DEPARTMENT OF CIVIL ENGINEERING

NPTEL EQUIVALENT COURSES FOR Honors Degree - 2024-2025

NPTEL EQUIVALENT COURSES

S NO	Course Id	Course Name	Course syllabus
1	noc24-ag06	Water Quality Management Practices	COURSE PLAN : Week 1: Introduction: Classification of pollutants, regulatory standards, necessity and essential requirement for water management systems Week 2: Fundamentals of reactor engineering and Self-purification of natural waters Week 3: Quantity estimation of major pollutants: TSS/VSS/TDS, Alkalinity, DO, pH, BOD, COD, TOC, etc. modelling and relation of BOD and COD, TOC, nitrogen, phosphorous and microbial numbers Week 4: Physico-chemical operations and processes – I: Screens, grit chamber, skimming tank, theory of sedimentation, primary sedimentation Week 5: Physico-chemical operations and processes – II: Equalization, neutralization, dissolved air floatation, flocculation, coagulation, flocculation and sedimentation

			Week 6: Fundamentals and principles of biological wastewater treatment Week 7: Aerobic wastewater treatment systems - I: Suspended growth processes Week 8: Aerobic wastewater treatment systems - II: Attached growth processes Week 9: Hybrid aerobic wastewater treatment systems Week 10: Advanced anaerobic wastewater treatment systems Week 11: Emerging biological processes for Nutrient removal and tertiary treatment systems Week 12: Guidelines for operation of treatment plant, suggestions for frequent troubleshooting, Case studies
2	noc24-ar03	Environmental Impact Assessment	COURSE PLAN : Week 1: Introduction to Environment Management & EIA Week 2: Legal, Policy & Regulatory Framework Week 3: EIA Procedure - Scoping & Screening and Establishing Baseline Conditions Week 4: EIA Methodologies Week 5: EIA Methods, Tools and Techniques Week 6: Impact Identification & Analysis of Alternatives-II Week 7: Public Involvement in EIA Week 8: Impact Management - Mitigation & Preparation of Environment Management Plans (EMP) Week 9: EIA Reporting & Review of EIA Quality Week 10: Decision Making & Project Management Week 11: Implementation & Follow up Week 12: EIA Case Examples
3	noc24-ce07	Construction Methods and Equipment Management	COURSE PLAN : Week 1: Module 1: Introduction to course and Planning Process of Equipment Lecture 1: Planning process of equipment – Factors affecting equipment selection, Planning equipment utilization, Equipment utilization chart. Module 2: Cost of Owning and Operating Construction Equipment Lecture 2: Estimation of Ownership cost (Average Annual Investment method) – Elements of ownership cost, Depreciation accounting methods, Cost Estimation using Average Annual Investment method.

			Week 2: Module 2: Cost of Owning and Operating Construction Equipment Lecture 3: Estimation of Ownership cost (Time value method) – Use of compounding factors in Equipment cost estimation based on time value method. Lecture 4: Operating cost of Equipment – Operating cost components, Illustrations on estimation of operating cost. Lecture 5: Equipment cost estimation – Caterpillar & Peurifoy method – Illustrations on use of Caterpillar method and Peurifoy method for estimation of total equipment cost Week 3: Module 3: Equipment Life and Replacement Analysis Lecture 6: Equipment Life and Replacement Analysis (Part 1) – Physical life, Profit life, Economic life, Illustrations on determination of economic life of equipment. Lecture 7: Equipment Life and Replacement Analysis (Part 2) – Equipment Replacement analysis- Intuitive method, Minimum cost method, Maximum profit method. Lecture 8: Equipment Life and Replacement Analysis (Part 3) – Determination of economic life based on equivalent annual cost (using time value concept). Week 4: Module 4: Engineering Fundamentals of Moving Earth Lecture 9: Engineering Fundamentals of Moving Earth – Machine Performance-Required power, Available power, Usable power, Rolling resistance, tractive force, co-efficient of traction, Effect of grade on tractive effort, Effect of altitude on performance of IC engines, Performance chart, ways to define payload of equipment. Module 5: Earthmoving and Excavating equipment Lecture 10: Bull Dozers – Bull Dozers-Types of dozer blades, blade adjustments, Blade performance, production estimation. Lecture 11: Scrapers (Part 1) – Scrapers, Scraper operation, types of scraper, Components of production cycle of scraper and pusher. Lecture 12: Scrapers (Part 2) – Illustrations on production estimation of scraper and balancing interdependent machines.

