

Fifth Semester Course Structure and Syllabus

Department of Civil Engineering

**NIST University, Institute Park, Berhampur,
Odisha-761008**

B. Tech Program Structure			Semester: Fifth (5th)	Department: CE			
S. N.	Category	Subject Code	Subject Name	L	T	P	C
1	PCC	22CE5PC01T	Hydrology	3	0	0	3
2		22CE5PC02T	Foundation Engineering	3	0	0	3
3		22CE5PC03T	Design of Concrete Structures	3	0	0	3
4	PEC	22CE5PE01T	Advanced Structural Analysis	3	0	0	3
		22CE5PE02T	Environmental Impact Assessment and Life Cycle Analysis				
		22CE5PE03T	Building Services and Maintenance				
		22CE5PE04T	Construction Practice				
Open elective for non-CE students							
5	OEC1	22CE5OE01T	Plastic Waste Management	3	0	0	3
		22CE5OE02T	Fluid Mechanics				
	OEC2	22CE5OE03T	Geo Environmental Engineering	3	0	0	3
		22CE5OE04T	Green Technology				
Open elective for CE students							
6	OEC1	22IT5OE01T	Java Programming	3	0	0	3
		22CS5OE01T	Introduction to Python Programming				
		22EE5OE04T	Introduction to Electrical Properties and Materials				
		22EE5OE01T	Renewable Energy Systems				
		22ME5OE03T	MEMS				
		22EC5OE01T	VLSI Design				
7	OEC2	22IT5OE02T	Computer Networks	3	0	0	3
		22CS5OE02T	Database Management System				
		22EE5OE03T	Smart Grid				
		22EE5OE02T	Sensor and Instrumentation				
		22ME5OE04T	Nano Science and Technology				
		22EC5OE03T	Embedded System Design				
		22EC5OE04T	Radar System Engineering				
8	MC	22CM5MC01T	Constitution of India	3	0	0	0
		22CM5MC02T	Essence of Indian Tradition Knowledge				
9	PCC	22CE5PC01L	Water Resources Engineering Laboratory	0	0	2	1
10		22CE5PC01L	Foundation Engineering Laboratory	0	0	2	1
11		22CE5PC02L	Design of Concrete Structures Laboratory	0	0	2	1
12	PSI	22CM5PS01L	Summer Internship/Training	0	0	1	1
Total				21	0	7	22

Detailed Syllabus

Course Code: 22CE5PC01T	Course Name: Hydrology	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To study occurrence movement and distribution of water in different forms and their measurement To know diverse methods of collecting the stream flow information, this is essential to understand surface water hydrology. To understand different methods to represent hydrological information such as rainfall and runoff and their application, To understand the about flood and their occurrence, estimation and control measures To know the basic principles and movement of ground water and properties of ground water 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Understand the hydrological cycle, precipitation, evaporation, infiltration, and their measurements for water balance analysis. Measure stream flow using various methods and establish stage-discharge relationships. Analyze runoff and hydrograph data, derive unit hydrographs, and apply synthetic methods. Estimate floods, conduct frequency analysis, and design storm drainage and flood control systems. Understand groundwater flow, apply Darcy's law, and analyze aquifer properties for groundwater management. 					
Module I	Introduction to Hydrological Cycle	Contact Hours (08)			
Introduction: Hydrologic cycle, Climate and water availability, Water balances, Precipitation and Abstraction: Forms, Classification, Measurement, Data analysis, Evaporation and its measurement, Evapo-transpiration and its measurement, Infiltration: Factors affection infiltration, infiltration models, Infiltration indices.					
Module II	Stream flow Measurement	Contact Hours (08)			
Stream flow Measurement: Measurement of stage and velocity of stream, Discharge measuring structures, Measurement of discharge, by direct method and indirect method, and stage-discharge relationship.					
Module III	Hyetograph and Hydrograph Analysis	Contact Hours (08)			
Hyetograph and Hydrograph Analysis: Hyetograph, Runoff: drainage basin characteristics, Hydrograph concepts assumptions and limitations of unit hydrograph, Derivation of unit hydrograph S hydrograph, Synthetic unit hydrograph: Snyder's approach, Introduction to Instantaneous Unit Hydrograph (IUH), Flow duration curve					
Module IV	Hydrologic Analysis and Design	Contact Hours (08)			
Hydrologic Analysis and Design: Design flood, Flood estimation, Frequency analysis, Flood routing through reservoirs and open channels, Storm drainage design. Flood control measures.					

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Reservoir: Types, Investigations, Site selection, Zones of storage, Safe yield, Reservoir capacity, Reservoir sedimentation and control.		
Module V	Groundwater & Well Hydraulics	Contact Hours (08)
Groundwater & Well Hydraulics: Occurrence and movement of groundwater, Darcy's law, governing ground water flow equations, Factors governing ground water flow, Types of aquifers, porosity, specific yield, specific retention, storage coefficient, permeability, hydraulic conductivity, hydraulic transmissibility.		
Total Lecture Hours		40
Textbooks		
1. K. Subramanian, " <i>Engineering Hydrology</i> ", Fourth edition, McGraw Hill Education, 2017, New York, New York, United States 2. S. K. Garg, " <i>Irrigation Engineering and Hydraulic Structures</i> ", First Edition, Khanna Publication, 2006, India		
Reference Books		
1. B. C. Punmia, B. B. L. Pande, A.K. Jain, A. K. Jain, " <i>Irrigation and Water Power Engineering</i> ", Laxmi Publication, 1992, New Delhi, India. 2. K. C. Patra, " <i>Hydrology and Water Resources Engineering</i> ", First Edition, Published by Narosa Publishing House Pvt. Ltd., 2015, New Delhi, India 3. V.P Singh, " <i>Elementary Hydrology</i> " Facsimile Edition, Prentice Hall Publication, 1991, Hoboken, New Jersey, United States 4. V.T. Chow, " <i>Handbook of applied hydrology</i> " First Edition, McGraw Hill Education, 2017, New York, New York, United States.		
Digital Learning Resources		
Course Name: Hydrology and Water Resources Engineering Course Link: https://nptel.ac.in/courses/105/104/105104103/ Course Instructor: Prof. Rajesh Srivastav, Department of Civil Engineering, IIT Kanpur		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

