – Theories, Practice and Treatment – N.L. Nemerow, Wesley Publishing Co.

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Course Code: 530113

Course Name: Advanced Treatment Process – I (Waste Water Engineering)

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To impart basic knowledge on sewerage system including estimation of sewage quantity & design of sewers.
2) To provide a broad knowledge on sewage composition & its characteristics.
3) To provide information on disposal standards of effluents & also about various methods of sewage disposal.
4) To provide broad knowledge on various techniques of sewage treatment including advanced processes.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts of waste water engineering & treatment.	Skill development
2.	**Determine** the requirements of safe disposal of sewage.	Skill development
3.	**Apply** various techniques for treatment of sewage.	Skill development/ employability
4.	**Apply** various techniques of sludge treatment and disposal.	Skill development, entrepreneurship & employability
5.	**Design** sewage system for safe disposal of sewage.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Estimation of sewage flow, fluctuations in flow, estimation of storm water quantity, self cleansing velocity, systems of sewerage, design of sanitary sewer & storm water sewer, sewer materials, sewer appurtenances, construction & maintenance of sewer lines, sewage characteristics.

Unit II:

Conventional municipal waste water treatment flow sheet, functions of different unit process, unit operations, treatment requirements. Preliminary treatment: screening, grit removal, design of screen, grit chamber. Primary Treatment: principles of sedimentation, design of sedimentation tanks and skimming tanks. Biological Treatment: principles & objectives of biological treatment, types of biological treatment, fundamentals of process kinetics, kinetics of biological growth, reactors – classification, selection, aspects of reactor design.

Unit III:

Attached & suspended growth biological treatment system, design of activated sludge process, trickling filters, oxidation ponds, septic tanks, imhoff tanks, rotating biological contactors, aerated lagoon, oxidation ditch, anaerobic treatment – UASB process, anaerobic filters, anaerobic digester, anaerobic lagoons.

Unit IV:

Advanced waste water treatment: requirement of tertiary treatment, disinfection, nitrogen removal, phosphorus removal, adsorption, removal of dissolved inorganic substances using various filtration techniques like R.O., ultra filtration etc, electrodialysis. Recent techniques of waste water treatment – MBBR, MBR, SBR, constructed wetlands.

Unit V:

Sludge treatment: sources of sludge, sludge quantity & quality, sludge thickening and digestion, various methods of sludge treatment, sludge drying beds, sludge disposal.

Sewage disposal: stream & effluent standards for various purposes, dilution methods, natural purification of stream, oxygen sag curve & its analysis, disposal of sewage on land, methods of sewage farming.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of waste water engineering & treatment.

CO 2: Determine the requirements of safe disposal of sewage.

CO 3: Apply various techniques for treatment of sewage.

CO 4: Apply various techniques of sludge treatment and disposal.

CO 5: Design sewage system for safe disposal of sewage.

Text Books:

1. Sewage Disposal & Air Pollution Engineering, S. K. Garg, Khanna Publishers, 2016
2. Metcalf & Eddy, Inc. Wastewater Engineering, Treatment and Reuse. 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.

Reference Books:

1. Waste Water Engineering, B.C. Punmia, Laxmi Publication.
2. Water & Waste Water Technology, Mark J Hammer, Prentice Hall of India, New Delhi
3. Wastewater Treatment Plant, Planning Design & Operation, S.R. Qasim, CRC Press, 1998
4. CPHEEO, Manual on Sewerage and Sewage Treatment, Ministry of Urban Development, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 2013.

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Course Code: 530112

Course Name: Solid and Hazardous Waste Management

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To provide broad knowledge on various aspects of planning & implementation of waste management system in a smart city/town.

2) To understand the principles applied in waste management.

3) To understand various ways to collect, treat & disposal of waste.

4) To understand various methods of energy recovery from waste.

5) To understand various aspects of hazardous waste management, E-waste management, biomedical waste management etc.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the principles & concepts of waste management.	Skill development
2.	**Apply** various techniques of handling the waste.	Skill development
3.	**Apply** various techniques of energy recovery from waste.	Skill development/ employability
4.	**Plan** an effective & efficient waste management system.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Introduction: Introduction to waste management, classification of solid waste, objective of solid waste management, Solid waste sources – Nature and characteristics (physical, chemical & biological) – Quantities and Qualities – Generation rates – Potential of disease – Nuisance and other problems.

Unit II:

Collection and Storage: Solid waste management – Functional elements of solid waste – on – site storage – Collection and separation – Containers and its location – Collection systems and its example – Vehicle routing – Route balance – Transfer station – Processing – Recovery and reuse.

Unit III:

Processing of Municipal Solid Waste: Conveying and compacting waste – Shredding – Types of shredders – Material separation – Types – Devices for material separation – Thermal processing of municipal solid waste – incineration, pyrolysis, gasification – Refuse Derived fuel – Biological process like composting, Vermicomposting and biomethanation.

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Unit IV:

Disposal: Disposal methods – Sanitary land filling – Planning – Site selection – Design – Landfill Process – Monitoring Closure – Post closure monitoring – leachate management & control of gases in landfills, environmental monitoring of landfills. MSW rules, Introduction to swachh bharat mission and smart cities program - current status, challenges and future trend of waste management.

Unit V:

Hazardous Waste Management: Introduction to hazardous waste - Definition – Characterization and

composition – TCLP test – Storage and transportation of hazardous waste – Labeling of hazardous waste – Physical, Chemical and Biological treatment of hazardous waste – Bioremediation of hazardous waste – Treatment of Bio medical – Nuclear waste and Radio – Active waste – Fly ash management and E-waste management.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the principles & concepts of waste management.

