

Department of Civil Engineering

Minor Courses Content

List of Courses for Minor Specialization

Sr. No.	Semester	Name of Course	Teaching Scheme	Duration	Instructor	Organizing Institute	Credits
01	V	Introduction to Civil Engineering Profession	4Hrs/week	12 Weeks	Prof. Ravindra Gettu, Prof. Subhadeep Banerjee	IIT Madras	04
02		Sustainable and Green Buildings	4Hrs/week	8 Weeks	Prof. Avlokita Agrawal	IIT Roorkee	04
03	VI	Water Supply & Waste Water	4Hrs/week	12 Weeks	Prof. Manoj Kumar Tiwari	IIT Kharagpur	04
04	VII	Municipal Urban Transportation System	4Hrs/week	12 Weeks	Prof. Arkopal Kishore Goswami	IIT Kharagpur	04
05		Fire Protection Services and Maintenance Management of Building	4Hrs/week	12 Weeks	Prof. B Bhattacharjee	IIT Delhi	04

I) Course : Introduction to Civil Engineering Profession

Semester : V

Instructor: Prof. Ravindra Gettu,

Prof. Subhadeep Banerjee

Content :

- What is Civil Engineering? Different disciplines of civil engineering. Scope and prospects. Heritage structures, architecture

- Environmental Engineering. Prevention of environmental impact. Pollution, waste and water treatment
- Geotechnical Engineering. Soil mechanics and foundations. Hydraulics and water resources
- Construction Materials and Methods. Infrastructure Engineering. Sustainability.
- Structural Engineering. Analysis, design and modelling
- Highway Engineering. Traffic Engineering and Planning
- Automation and Robotics in Construction. Water Security.
- Novel areas. Career Prospects

II) Course : Sustainable and Green Buildings

Semester : V

Instructor: Prof. Avlokita Agrawal

Content :

- Fundamentals of sustainability, definitions, historical development of the concept of sustainability and sustainable development, Sustainable architecture as a subset of sustainable development.
- Impacts of built environment on natural environment, Sustainable Development, Agenda 21, UN Goals
- Characteristics of sustainable architecture, fundamentals of passive designing and climatology, thermal comfort, visual comfort, acoustic comfort
- Sustainable buildings, parameters of sustainable buildings, Green buildings, indicators of green buildings, Terminologies related to sustainable buildings- carbon footprint, life cycle analysis,
- Site development- site selection, UHI, Public Transport, vegetation, development footprint, storm water runoff, SRI
- Water – estimating the use, reductions in consumption, recycling, reuse, landscape requirement, strategies and technology for water conservation

- IEQ- day lighting, views, CFC free, ventilation, comfort, VOC free
- Materials and Resources- segregation, recycling, reduction in waste, reuse of materials and building, renewability
- Energy- energy efficiency, energy conservation, ECBC, renewable energy, M&V
- Codes and compliances – ECBC, NBC, other rating systems prevalent in india
- Vernacular architecture and sustainability, culture and sustainability
- Software use for Energy compliance- Design Builder, Climate Consultant etc

III) Course : Water Supply & Waste Water

Semester : VI

Instructor: Prof. Manoj Kumar Tiwari

Content :

- Introduction: General outline of water supply; Water availability and uses; Temporal and spatial distribution; Key issues and concerns; Features and elements of a water distribution systems
- Water Demand: Concept of water demand; Estimation of water demand; Factors affecting demand; Components of demand; Demand fluctuations; Demand forecasting; Population forecasting methods
- Water Intake: Intake of water; Types of intake; Intake Structures; Conveyance and intake conduits; Free flow and Pressure flow systems; Pumps and their capacity estimation; Economic diameter of water supply pipes
- Treatment Philosophy: Storage structures, Reservoir designing, Storage Capacity of Distribution Reservoirs; Mass curve concepts; Design considerations for hourly, daily, weekly and seasonal regulation;
- Water Quality and Treatment: Water quality assurance; Water quality standards; Philosophy of treatment; Unit operations and unit processes; Theory and operations of aeration, sedimentation

- Conventional Water Treatment: Coagulation and flocculation; Clariflocculation; Filtration: Slow and rapid gravity filter, multi-media filters and pressure filters
- Water Treatment: Disinfection and Advanced Treatment: Disinfection through chlorination and other methods; Advanced methods of water treatment; Advanced oxidation processes; Removal of iron and manganese, hardness, fluorides, colour, taste and odour, dissolved metals and gases.
- Water Distribution Networks: Water Distribution; Hydraulics of pipe network design; Layouts of Distribution Network; Pipe network analysis; Hardy Cross method
- Water Losses and Control: Water-losses in water supply systems; Concepts of NRW and UFW; Apparent and real losses; water loss detection methods; water losses reduction strategies
- Advanced Water Distribution Design Approaches: Sectorization of distribution networks; DMA Demarcation; Advantages and risks; Software for network design (WaterGEMS and EPANET)
- Automation in Water Supply: Automation in water supply; Real time monitoring and control; SCADA; Case studies of WTP automation; Automation in distribution systems; Concept of Smart Water Supply System for India cities
- Water Economics and Pricing: Economics of water supply systems; Calculation of investments and operational costs; Cost optimization; Approaches of water metering; Water pricing for sustainability; Pricing water in context to Indian cities; Issues and approaches.