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Course Code: 22CE5PC01L	Course Name: Hydrology Sessional	L	T	P	C
		0	0	2	1
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Laboratory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> Equip students with the ability to analyze and calculate average precipitation over a specific area. Develop skills for accurate calculation of river discharge and hydrograph derivation. Enable students to perform flood frequency analysis using various statistical methods. Teach the application of GIS tools in watershed delineation and flood routing. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Students will be able to determine and interpret precipitation and discharge data. Students will master the derivation of stage hydrographs, hyetographs, and hydrographs. Students will apply flood frequency analysis techniques using Gumbel's and Log-Pearson methods. Students will utilize GIS for effective watershed delineation and flood routing. 					
List of Experiments					
<ol style="list-style-type: none"> Determination of average precipitation over an area. Calculation of discharge of river. Derivation of stage hydrograph of a river Derivation of hyetograph for given set of rainfall Determination of hydrograph and unit hydrograph of a river. Determination of synthetic unit hydrograph of a catchment Flood frequency analysis using Gumbel's distribution of a river. Flood frequency analysis using Log-Pearson method of a river Flood routing using Muskingum Routing equation Delineation of watershed using Geographical Information system. 					
Mode of Evaluation: Internal Assessment (Attendance, Continuous Assessment, Quiz or Viva-voce)					
Recommended by Board of Studies		No.:		Date:	
Approved by Academic Council		No.:		Date:	

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Course Code: 22CE5PC02T	Course Name: Foundation Engineering	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> • Understand earth pressure theories and apply them to analyze the stability of retaining structures. • Learn the bearing capacity of shallow foundations using various theories and methods, including field tests. • Distinguish between shallow and deep foundations and evaluate the load-carrying capacity and settlement of pile foundations. • Explore methods of subsoil exploration, including sampling and in-situ testing techniques for geotechnical analysis. • Understand rock mechanics, geophysical prospecting methods, and analyze the stability of slopes in rock masses. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> • Analyze and apply concepts of earth pressure at rest, active and passive earth pressure, and stability conditions for retaining walls • Evaluate the bearing capacity of shallow foundations, including types of shear failure, Terzaghi's equation, and limitations, and apply field methods such as plate load tests. • Design and analyze deep foundations, including pile foundations, types of piles, pile driving, load carrying capacity, and settlement analysis. • Execute subsoil exploration methods, including direct and indirect methods, soil sampling, and in-situ tests. • Analyze the stability of rock masses and slopes, including joints, faults, folds, and geophysical prospecting methods 					
Module I	Earth Pressure Theory	Contact Hours (08)			
Lateral Earth Pressure and Retaining Structures: Concept of earth pressure, Earth pressure at rest, active and passive earth pressure for both cohesionless and cohesive soils, Earth pressure theories: Rankine's theory, Coulomb's Wedge theory, Stability conditions for retaining walls.					
Module II	Shallow Foundation	Contact Hours (08)			
Bearing Capacity of Shallow Foundations: Types of shear failure in foundation soil, Terzaghi's bearing capacity equation and its limitations, Meyerhof's, Vesics's, Brinch-Hansen, IS code method of bearing capacity theory, Effect of water table on bearing capacity, Plate load test and its limitations					
Module III	Deep Foundation	Contact Hours (08)			
Deep Foundations: Difference between shallow and deep foundations, Types of deep foundations. Pile Foundations: Types of piles, pile driving, load carrying capacity of piles-static and dynamic formulae, Pile load test and its limitations, Pile group analysis, Settlement analysis of pile.					
Module IV	Sub Soil Exploration	Contact Hours (08)			
Necessity and planning for subsoil exploration, Methods -direct (test pits), indirect (sounding, penetration tests and geophysical methods). Soil sampling – types of samples, standard penetration test, static and dynamic cone penetration test.					
Module V	Rock Mechanics and Slope Stability analysis	Contact Hours (08)			
Rock Mechanics: Introduction, problems, defects in rock mass, joints, faults, folds. Stability of Slopes: Stability of infinite slopes, the stability of finite slopes.					