			Week 5: Module 5: Earthmoving and Excavating equipment Lecture 13: Front End loaders – Front-End loaders –loader attachments, productivity estimation. Lecture 14: Excavators – Excavators-Front shovels and backhoes, operation, factors affecting selection, production estimation. Lecture 15: Trucks – Production cycle, cycle time estimation, Productivity of trucks, balancing interdependent machines. Week 6: Module 6: Piles and Pile driving equipment Lecture 16: Piles and Pile driving equipment (Part 1) – Pile types: Precast and cast in situ piles, pile hammers, principle of pile hammer, factors affecting pile hammer selection. Lecture 17: Piles and Pile driving equipment (Part 2) – Types of pile hammer: Drop hammer, Single acting and double acting steam hammers, Diesel hammers, Vibratory pile drivers. Week 7: Module 7: Lifting equipment Lecture 18: Cranes (Part 1) – Cranes, Crane motions, Principles of lifting mechanism of crane, types of cranes-lattice boom crawler crane, lattice boom truck mounted cranes, telescopic boom crane. Lecture 19: Cranes (Part 2) – Types of cranes-Tower cranes, Factors affecting lifting capacity of crane, Range diagram. Week 8: Module 8: Concreting equipment Lecture 20: Concreting equipment (Part 1) – Steps in concrete making process, types of concrete mixer machines. Lecture 21: Concreting equipment (Part 2) & Conclusion – Methods of handling and transporting concrete, Consolidation of concrete, Methods of finishing and curing of concrete
4	noc24-ce08	Development and Applications of Special Concretes	COURSE PLAN: Week 1: Normal concrete Week 2: Normal concrete (Cont'd) Week 3: Special concretes (1)-Concreting in cold and hot weather

			Week 4: Special concretes (2)-Self-compacting and fiber reinforced concretes Week 5: Special concretes (3)-Basic understanding of high strength concrete, mass concrete and shotcrete Week 6: Special concretes (4)-Handling preplaced aggregate concrete and light weight aggregate concrete Week 7: Special concretes (5)-Special topics I: Underwater anti-washout concrete; micro-concrete Week 8: Special concretes (6)-Special topics II: Expansive concrete, roller compacted concrete, concrete using recycled aggregate
5	noc24-ce17	Geosynthetics And Reinforced Soil Structures	COURSE PLAN : Week 1: Introduction to Geosynthetics Types of geosynthetics and their applications Manufacture of geosynthetics Week 2: Strength of reinforced soils Testing of Geosynthetics Week 3: Different Types of Soil Retaining Structures Construction Aspects of Geosynthetic Reinforced Soil Retaining Walls Design Codes for Reinforced Soil Retaining Walls Week 4: External Stability Analysis of Reinforced Soil Retaining Walls Seismic Loads and Internal Stability Analysis of Reinforced Soil Walls Testing Requirements for Reinforced Soil Retaining Walls Week 5: Design of Reinforced soil Retaining walls - simple geometry Design of reinforced soil retaining walls – sloped backfill soil Design of reinforced soil retaining walls supporting a bridge abutment Week 6: Stability analysis of soil slopes- Infinite slopes Stability analysis of reinforced soil slopes resting on soft foundation soils Stability analysis of reinforced soil slopes resting on strong foundation soil Week 7: Stability analysis of reinforced soil slopes - bilinear wedge analysis Design of Embankments supported on Load Transfer Platforms Week 8: Reinforced soil for supporting shallow foundations Week 9: Accelerated consolidation of soft clays using geosynthetics Geosynthetic encased stone columns for load support Week 10: Drainage application of geosynthetics Filtration Applications of Geosynthetics

			Week 11: Erosion control using geosynthetics Natural geosynthetics and their applications Week 12: Geosynthetics for construction of municipal and hazardous waste landfills
6	noc24-ce22	Maintenance and Repair of Concrete Structures	COURSE PLAN : Week 1 : Introduction, significance of corrosion, and corrosion mechanisms Week 2 : Embedded metal corrosion Week 3 : Deterioration of cementitious systems – Sulphate and Acid attack Week 4 : Deterioration of cementitious systems – Alkali Silica Reaction (ASR), Shrinkage, and others Week 5 : Concrete assessment using non-destructive tests (NDT) Week 6 : Concrete assessment and load effects Week 7 : Surface repair – Condition assessment Week 8 : Surface repair – Analysis, strategy, and design Week 9 : Surface repair – Material requirement, surface preparation, placement of repair material Week 10 : Strengthening and stabilization – Introduction and beam shear capacity strengthening Week 11 : Strengthening and stabilization – Column strengthening Week 12 : Strengthening and stabilization – Flexural strengthenin
7	noc24-ce25	Plastic Waste Management	COURSE PLAN : Week 1: Plastics – What it is? Types, Uses and Global Statistics Week 2: Plastic Waste – Sources, Production, Global and Indian Context Week 3: Plastic Waste Management Rules 2016 (India) and Global Rules and Regulations Week 4: Plastic Bans including China Sword Policy implication on global plastic waste management Week 5: Impact of Plastics on Marine Life, Effect on Wildlife, Human Health and Environment Week 6: Plastic Waste Management Practices – Use of Plastic waste in roads, issues and challenges Week 7: Possible Alternate Materials to Plastics –Greener Alternatives Week 8: Plastics Resource Recovery and Circular Economy.
8	noc24-ce27	Retrofitting and Rehabilitation of Civil Infrastructure	COURSE PLAN : Week 1: Overview of Retrofitting and Rehabilitation of Civil Infrastructure Week 2: Condition Evaluation and Testing Week 3: General Repair and Strengthening of Concrete Structures Week 4: Fiber Reinforced Polymer Composites (FRPC) and its