IV) Municipal Urban Transportation System

Semester : VII

Instructor: Prof. Arkopal Kishore Goswami

Content :

- Module 1: **Overview of urban transportation**, Urbanization and Transport, Key issues in urban transportation, Challenges in urban transportation, Travel demand modelling overview, Vehicular Level of Service (LOS) overview

- Module 2: **Public Transportation**, Introduction to public transportation, Basic operating elements of public transportation, Basic operating elements of public transportation (contd.), Bus Transportation, Bus Transportation (contd.), Financing public transportation, Transit marketing, Rail transportation, Intermediate Public Transportation, Measuring performance of transit systems, Advanced operation concepts of public transportation, Bus & Rail Transit Capacity, Bus & Rail Transit Capacity (contd.), Station Capacity, Transit Stop Location
- Module 3: **Non-Motorised Transportation (NMT) Planning**, Introduction to NMT Systems, Assessing existing NMT scenario, Data collection and analysis in NMT Planning, Complementarity and Selection of Interventions, Alternative Selection through Economic & Financial Analysis, Introduction to NMT systems, Basic NMT Characteristics, Pedestrian Data Collection and Flow Characteristics, PTS Case Studies Pedestrian flow characteristics on facilities, Pedestrian Level of Service (PLOS) based on Flow models, Other types of Pedestrian Level of Service (PLOS), HCM 2010 Methodology for PLOS, HCM 2010 Methodology for PLOS, Bicycle Facilities and Level of Service (BLOS), BLOS and Bicycle Compatibility Index (BCI), NMT Design Principles, Design of Pedestrian Infrastructure, Design of Pedestrian Infrastructure (contd.), Design of Cycling Infrastructure, Design of Cycling Infrastructure
- Module 4: **Urban Transport & Sustainability** Travel Demand Management (TDM) overview, Push measures cases, Pull measure cases, Parking Studies, Transit Oriented Development (TOD), Introduction to Intelligent Transportation Systems (ITS), ITS components, applications and communication, ITS Architecture, Electronic Toll Collection (ETC), Public Bicycle Sharing (PBS) System with ITS, Multimodal transportation (MMT) environment, Multimodal Level of Service (MMLOS), Multimodal Level of Service (MMLOS) (contd.), Design of multimodal transfer facilities, Park & Ride (P&R) Facility Planning, An Introduction to Pedestrian Road Safety and associated Risk Factors, Road crash

estimation and elements of predictive methods, Predicting Vehicle-Pedestrian and Vehicle-Bicycle conflicts, Environmental Concerns of Urban Transport, Sustainable strategies for Urban Transportation

V) Fire Protection Services and Maintenance Management of Building

Semester : VII

Instructor: Prof. B Bhattacharjee

Content :

- Fire Protection: Process of combustion in fire, Effect of fire load & ventilation condition on enclosure fire, growth and decay of fire in enclosure
- Concepts of fire resistant and severity, Effect of fire on materials. Simple Design of elements for given fire resistance.
- Planning, Fire detection & suppression systems, Smoke venting
- Lifts & Vertical Transportation: arrangement of lifts and Design for optimum service condition.
- Building Services as a system, Capacity of storage and sizing, control system etc. & intelligent building.
- HVAC System: Design Consideration. Basic psychometrics, Air conditioning process & system. Methods of Air Conditioning.
- Water Supply, Hydraulic design, Storage Distribution, Component of cold & hot water supply system.
- Waste water & Drainage systems: Fixture units & Design of system and elements of electrical services.
- Definition, Role of building maintenance in construction process Maintenance generators, Expression of Standards, selection of level of maintenance and fixing standards.

- Planned maintenance: Planning vis-a-vis adhoc maintenance, schedule & contingency maintenance, levels of planning, planned inspection, etc
- Maintenance cycle, maintenance profile, repair & replacement models, statistical methods, decision models, optimal renewal cycle, budgeting etc
- Effect of design on maintenance, Diagnosis, appraisal, structural defects & various methods of repair