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Total Lecture Hours		40
Textbooks		
<ol style="list-style-type: none"> 1. B. M. Das, Principles of Geotechnical Engineering, First Edition, Thompson Learning, 2002, Boston, Massachusetts, United States. 2. G. Ranjan and A. S. R. Rao, Basic and Applied Soil Mechanics, Second Edition, New Age International, 2007, New Delhi. 		
Reference Books		
<ol style="list-style-type: none"> 1. S. K. Gulhati and M. Datta, Geotechnical Engineering, First Edition, McGraw Hill Education, 2017, New York, United States. 2. V. N. S. Murthy, Principles of Soil Mechanics and Foundation Engineering, First Edition, UBS Publishers and Distributors, 2002. New Delhi. 		
Digital Learning Resources		
Course Name: Foundation Engineering		
Course Link: https://nptel.ac.in/courses/105/105/105105176/		
Course Instructor: Prof. Koushik Deb, Department of Civil Engineering, IIT Kharagpur		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
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Course Code: 22CE5PC02L	Course Name: Foundation Engineering Laboratory	L	T	P	C
		0	0	2	1
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Laboratory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To develop skills in laboratory testing and analysis of soil properties, including compressibility, bearing capacity, and shear strength. To apply knowledge of soil mechanics to design and analyze shallow and deep foundation systems. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Students will be able to design and analyze shallow foundation systems, including determination of load carrying capacity and settlement analysis. Students will be able to apply laboratory testing and analysis to determine the compressibility, bearing capacity, and shear strength of soil, and to use this information to design and analyze deep foundation systems. 					
List of Experiments					
<ol style="list-style-type: none"> Determination of compressibility characteristics of fine-grained soil by consolidation test. Determination of bearing capacity by Standard Penetration test. Determination of bearing capacity by Cone Penetration test. Determination of shear strength of saturated soil by Triaxial Shear Test. Determination of Shear Strength of Saturated soil by Drained Triaxial Shear Test. Determination of Free Swell and Swelling Potential. 					
Mode of Evaluation: Internal Assessment (Attendance, Continuous Assessment, Quiz or Viva-voce)					
Recommended by Board of Studies	No.:	Date:			
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Course Code: 22CE5PC03T	Course Name: Design of Concrete Structures	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> Understand concrete and steel properties and apply the limit state method to design rectangular beams. Design beams for shear, bond, torsion, and develop skills in designing doubly reinforced and T/L beams. Design and detail reinforcement for one-way and two-way slabs under various loading and support conditions. Design short and slender columns under axial loads and bending, including uni-axial and bi-axial cases. Learn to design isolated square and rectangular footings for different foundation types. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Design rectangular beams using working stress and limit state methods. Design beams for shear, bond, torsion, and develop skills in doubly reinforced, T, and L beams. Design one-way and two-way slabs with proper reinforcement detailing. Design compression members for axial loads and bending, considering uni-axial and bi-axial effects. Design isolated square and rectangular footings for various foundation types. 					
Module I	Design of flexure	Contact Hours (08)			
Properties of concrete and reinforcing steel; philosophy, concept and methods of reinforced concrete design; Concept of working stress method, introduction to limit state method: limit state of collapse and limit state of serviceability, application of limit state method to rectangular beams for flexure.					
Module II	Design of beam	Contact Hours (08)			
Design the beams for shear; bond; and torsion. Design of doubly reinforced beams; T and L beams.					
Module III	One-way and Two-way slab	Contact Hours (08)			
Structural behaviour of one way and two-way slabs under uniformly distributed load, Types of end supports, Design and reinforcement detailing of one way slab: cantilever and simply supported .one way continuous slab Design and reinforcement detailing of Two-way slab: Corners are not held down, Corners are held down: All the Four edges discontinuous case only.					
Module IV	Compression members	Contact Hours (08)			
Design of compression members for axial loads and axial load plus, Uni-axial moment ,Short columns under axial compression, Short columns under axial compression with uni-axial bending, Short columns under axial compression with bi-axial bending. Slender columns.					
Module V	Foundation	Contact Hours (08)			
Foundation types, Types of footings, Design of isolated square and rectangular footings.					
Total Lecture Hours					40
Textbooks					
1. S. Pillai and D.Menon, “Reinforced Concrete Design” Third Edition, McGraw Hill Education, 2017, New York, New York, United States.					

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Reference Books		
2. B.C.Punmia, A.K.Jain and A.K.Jain “RCC Design”, Tenth edition, Laxmi Publications, 2015, New Delhi, India.		
Digital Learning Resources		
Course Name: Design of Reinforced Concrete Structures Course Link: https://nptel.ac.in/courses/105/105/105105105/ Course Instructor: Prof. Nirjhar Dhang, Department of Civil Engineering, IIT Kharagpur		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code:	Course Name:	L	T	P	C
22CE5PC03L	Design of Concrete Structures Laboratory	0	0	2	1
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Laboratory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To familiarize students with various tests for assessing the workability of concrete, including slump, compaction factor, and flow table tests. To teach students the methods of evaluating concrete strength through cube tests, cylinder tests, and split tensile strength tests. To impart knowledge on the design of concrete mixes according to Indian Standard methods and practical field applications for reinforcement detailing. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Students will be able to perform and interpret the results of different workability and strength tests on concrete. Students will gain the ability to design concrete mixes as per Indian standards, ensuring the desired properties and strength for various construction projects. Students will acquire hands-on experience in the field by detailing reinforcements during site visits, bridging theoretical knowledge and practical application. 					
List of Experiments					
<ol style="list-style-type: none"> Workability test of concrete: Slump test Workability test of concrete: Compaction factor test Workability test of concrete: Flow table test Cube Test of Concrete(Nominal Mix) Cylinder Test for Concrete(Nominal Mix) Split Tensile Strength Test of Concrete Prism test for determining modulus of rupture of concrete Design of Concrete Mix (As per Indian Standard Method) Two Field visits (Detailing of reinforcements, RMC plant) 					
Mode of Evaluation: Internal Assessment (Attendance, Continuous Assessment, Quiz or Viva-voce)					
Recommended by Board of Studies		No.:		Date:	
Approved by Academic Council		No.:		Date:	