CO 2: Apply various techniques of handling the waste.

CO 3: Apply various techniques of energy recovery from waste.

CO 4: Plan an effective & efficient waste management system.

Text Books:

1. Text Book of Solid Wastes Management, Iqbal H. Khan and Naved Ahsan, CBS Publishers, 1st edition 2012
2. Integrated Solid Waste Management, Hilary Theisen and Samuel A, Vigil, George Tchobanoglous, McGraw Hill Yew York, 1993

Reference Books:

1. Environmental Engineering, Rowe, Peavy & Tchobanogolous, Tata McGraw Hill Publications, 2017
2. CPHEEO, Manual on Municipal Solid Waste management, Central Public Health and Environmental Engineering organization, Government of India, New Delhi, 2016
3. Solid Waste Engineering, Vesilind P.A., Worrel H. W. and Reinhard, Thomson Learning Inc, 2003
4. Charles A. Wentz, Hazardous Waste Management, McGraw Hill, New York. 1995.
5. David Rimbers, Municipal Solid Waste Management: Pollution Technologies Review, Noyes Data Corporation, London, 1990.
6. Michael D. Lagrega, Philip L. Buckingham, Jeffrey C. Evans. Hazardous Waste Management McGraw Hill, New York. 1994.

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Course Code: 530111

Course Name: Environmental Chemistry & Microbiology

L	T	P	Credit
3	0	0	3

Course Objectives:

1) To impart knowledge of environmental chemistry and its concepts.
2) To apply concepts of environmental chemistry in various analysis of water and waste water.
3) To impart knowledge of environmental microbiology and its concepts.
4) To apply concepts of environmental microbiology in various analysis of water and waste water.

Course outcomes focused on employability/entrepreneurship/skill development:

S.No.	Course Outcomes (Co's)	Mapping
1.	**Explain** the concepts of environmental chemistry & microbiology.	Skill development
2.	**Apply** the concepts of environmental chemistry in environmental engineering.	Skill development
3.	**Analyse** water and waste water quality parameters using the concepts of environmentalchemistry	Skill development/ employability
4.	**Apply** the concepts of environmental microbiology in environmental engineering.	Skill development, entrepreneurship & employability
5.	**Explain** the concepts of energy generation in cells.	Skill development, entrepreneurship & employability

Syllabus:

Unit I:

Environmental Chemistry

Basic Principles: Physical and chemical properties of water and their significance in environmental engineering- Types of chemical reactions – stoichiometric calculations – solutions – chemical equilibrium. Acid-base equilibria – alkalinity, acidity, buffers and buffer index – Chemical thermodynamics – Oxidation-Reduction – Mass transfer and transport of impurities in water and air – diffusion, dispersion – Physical and chemical interactions due to various forces, suspensions and dispersions.

Unit II:

Analysis: Basic concepts of quantitative analytical chemistry – Instrumental methods of analysis – Determination of turbidity, colour, pH, acidity, alkalinity, hardness, residual chlorine and chlorine demand, chlorides, dissolves oxygen demand, nitrogen, solids, iron and manganese, fluoride, sulphate, phosphorous and phosphate, grease, volatile acids, gas analysis – Preparation of standard solutions – Drinking water and wastewater standards – Trace organics and inorganics.

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Unit III:

Environmental Microbiology

Introduction: Microorganisms – Classification, prokaryotic and eukaryotic cells, structure, characteristics, nucleic acids, DNA and RNA, Viruses, their detection and quantification – Microscopy – Measurements and isolation of Microorganism – Different Cultures – Media and Techniques of Staining

and Enumeration of microorganism.

Unit IV:

Microbial metabolism and growth: Enzyme and enzyme kinetics – Metabolism – Respiration – Fermentation – Glycolysis – Kreb's cycle – Carbohydrate – Protein, lipids, significance of energetic – Chemical composition of cell and nature of organic matter used by microorganisms – Metabolic classification of microorganisms: phototroph, chemotroph, applications in environmental engineering.

Unit V:

Microbiology of water and wastewater: Distribution of microorganisms in natural water – Indicator organisms – Coliforms – Faecal coliforms – E.coli, streptococcus faecalls – Differentiation of coliforms – Significance – MPN – M.F. techniques – Microbiology of waste-water treatment processes such as activated sludge process – Trickling filter – Anaerobic processes.

Course Outcomes:

Upon completion of the course, the students will be able to:

CO 1: Explain the concepts of environmental chemistry & microbiology.

CO 2: Apply the concepts of environmental chemistry in environmental engineering.

CO 3: Analyse water and waste water quality parameters using the concepts of environmental chemistry.

CO 4: Apply the concepts of environmental microbiology in environmental engineering.

CO 5: Explain the concepts of energy generation in cells.

Books Recommended:

1. Maier R.M. Pepper I.L and Gerba C.P. Environmental Microbiology, Elsevier- AP, New York 2009.
2. Pelczar Jr, M.J., Chan E.C.S., Krieg R.N., and Peiczar M.F., Microbiology, Tata McGraw-Hill, New Delhi, 1996.
3. Sawyer C.N., McCarty P. L., and Parkin G.F., Chemistry for Environmental Engineers, McGraw-Hill, New Delhi, 1994.
4. Benefield, Judkins and Weand – Process Chemistry for Water and Wastewater Treatment, Prentice Hall, New Delhi, 1996.
5. Rittman B. McCarty P.L., and McCarty P., Environmental Biotechnology: Principles and Applications, McGraw-Hill, New Delhi, 2000.

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