			Characteristics Week 5: Retrofitting by FRP Composites Week 6: Retrofitting by FRP Composites (continued…) Week 7: Retrofitting by FRP Composites (continued…) Week 8: Concrete Overlay for Pavement Rehabilitation Week 9: Retrofitting of Masonry Structures Week 10: Retrofitting of Building structures damaged due to seismic event Week 11: Retrofitting of Special structures damaged due to seismic events Week 12: Retrofitting of Steel Structures
9	noc24-ce37	Urban Transportation Systems Planning	COURSE PLAN : Week 1: Module-A: Introduction to Urban Transportation Planning Urbanization, Urban Transportation: Impacts, Behavioral Changes, Urban Transportation problems & Externalities- Congestion, Safety, Emissions, etc. Introduction to Transport planning; Transport Planning Morphology: Problem definition, Solution generation, solution analysis, Evaluation and choice, Implementation Hierarchical levels of Urban Transport Planning: Conceptual Plan, Outline plan, Master plans, statutory or advisory plans, detailed development plans Week 2: Module-B: Overview of 4-Stage Urban Transportation Planning Process Overview of traditional four step travel demand forecasting process: Urban Activity forecasts, Trip generation, Trip Distribution, Mode Choice, Traffic assignment Specification, Calibration, Validation and Forecasting; Information needs for Travel Demand Forecasting: Study Area, Urban Activities, Zoning, Urban Activities, Transportation System, Travel information, Types of Movements Data Collection Techniques (Home-interview survey, Commercial vehicle survey, Innovative Commercial Vehicle Tracking Methods, Intermediate Public Transport Survey, Cordon-Line Survey, Post-Card Questionnaire Survey, Registration – Number Survey, License Plate Follow-Up Survey Technique, Tag-on- Vehicle Survey) Week 3: Module-C: Trip Generation Introduction; Basic considerations in trip generation - amount of urban activity, character of urban activity, other

			considerations, special generators; Trip classification; Factors affecting trip generation Methods of trip Generation- Regression analysis, trip rate analysis, cross classification analysis; Multiple Linear RegressionRegression analysis concept; The step wise approach with examples Week 4: Module-C: Trip Generation (Continued…) Multiple Linear Regression Considerations for zonal based multiple regression, Considerations for household based multiple regression, matching productions and attractions Category analysis- Basic approach, specifying trip generation model (trip production model structure, trip attraction model structure, Internal-External trip generation), Trip generation model calibration (developing trip production rates, developing trip attraction rates), advantages and disadvantages Stability of trip generation model- Temporal stability, geographical stability; Trip generation model application- Trip production model application, Trip attraction model application Week 5: Module-D: Trip Distribution Introduction, Basic considerations in Trip Distribution, P-A Matrix to O-D Matrix, Factors affecting trip distribution: Properties of transport network, spatial separation between various zones Growth factor methodsUniform factor method, Average factor method, Detroit Method, Fratar method; Furness method Synthetic methods -Introduction to Gravity Model Week 6: Module-D: Trip Distribution (Continued…) Gravity Model - Calibration, BPR Approach of Calibration Intervening opportunities model: Concept, Advantages, Limitations, Illustrative example, Competing opportunities model, Limitations Doubly restrained model: Concept, Calibration, Linear programming approach to Trip Distribution: Concept, limitations Week 7: Module-E: Modal Split Introduction; Influencing factors of mode choice; Types of modal split models- Trip end type and trip interchange type; Types of modal split models - Trip end type (Southern Wisconsin Model) and trip interchange