Course Code: 22CE5PE01T	Course Name: Advanced Structural Analysis	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To analyze rolling loads and influence lines for determinate beams. To learn analysis techniques for continuous beams and plane frames using Kani's Method. To analyze two-hinged arches and suspension cables with two-hinged stiffening girders. To apply matrix methods of analysis to simple beams. To comprehend plastic modulus, shape factor, and perform plastic analysis of continuous beams and rectangular portals. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Analyze influence lines for reaction, shear force, and bending moment at various sections. Apply Kani's Method to analyze continuous beams and plane frames. Evaluate two-hinged arches and suspension cables with stiffening girders. Implement flexibility and stiffness methods in analyzing simple beams. Perform plastic analysis on continuous beams and rectangular portals, understanding key design factors. 					
Module I	Influence Line Diagram	Contact Hours (08)			
Rolling loads and influence lines for determinate beam. ILD for reaction, shear force and bending moment at a section, ILD for wheel loads, point loads and udl, Absolute maximum bending moment and shear force.					
Module II	Analysis of beams, frames and plane trusses	Contact Hours (08)			
Analysis of continuous beams and plane frames by Kani's Method. Analysis of indeterminate plane trusses					
Module III	Analysis Arches	Contact Hours (08)			
Analysis of two hinged arches, Suspension cables with two hinged stiffening girders.					
Module IV	Matric Method of Analysis	Contact Hours (08)			
Matrix methods of analysis: flexibility and stiffness methods; Application to simple beams.					
Module V	Plastic Analysis	Contact Hours (08)			
Plastic Design: Plastic modulus, shape factor, plastic moment of resistance, Load factor, Plastic analysis of continuous beam and simple rectangular portals					
Total Lecture Hours					40
Textbooks					
1. C. S. Reddy, Basic Structural Analysis, Third Edition, McGraw Hill Education,					

2017		
2. S. S. Bhavikatti, Structural Analysis I&II”, Fifth Edition, Vikas Publishing House, Noida, 2011.		
Reference Books		
1. Norris and Wilber, Elementary Structural Analysis, Fourth Edition, McGraw Hill, Inc., USA, 1991		
2. A. Kassimali, Structural Analysis, Fifth Edition, Cengage Learning India Private Limited, 2015		
Digital Learning Resources		
Course Name: Advanced Structural Analysis		
Course Link: https://nptel.ac.in/courses/105105180/		
Course Instructor: Prof. Amit Shaw & Prof. Biswanath Banerjee, IIT KGP		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE5PE02T	Course Name: Environmental Impact Assessment and Life Cycle Analyses	L 3	T 0	P 0	C 3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To understand the principles of environmental management and ecosystem concepts, focusing on policy and legal aspects. To learn the processes and documentation involved in Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA). To grasp the elements of the audit process, including waste audits and pollution prevention assessments. To study the stages and procedures of LCA for products and explore sustainable approaches to environmental management. To implement and conform to EMS standards like ISO 14001 and understand the economic tools for environmental evaluation. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Students will understand environmental policies, laws, and legislations in India. Students will perform and document Environmental Impact Assessments and understand the environmental clearance procedure in India. Students will conduct environmental audits and pollution prevention assessments in industrial projects. Students will apply Life Cycle Assessment procedures to various products and understand their environmental impact. Students will implement Environmental Management Systems conforming to ISO 14001 and utilize economic tools like Green GDP and Cleaner Development Mechanisms. 					
Module I	Environmental Management Fundamentals:	Contact Hours (08)			
Principles of Environmental Management, Ecosystem Concepts, Environmental Concerns in India, Policy and Legal Aspects of Environmental Management, Introduction to Environmental Policies, Environmental Laws and Legislations, Environmental Legislations in India.					
Module II	Environmental Impact Assessment Methods:	Contact Hours (08)			
Environmental Impact Assessment (EIA) and methods, Impact Prediction, Evaluation and Mitigation, Forecasting Environmental Changes, Strategic Environmental Assessment (SEA), Environmental Clearance Procedure in India, EIA Documentation and Processes, EIA Monitoring and Auditing.					
Module III	Environmental Auditing:	Contact Hours (08)			
Environmental Auditing, Elements of Audit Process, Waste Audits and Pollution Prevention Assessments, EA in Industrial Projects.					
Module IV	Life Cycle Assessment (LCA):	Contact Hours (08)			
Life Cycle Assessment (LCA): Stages in LCA of a Product, Procedures for LCA, Different Applications of LCA. Sustainable approach towards Environment Management, Environmental Protocols.					

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Module V	Environmental Management Systems (EMS):	Contact Hours (08)
Environmental Management System Standards, Implementation of EMS Conforming to ISO 14001. Environmental Economics: Introduction, economic tools for evaluation, Green GDP, Cleaner development mechanisms and their applications.		
Total Lecture Hours		40
Textbooks		
<ol style="list-style-type: none"> 1. V. Kulkarni and T.V. Ramachandra, "Environmental Management", Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore, Printed by TERI Press, New Delhi. 2. L.W. Canter, "Environmental Impact Assessment", Second Edition, McGraw-Hill Higher Education, 1996, New York, New York, United States. 		
Reference Books		
<ol style="list-style-type: none"> 1. Paul, A Erickson, "<i>A Practical Guide to Environmental Impact Assessment</i>" Academic Press Inc, 1994, Cambridge, Massachusetts, United States. 2. B. N. Lohani "<i>Environmental Quality Management</i>", South Asian Publishers, 1984, New Delhi. 3. Chanlett "<i>Environmental Protection</i>", McGraw Hill Publication, 1979, Newwork. 4. G.E. Danoy and R.F. Warner "<i>Planning and Design of Engineering Systems</i>" Unwin Hyman Publications. 5. ISO 14001:2004 Environmental management systems - Requirements with guidance for use. 		
Digital Learning Resources		
Course Name: Environmental Impact Assessment and Life Cycle Analyses		
Course Link: https://nptel.ac.in/courses/120/108/120108004/		
Course Instructor: Prof. Brajesh Kumar Dubey , Department of Civil Engineering, IIT Kharagpur		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE5PE03T	Course Name: Building Services and Maintenance	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To understand the maintenance of buildings, including white washing, painting, and repairs to various structural elements. To learn methods for removing stains, performing anti-termite treatment, and repairing plumbing and drainage systems. To acquire knowledge on special repairs, including foundation strengthening, roof repairs, and addressing masonry wall cracks. To study techniques for strengthening beams, columns, slabs, and masonry walls. To understand water quality, purification, supply systems, and sanitation practices in buildings and small towns. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Students will perform building maintenance tasks such as white washing, painting, and repairing flooring and windows. Students will execute stain removal, anti-termite treatment, and plumbing and sanitary repairs effectively. Students will conduct special repairs, including strengthening foundations, rectifying leaks, and repairing expansion joints. Students will apply techniques to strengthen beams, columns, slabs, and masonry walls in existing structures. Students will design and implement water supply and sanitation systems in buildings, adhering to municipal bye-laws and regulations. 					
Module I	Building Maintenance Practices:	Contact Hours (08)			
Maintenance of Building: White washing, colour washing and distempering, painting, replacement of glass panels, re-polishing of terrazzo and mosaic, replacement of decayed timber, easing of doors and windows, repairs to damaged part of the flooring.					
Module II	Repairs and Treatments:	Contact Hours (08)			
Removal of stains from concrete and terrazzo floor, anti-termite treatment in building, foundations, floors and wood work , repairing of plumbing, drain and sanitary works. Repair of water storage sumps and tanks					
Module III	Special Repairs Techniques:	Contact Hours (08)			
Special Repairs: Strengthening of foundation and foundation soils, rectification of leaking roof and concrete cover spalled roof, repairs to crack in masonry wall, repairs to leakage at window sill, special repairs to joinery work at roof level, providing D.P.C. to the exciting buildings, repairs to expansion and contraction joints, repairs to ramped floors.					
Module IV	Structural Strengthening:	Contact Hours (08)			
Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall					
Module V	Water and Sanitation Systems:	Contact Hours (08)			
Water quality, Purification and treatment- water supply systems-distribution systems in small towns –types of pipes used- laying jointing, testing-testing for water tightness					

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plumbing system for building-internal supply in buildings- municipal bye laws and regulations - Rain Water Harvesting - Sanitation in buildings-arrangement of sewerage systems in housing -pipe systems storm water drainage from buildings -septic and sewage treatment plant – collection, conveyance and disposal of town refuse systems.		
Total Lecture Hours		40
Textbooks		
1. V. N. Vazirani and S.P. Chandola, “ <i>Building Construction</i> ”, Khanna Publishers, New Delhi, India.		
Reference Books		
1. B. Chanter and P. Swallow “ <i>Building Maintenance Management</i> ”, Second Edition, Wiley-Blackwell, 2017, New Jersey, United States.		
2. General Specification for Building Maintenance Works in Residential Buildings, prepared by Building Surveying Division, HKIS		
Digital Learning Resources		
Course Name: Fire Protection, Services and Maintenance Management of Building		
Course Link: https://nptel.ac.in/courses/105/102/105102176/		
Course Instructor: Dr. B. Bhattacharjee, Department of Civil Engineering, IIT Delhi		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE5PE04T	Course Name: Construction Practice	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> Understand the essential construction processes, including site preparation, earthwork, and masonry coordination. Master the principles and techniques of brick and stone masonry, including construction and maintenance. Learn methods to prevent dampness, apply plastering techniques, and maintain building integrity. Gain insight into the selection and use of construction and earth-moving equipment, comparing mechanical and manual methods. Review the types and roles of various construction machinery and equipment used in different stages of construction. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Ability to manage and execute essential construction activities with proper sequencing and coordination. Proficiency in constructing and maintaining brick and stone masonry structures. Capability to apply damp proofing, plastering techniques, and implement effective building maintenance strategies. Competence in selecting and operating appropriate earth-moving equipment for various construction tasks. Understanding of the functions and applications of construction machinery for efficient project execution. 					
Module I	Construction Practices	Contact Hours (08)			
Construction Practices: Specifications, details and sequence of activities and construction co- ordination, Site Clearance, Marking, Earthwork, masonry, Bond in masonry. Foundation: Types of foundation					
Module II	Masonry Works	Contact Hours (08)			
Brick Masonry: Types of bonds, Brick laying, Joints in brickwork, Reinforced brickwork, Joint between old and new masonry, Maintenance of brick work. Stone Masonry: Types of stone masonry-Rubble and Ashlar, General principles of construction, Joints of stone, maintenance of stone work.					
Module III	Damp Proofing, Plastering, and Building Maintenance	Contact Hours (08)			
Damp Proofing: Causes and effects, materials used for damp proofing, methods of preventing dampness, Damp Proof Course. Plastering: Definition. Materials used for plastering, types of plastering, methods of plastering, defects and remedial measures in plastering. Maintenance of Buildings: Causes and prevention of cracks in building, Leakage of buildings, special repair of buildings, annual maintenance.					