			type (Diversion curve model), Limitations, Aggregate and disaggregate models, advantages of disaggregate over aggregate modelling; Elements of choice decision process; Framework for the choice process of an individual Disaggregate mode choice models- Introduction, Utility theory, Probabilistic choice theory Week 8: Module-E: Modal Split (Continued…) Binary choice models - Binary logit model, discriminant analysis, Probit analysis; Logit model; Multinomial Logit model; Nested logit model, Estimation of logit models, Two-stage modal split models Week 9: Module-F: Traffic Assignment General, link cost function, Person-trips and vehicle Trips, diurnal patterns of demand, Trip directions Network properties: Link, nodes, characteristics of link (capacity, free flow speed, travel time, etc.), link flows, interzonal flows, Network connectivity, Minimum spanning tree, shortest path, etc.; Network Algorithms: Kruskal, Prims, Dijkstra, Floyd Week 10: Module-F: Traffic Assignment (Continued…) Route Choice Behavior: User equilibrium, system equilibrium, stochastic equilibrium, Diversion Curves: California diversion curves, Detroit diversion curves, Bureau of Public roads diversion curves Deterministic traffic assignment techniques- All-or-nothing assignment, Multi-Path Traffic Assignment,; Incremental assignment, capacity restraint assignment,; Stochastic Traffic assignment techniques; Dynamic traffic assignment techniques: Basic Concepts and Approach Week 11: Module-G: Land Use and Transportation Introduction; Urban land use planning- land use and land cover, land use classification; Land use transportation interaction; Accessibility and mobility, Land use models Module-H: Urban Goods Movement Introduction; Classification of urban goods movement; Factors affecting goods movement; Modelling Approaches Data collection; Strategy for goods transport facility planning; Facilities required in goods terminals; Time series techniques for forecasting truck traffic

			Week 12: Module-H: Urban Goods Movement (Continued…) Introduction; Classification of urban goods movement; Factors affecting goods movement; Modelling Approaches Module I: Emerging Trends in Transportation planning Activity based modelling; Spatial data infrastructure (SDI); Big Data analytic
10	noc24-ce43	Introduction to Lean Construction (Module 1 - Lean Basics)	COURSE PLAN : Week 1: Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS) Week 2: Sampling/ Work Sampling; Survey/ Foreman delay survey; Value Stream/ Process Mapping Week 3: 5S (Part 1 and 2, Collaborative Planning System (CPS)/ Last Planner™ System (LPS) Week 4: Big Room Approach, IT/BIM and Lean, How to Start Practicing Lean Tools in Project Sites-1
11	noc24-ce44	Modern Construction Materials	COURSE PLAN : Week 1: Prologue – Intro. to the course, Science,Engineering and Technology of Materials- 1&2, Atomic Bonding-1 Week 2: Atomic Bonding-2, Structure of Solids-1, Structure of Solids-2&3 Week 3: Movement of Atoms, Development of Microstructure-1,Development of Microstructure-2 Week 4: Surface Properties, Response to Stress-1, Response to Stress-2&3 Week 5: Failure Theories, Fracture Mechanics-1, Fracture Mechanics-2 Week 6: Rheology & Thermal properties, Review of Const. Materials & Criteria for Selection, Wood and Wood Products-1 Week 7: Wood and Wood Products-2, Wood and Wood Products-3, Polymers Week 8: Fibre Reinforced Polymers-1&2, Metals-1, Metals-2 Week 9: Metals-3, Bituminous Materials-1, Bituminous Materials-2 Week 10: Concrete-1, Concrete-2, Concrete-3 Week 11: Concrete-4, Concrete-5, Glass - Guest Lecture Week 12: Waterproofing Materials, Polymer Floor Finishes, Anchor
12	noc24-ce53	Industrial Wastewater Treatment	COURSE PLAN : Week 1: Sources and characteristics of industrial wastewater & effect on environment, Management- volume reduction, neutralization,

			equalization and proportioning (SKG) Week 2: Adsorption Process (SKG) & Ion Exchange Process (AS) Week 3: Gas transfer & Air Stripping (Ammonia removal) (SKG) Week 4: Advanced Oxidation Processes (AS) Week 5: Membrane processes for wastewater treatment (AS), Coagulation, Precipitation and Heavy Metal Removal (AS) Week 6: Treatment and disposal of sludge (SKG) & Industrial Complexing for Zero Pollution Attainment (AS) Week 7: Treatment of wastewater produced from Distillery and Dairy Industries (SKG) Week 8: Treatment of wastewater produced from Tannery and Pulp and Paper (AS) Week 9: Treatment of wastewater produced from Textile and Dye and Fertilizers (AS) Week 10: Treatment of wastewater produced from Refineries and Iron & Steel (Coke Ovens) (SKG) Week 11: Treatment of wastewater produced from Pharmaceutical industry. (AS) Week 12: Mine Wastewater including Acid Mine Drainage (Coal mines, Washeries and coke oven plants). (SKG)

Head