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Module IV	Construction Equipment and Earth Moving Fundamentals	Contact Hours (08)
Construction Equipment: Conceptual planning of new project, site access and services, mechanical v/s manual construction. Earth moving Equipment: Fundamentals of earth moving and earth moving equipment Types of Earth Work Equipment -Tucks, bulldozers, power shovels, Scrapers, frond end loaders, Excavators.		
Module V	Construction Equipment and Machinery Overview	Contact Hours (08)
Types of pumps used in Construction, Foundation and Pile Driving Equipment, lifting equipment, Concreting equipment. Plants for grading, batching, mixing, types of mixers, concrete pumps, bitumen plants.		
Total Lecture Hours		40
Textbooks		
1. B.C.Punmia, A. K. Jain and A. K. Jain, “Building Construction, Laxmi Publications (P) ltd., New Delhi 2. R.L. Peurifoy, “Construction Planning and Equipment” -McGraw-Hill Publishing Co.; 6th edition, 2001.		
Reference Books		
1. Mahesh Verma, “Construction Equipment and Its Planning and Application”, Metropolitan Book Co; 2nd edition, 1975. 2. U. K. Shrivastava, “Construction Planning and Management”, Galgotia Publications Pvt Ltd, 2000. 3. S.C Sharma, “Construction Equipment and Management”, Khanna Publishers New Delhi, 1988.		
Digital Learning Resources		
Course Name: Construction method and equipment management Course Link: https://nptel.ac.in/courses/105/103/105103206/ Course Instructor: Dr. Indu Shiva Ranjani Gandhi , IIT Guwahti		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE5OE01T	Course Name: Plastic Waste Management	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To provide a comprehensive overview of plastics, including types, uses, and global statistics, and to understand plastic waste management rules and regulations. To learn the 4 R & I approach (Reduce, Reuse, Repair, Recycle, Incinerate) for plastic waste management with practical examples. To study mechanical and chemical recycling processes for common plastics and mixed waste, focusing on production methods like extrusion and solvolysis. To explore practical applications and challenges of plastic waste management, including use in roads, greener alternatives, and the impact of plastic bans. To understand biodegradable plastics, environmental issues, policies, and legislation, and to explore their energy-saving and eco-friendly benefits through case studies and life cycle analysis. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Understand the types and uses of plastics and the global and Indian context of plastic waste production and management. Apply the 4 R & I approach to plastic waste management, understanding practical examples and classification codes. Execute mechanical and chemical recycling processes for various plastics, including recovery methods and production techniques. Manage plastic waste in practical applications, explore greener alternatives, and understand the impact of plastics on marine life, wildlife, human health, and the environment. Gain insights into biodegradable plastics, their environmental impact, and policies, and perform life cycle analysis to evaluate their eco-friendliness and energy-saving potential. 					
Module I	Understanding Plastics	Contact Hours (08)			
Plastics – What it is? Types, Uses and Global Statistics, Plastic Waste – Sources, Production, Global and Indian Context, Plastic Waste Management Rules 2016 (India) and Global Rules and Regulations					
Module II	Plastic Waste Management Techniques	Contact Hours (08)			
Plastics waste management-4 R & I approach viz. Source reduction, Reuse, Repair, Recycling, and Incineration with examples. Plastics recycling, Classification Code of practice-Primary, secondary, tertiary and quaternary recycling with examples-Coextrusion and co-injection moulding-Waste plastics as fillers.					
Module III	Recycling Processes	Contact Hours (08)			
Mechanical recycling of commonly used plastics, such as PP, PE, PET, etc. mixed waste recycling- co-extruded films waste, commingled waste extrusion flow moulding for production of plastics lumbars, chemical recycling/feed Stock recycling processes for recovery of oil, monomer and energy-thermolytic processes. Solvolysis-process outline for PMMA, PET, etc.					
Module IV	Plastic Waste Management Practices	Contact Hours (08)			

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Plastic Waste Management Practices – Use of Plastic waste in roads, issues and challenges, Possible Alternate Materials to Plastics –Greener Alternatives, Plastics Resource Recovery and Circular Economy, Plastic Bans including China Sword Policy implication on global plastic waste management, Impact of Plastics on Marine Life, Effect on Wildlife, Human Health and Environment.		
Module V	Biodegradable plastics	Contact Hours (08)
Biodegradable plastics-an overview. Environmental issues, policies and legislation in India. Plastics-Energy saving, Eco-Friendly-Case studies. Life cycle analysis-a model.		
Total Lecture Hours		40
Textbooks		
<ol style="list-style-type: none">1. R.J. Brandrup, Recycling and recovery of plastics, First Edition, Hanser Publishers, 1996 New York2. N. Mustafa, Plastics Waste Management, Disposal Recycling and Reuse, First Edition, Marcel Dekker, Inc. 1993, New York.		
Reference Books		
<ol style="list-style-type: none">1. B. Chanter and P. Swallow “<i>Building Maintenance Management</i>”, Second A. L. Andrady, Plastics and the Environment, First Edition Wiley Inter science, 2003, New York.2. R.J. Ehrig, Plastics Recycling, Products and Processes, First Edition Hanser Publishers, 1992, New York.3. Technologies in Plastics Recycling, American Chemical Society, Washington, DC 1992.		
Digital Learning Resources		
Course Name: Plastic Waste Management Course Link: https://nptel.ac.in/courses/105/105/105105184/# Course Instructor: Prof. B. K. Dubey, Department of Civil Engineering, IIT Kharagpur		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE5OE02T	Course Name: Fluid Mechanics	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To introduce the scope and development of fluid mechanics and its fundamental physical properties. To comprehend the classification and description of fluid flow, including key concepts such as Reynold's number and continuity equations. To learn and apply fundamental equations of fluid dynamics, including Bernoulli's and Euler's equations, in practical scenarios. To study the classification, operation, and efficiency of hydraulic turbines, such as Pelton, Francis, and Kaplan turbines. To understand the construction, operation, and performance characteristics of centrifugal and positive displacement pumps. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Understand fluid properties, pressure measurements, buoyancy, and stability of bodies. Classify fluid flow, calculate flow rates, and apply continuity equations in fluid kinematics. Apply Bernoulli's equation, analyze flow in pipes, and understand energy losses in fluid systems. Understand operation, efficiency, and performance of impulse and reaction turbines. Grasp working principles, efficiency, and performance of centrifugal and positive displacement pumps, including NPSH and cavitation. 					
Module I	Understanding Fluid Mechanics	Contact Hours (08)			
<p>Introduction: Scope of fluid mechanics and its development as a science Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.</p> <p>Fluid statics: Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer. Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface. Buoyancy and floatation, Archimedes' principle, stability of immersed and floating bodies, determination of metacentric height.</p>					
Module II	Fluid Kinematics	Contact Hours (08)			
<p>Fluid kinematics: Introduction, description of fluid flow, classification of fluid flow. Reynold's number, Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity, Mathematical definitions of irrotational and rotational motion. Circulation, potential function and stream function. Flow net</p>					
Module III	Fluid dynamics	Contact Hours (08)			
<p>Fluid dynamics : Introduction, Introduction to N-S equation, Euler's equation along a streamline, energy equation, Bernoulli's equation and its application to siphon, venturimeter, orifice meter, pitot tube. Flow in pipes and ducts: Loss due to friction,</p>					

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Minor energy losses in pipes Hydraulic Gradient Line (HGL), Total Energy Line (TEL), Power transmission in the fluid flow in pipes, fluid flow in pipes in series and parallel. Flow through nozzles.		
Module IV	Hydraulic Machines	Contact Hours (08)
Hydraulic turbines: Classification, Impulse and Reaction turbine; Tangential, Radial and axial turbine. Impulse turbine, Pelton wheel, bucket dimensions, number of buckets in pelton wheel, efficiency and performance curves. Reaction Turbines: Francis turbine and Kaplan turbine, velocity triangle and efficiencies, performance curve. Function of draft tube and casing cavitation.		
Module V	Centrifugal Pump	Contact Hours (08)
Centrifugal Pump: constructional features, vane shape, velocity triangles, Efficiencies, Multi stage centrifugal pumps, Pump Characteristic, NPSH and Cavitation. Positive displacement pumps: Reciprocating Pump, Working principle, Discharge, work done and power requirement, Slip, Indicator diagram.		
Total Lecture Hours		40
Textbooks		
<ol style="list-style-type: none"> 1. R Y. A Cengel and J. M. Simbala “<i>Fluid Mechanics</i>”, McGraw-Hill Higher Education, New York, United States. 2. C. S. P Ojha, P.N. Chandramouli, and R. Berndtsson “<i>Fluid Mechanics and Machinery</i>”, First Edition, Oxford University Press. 2010, Oxford, United Kingdom. 		
Reference Books		
<ol style="list-style-type: none"> 1. S.K. Som and G. Biswas “<i>Introduction to Fluid Mechanics and Fluid Machines</i>”, Third Edition, -Hill Higher Education, 2017, New York, United States 		
Digital Learning Resources		
Course Name: Fluid Mechanics		
Course Link: https://nptel.ac.in/courses/105/103/105103192/		
Course Instructor: Dr. Subhashisa Dutta , Department of Civil Engineering, IIT Guwahati		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

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Course Code: 22CE5OE03T	Course Name: Geo-Environmental Engineering	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> To introduce the scope, importance, and economic impact of waste generation, manufacturing functions, and applications. To classify and characterize solid and hazardous wastes, and understand the environmental concerns and management strategies associated with them. To study the processes involved in the transport of contaminants, including mass-transfer, bioremediation, and phytoremediation. To explore various site remediation techniques, including active and passive methods, soil washing, and emerging remediation technologies. To understand the types of landfills, site selection criteria, and the design and function of waste containment liners, leachate collection systems, cover systems, and gas collection systems. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> Understand the scope, importance, and economics of waste generation and management. Classify and characterize solid and hazardous wastes and develop effective waste management strategies. Comprehend the transport processes of contaminants and apply bioremediation and phytoremediation techniques. Apply various remediation techniques, both active and passive, including soil washing and emerging technologies. Understand the types, site selection, and design components of landfills, including waste containment liners, leachate and gas collection systems. 					
Module I	Understanding Waste Management	Contact Hours (08)			
Introduction: Scope, Multidisciplinary aspects of Geoenvironmental Engineering, Waste generation, Geotechnical and Geo-environmental testing: Grain size distribution, consistency limits, pH, specific surface, ion Exchange capacity, thermal & electric properties.					
Module II	Contaminant Transport	Contact Hours (08)			
Soil-water-contaminant interaction, Subsurface contamination, Contaminant Transport: Transport process, Mass-transfer process, Bioremediation: In-situ and Ex-situ Techniques, Phytoremediation and plants used for Phytoremediation					
Module III	Solid and Hazardous Waste Management	Contact Hours (08)			
Solid and Hazardous Waste Management: Principle of waste management, Classification of waste, Characterization solid wastes, Elements of Solid Waste Management System, methods of solid waste disposal, Hazardous waste and its management, Waste management strategies, Regulatory Framework.					
Module IV	Remediation Techniques	Contact Hours (08)			
Remediation Techniques: Objectives of site remediation, various active and passive methods, Soil washing, Emerging Remediation Technologies, Geo-synthetics: Types,					

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manufacturing functions, applications and economics		
Module V	Landfills	Contact Hours (08)
Landfills: Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system		
Total Lecture Hours		40
Textbooks		
1. K. R. Reddy and H D Sharma, “Geoenvironmental Engineering: Site Remediation, waste containment, and emerging waste management technologies”, John Willey , New Jersey, USA		
2. R N. Yong, “Geo Environmental Engineering: Contaminated Ground: Fate of Pollutions and Remediation”., Thomson Telford , London, UK		
Reference Books		
1. L N Reddy and H.I. Inyang, “Geoenvironmental Engineering: Principles and Applications”, Marcel Dek , New York, USA		
2. R. W. Sarsby, “Environmental Geotechnics”, Thomson Telford , London, UK		
Digital Learning Resources		
Course Name: Geo-Environmental Engineering		
Course Link: https://nptel.ac.in/courses/105/102/105102160/		
Course Instructor: Prof. Manoj Datta, Department of Civil Engineering, IIT Delhi		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date:

Course Code: 22CE5OE04T	Course Name: Green Technology	L	T	P	C
		3	0	0	3
Pre-requisite:	NIL				
Branch:	Civil Engineering				
Course Type	Theory				
Batch	2022 & 2023				
Course Objective:					
<ul style="list-style-type: none"> • Understand the impact of global warming and related protocols. • Identify strategies for controlling carbon emissions. • Evaluate green energy technologies. • Apply green technologies at different scales. • Explore advanced carbon reduction technologies. 					
Expected Course Outcomes					
<ul style="list-style-type: none"> • Analyze the causes of global warming, evaluate its impact on India, and understand the role of international protocols. • Identify control strategies, analyze business opportunities, and understand the need for green and traditional power sources. • Compare green energy technologies, evaluate their costs, and identify R&D needs for alternative methods. • Apply carbon reduction strategies, understand green building practices, and develop plans for green infrastructure. • Analyze high-tech solutions, evaluate case studies, and develop adaptive measures for India's climate resilience. 					
Module I					Contact Hours (08)
<p>Global Warming and its effect:- Introduction and physical definition of global warming, the New Carbon Problem: Accumulation, Long Half-Life, Heating Potential, Carbon Emission Factors, Carbon Absorption in Nature, The Global Emission Situation and its effect in India, The Kyoto and Other Protocols and its view in India, Effect of climate change and its impact.</p> <p>Planning for the Future to reduce global warming:- Steps taken to Control Carbon Emissions universally, Use of Promotional and Punitive Mechanisms for Reducing Carbon in Atmosphere, The General Approach in Planning for the Future, Developing Countrywide Adaptive Measures for Safety of Local People, Developing Mitigative Measures for Global Reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India, The MRV Debate.</p>					
Module II					Contact Hours (08)
<p>Opportunities in Control of Carbon Emissions and Accumulation:- Essential Steps for Control of Carbon Emissions and Accumulation, Procedure to develop own Priorities and Business Opportunities in India for control of carbon emissions and accumulation, Needs a Mix of Green and Traditional Power Sources in India, A Logical Approach for Carbon Reduction, Need in India —More Forests, Less Deforestation and payment rates procedure for controlling carbon emissions and its Promotional Mechanisms at India.</p>					
Module III					Contact Hours (08)

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Green Technologies for Energy Production :- Various Technologies Available for Energy Production, Cost Comparison of a Few Typical Systems for Power Generation, Sources of Energy Production Already in Use, Alternative Methods Ready for Use, Green Technologies Needing some Prior R&D Work.		
Module IV		Contact Hours (08)
Green Technologies for Personal and Citywide Application :- Measures to be taken for Green city, Carbon Emission Reduction at Personal Level, Carbon Emission Reduction at Local Authority and Citywide Level, Carbon Emissions from Imports. Green Technologies for Specific Applications:- Promotion of 'Green' Buildings, Guidelines, The Energy Conservation Building Code (ECBC), Green Hotels and Hospitals, Green Technologies for Transport, Green Roads, Ports and Harbors, Industries, Carbon, Carbon Emissions from a Few Selected Industries in India, The Changing Scenario in Cities, Need for Wider Application to Town Planning and Area Re-Development Projects , 'Green' Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.		
Module V		Contact Hours (08)
Some High-tech Measures for Reducing Carbon Emissions :- Use of Solar Power with Satellite-Based Systems, Use of Carbon Capture and Storage (Sequestration) , Microorganisms, A Quick SWOT Analysis. Recommended Plan of Action :- India's National Action Plan Take Us to a Low-Carbon Path, The Missions Help Develop Awareness, Few case studies on Projects undertaken by Various Countries, Adaptive Measures Essential for Indian People to Cope with Climate Change.		
Total Lecture Hours		40
Textbooks		
3. K. R. Reddy and H D Sharma, “Geoenvironmental Engineering: Site Remediation, Soli J. Arceivala “ <i>Green Technologies</i> ”, First Edition, McGraw Hill Education (India) Private Limited, 2014, New Delhi.		
Reference Books		
4. R. Singh and S. Kumar “ <i>Green Technologies and Environmental Sustainability</i> ” First Edition, Springer International Publishing, 2017.		
Digital Learning Resources		
Course Name: Sustainable Materials and Green Buildings		
Course Link: https://nptel.ac.in/courses/105/102/105102195/		
Course Instructor: Dr. B. Bhattacharjee, Department of Civil Engineering, IIT Delhi		
Mode of Evaluation: Internal Assessment (Assignment, Quiz, Surprise Test, Mid-Term) and External Assessment (End Term)		
Recommended by Board of Studies	No.:	Date:
Approved by Academic Council	No.:	Date: