

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Civil Engineering
(Applicable from the academic session 2018-2019)

Semester VII (Fourth year)

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| CE(PC)701 | Hydrology & Water Resources Engineering | 2L + 1T | 3 Credits |
| Module | Introduction - hydrologic cycle, water-budget equation, history of hydrology, worldwater balance, applications in engineering, sources of data. | | 2L |
| Module 2 | Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India. | | 5L |
| Module 3 | Abstractions from precipitation - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices. | | 6L |
| Module 4 | Runoff - runoff volume, SCS-CN method of estimating runoff volume, flow-duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows. | | 6L |
| Module 5 | Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests. | | 5L |
| Module 6 | Water withdrawals and uses – water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation. | | 6L |
| Module 7 | Distribution systems - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods. | | 6L |
| Module 8 | Dams and spillways - embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site. | | 6L |
| Reference | 1. K Subramanya, Engineering Hydrology, Mc-Graw Hill. 2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill. 3. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill. 4. G L Asawa, Irrigation Engineering, Wiley Eastern 5. L W Mays, Water Resources Engineering, Wiley. 6. J D Zimmerman, Irrigation, John Wiley & Sons 7. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford. | | |

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| CE(PC)702 | Disaster Preparedness & Planning | 1L + 1T | 2 Credits |
| Module 1 | Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation). | | 2L |
| Module 2 | Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility. | | 6L |
| Module 3 | Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters. | | 6L |
| Module 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 (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority. | | 8L |

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| Module 5 | Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods. | 6L |
| Reference | 1. http://ndma.gov.in/ (Home page of National Disaster Management Authority) 2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs). 3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall. 4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication. 5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation 6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003 7. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC | |

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|-------------------|---|----------------|------------------|
| CE(PE)701A | Airport Planning and Design | 2L + 1T | 3 Credits |
| | Aircraft characteristics; Aircraft performance characteristics: Airport planning and air travel demand forecasting; Airport Site Selection; Geometric Design of the Airfield: Determination of Runway Capacity and Delay - Taxiway and Gate Capacity - Holding Aprons - Terminal Aprons - Airport drainage - Function of Airport Passenger and Cargo Terminal - Design of Air Freight Terminals - Airport access - Airport Landside planning - Capacity; Air Traffic Management: Navigational aids: ground based systems, satellite based systems - Air traffic control and surveillance facilities - Airfield lighting - air traffic management. | | 36L |

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|-------------------|--|----------------|------------------|
| CE(PE)701B | Design of Steel Structures | 2L + 1T | 3 Credits |
| | Properties of materials; loads and stresses, Design of semi-rigid, rigid and moment resistant connections; Built-up sections Design of tension members subjected to axial tension and bending, splicing of tension member, Design of compression members, Beam-column connections, Design of columns and their bases Design of flexural members and Plate girder; loads, specification and design Industrial buildings; loads, design of purlins, trusses, bracings; gantry girders; Introduction to Plastic analysis; Simple cases of beams and frames; All design steps/processes as per the most recent BIS code of practices | | 42L |

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|-------------------|--|----------------|------------------|
| CE(PE)701C | Groundwater Engineering | 2L + 1T | 3 Credits |
| | The main objective is to provide sufficient knowledge to the students about the groundwater hydrology, well hydraulics and well construction, geo-physical explorations, groundwater quality and management of groundwater resources; Problems and perspectives regarding groundwater in India; Hydrogeology: Darcy's Equation; flow characteristics; general flow equations; unsaturated flow; Well Hydraulics: Steady and unsteady radial flows in aquifers; partially penetrating wells; multiple well systems; characteristic well losses; specific capacity, Surface and Subsurface investigations (Geologic methods; remote sensing; geophysical explorations; electrical resistivity and seismic refraction), Water Wells: Construction; completion, development, protection and rehabilitation of wells; Groundwater quality; Groundwater Management: Basin management, investigations, conjunctive use, modeling, artificial recharge; Saline water intrusion | | 42L |

GROUND IMPROVEMENT TECHNIQUES.

Code – CE(PE)701D

Contact – 2L +1T

Credits-3

| Module | Details of Course Content | Hours | Total |
|---------------|--|--------------|--------------|
| 1 | Introduction, Stabilization of soil with granular skeleton and soil without granular skeleton, soil stabilization: Stabilization with cement, lime fly-ash | 6 | 32 |
| 2 | Densification of granular soil: Vibration at ground surface, Vibration at depth (Vibroflotation), ground modification by vibro-replacement | 4 | |
| 3 | Densification of Cohesive Soils: preloading and prefabricated drains and stone | 6 | |

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| 4 | Reinforced earth structures, Introduction to Geotextiles and geomembranes, applications of geotextiles, design methods using geotextiles, geogrids, geonets, geomembranes, geotubes | 6 | |
| 5 | Grouting: Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, deep mixing, PVDs, vacuum consolidation | 6 | |
| 6 | Soil stability: Soil nailing, Soil and Rock Anchors, Underpinning | 4 | |

Reference books:

1. Principles and Practice of Ground Improvement by Jie Han
2. Ground Improvement Techniques by B.C.Chattopadhyay and J.Maity, PHI learning Pvt. Ltd.
3. Foundation Design Manual N. V. Nayak, Dhanpat Rai Publication Pvt. Ltd
4. Ground Improvement Techniques by P. Purushothama Raj
5. Reinforced Earth T S Ingold Thoam Telford
6. Designing with Geosynthetics R M Koerner Prentice Hall

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|-------------------|--|----------------|------------------|
| CE(PE)701E | Ecological Engineering | 2L + 1T | 3 Credits |
| | <p>River/Lake water pollution: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration]; COD; Eutrophication [Definition, source and effect].</p> <p>Wastewater Types and Characteristics: Difference between domestic and industrial waste water; Sources & classification of domestic & industrial Wastewater, Physical, chemical and biological characteristics of domestic and industrial wastewater; Indian Standards for effluent disposal and receiving water body; Disposal of treated wastewaters; Effect of organic pollution on river water quality.</p> <p>Wastewater Treatment: Typical flow chart for wastewater treatment; Primary Treatments; Secondary Treatments: Activated Sludge Process, Trickling Filter Process, Septic Tank.</p> <p>Chemical Hazards and Biomonitoring: Causes and effects of chemical hazards; Concepts, Methods, Advantages and Limitations of Bio-monitoring and surveillance; Categories and practical use of Biological Indicators.</p> <p>Effluent Monitoring: Basic principles of environmental laws; Role of regulatory bodies& Local bodies-CPCB-TWAD Board-CMWSSB, SPCB etc.; Standards for Effluent Discharge in India</p> <p>References:</p> <ol style="list-style-type: none"> 1.Garg .S.K., “Environmental Engineering”, Vol. I, Khanna Publishers, New Delhi, 2014. 2.Duggal .K.N, “Elements of Environmental Engineering”, S. Chand & Company Ltd., New Delhi, 2012. 3. Chatterjee, A.K., “Water Supply, Waste Disposal and Environmental Pollution Engineering”, Khanna Publishers, New Delhi, 2014. | | 38L |

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|-------------------|--|----------------|------------------|
| CE(PE)702A | Intelligent Transportation Systems | 2L + 1T | 3 Credits |
| | <p>Introduction to Intelligent Transportation Systems (ITS) –Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS – ITSData collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.Telecommunications in ITS – Importance of telecommunications in the ITS system, InformationManagement, Traffic Management Centres (TMC). Vehicle – Road side communication – VehiclePositioning System; ITS functional areas – Advanced Traffic Management Systems (ATMS),Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), AdvancedVehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), AdvancedRural Transportation Systems (ARTS); ITS User Needs and Services – Travel and Trafficmanagement, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management;</p> <p>Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems.ITS Programs in the World – Overview of ITS implementations in developed countries, ITS indeveloping countries.</p> | | 40L |

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| CE(PE)702B | Water and Air Quality Modelling | 2L + 1T | 3 Credits |
| | Introduction to Mathematical Models: water quality model development, calibration and verification cost: benefit analysis using models, Model requirements and limitations. D.O. Models for Streams: Dissolved oxygen model for streams sources and sinks of dissolved oxygen estimation of system parameters Streeter Phelps model oxygen 'sag' curve determination of deoxygenation and re-aeration coefficients- Benthic oxygen demand mass transport mechanisms- Models for Estuary and Lakes: Physical chemical and biological processes in estuaries; Air quality models: Micrometeorological processes, wind rose, dispersion, coefficients and stability classes, Gaussian and dispersion model, Stack height computation, Regional air quality models, Source inventories and significance . | | 40L |

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|-------------------|---|----------------|------------------|
| CE(PE)702C | Earthquake Engineering | 2L + 1T | 3 Credits |
| | Theory of Vibrations; Concept of inertia and damping - Types of Damping - Difference between static forces and dynamic excitation - Degrees of freedom – SDOF idealization - Equations of motion of SDOF system for mass as well as base excitation – Free vibration of SDOF system - Response to harmonic excitation - Impulse and response to unit impulse - Duhamel integral; Multiple Degree of Freedom System; Two degree of freedom system – Normal modes of vibration - Natural frequencies - Mode shapes - Introduction to MDOF systems - Decoupling of equations of motion - Concept of mode superposition (No derivations); Elements of Seismology; Causes of Earthquake - Geological faults - Tectonic plate theory - Elastic rebound – Epicentre; Hypocentre - Primary, shear and Rayleigh waves - Seismogram - Magnitude and intensity of earthquakes - Magnitude and Intensity scales - Spectral Acceleration - Information on some disastrous earthquakes; Response of Structures to Earthquake; Response and design spectra – Design earthquake - concept of peak acceleration - Site specific response spectrum - Effect of soil properties and damping - Liquefaction of soils - Importance of ductility - Methods of introducing ductility into RC structures Design Methodology IS 1893, IS 13920 and IS 4326 - Code provisions - Design as per the codes - Base isolation techniques - Vibration control measures - Important points in mitigating effects of earthquake on structures | | 42L |

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|-------------------|--|----------------|------------------|
| CE(PE)702D | Prestressed Concrete | 2L + 1T | 3 Credits |
| | Study of strength, behavior, and design of prestressed reinforced concrete members and structures, with primary emphasis on pretensioned, precast construction; emphasis on the necessary coordination between design and construction techniques in prestressing. | | 40 L |

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| CE(OE)701A | Metro Systems & Engineering | 3L + 0T | 3 Credits |
| Module 1 | General: Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials | | 4L |
| Module 2 | Civil Engineering-Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management | | 12L |
| Module 3 | Electronics And Communication Engineering- Signalling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors | | 9L |
| Module 4 | Mechanical & TV + AC: Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators | | 9L |
| Module 5 | Electrical: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics | | 8L |

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| CE(OE)701B | ICT for Development | 3L + 0T | 3 Credits |
| Module 1 | Introduction to ICT: New media and ICT, Different types of ICT. Use of ICT for development; e-learning; Web commerce; Mobile telephony and Development: telecom industry in India. ICT Projects implemented in India and Northeast – Problems and Prospects | | 10L |
| Module 2 | Digital Revolution and Digital Communication: Basics of New media theories - Information Society; Surveillance society; Digital Divide, Knowledge society; Network society. Works of Machlup, Bell, Negroponte and Castells | | 8L |

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| Module 3 | Technology and Development: ICT for Development its societal implications; Evolution of ICT in Development Endeavour; ICT and Millennium Development Goals. Democratic and decentralized processes in development. Technology and culture: community and identity; participatory culture and ICT, community informatics | 10L |
| Module 4 | Computer Mediated Communication and development: Different types of CMC; Important theoretical framework of CMC, cyber platform and communities, Social Networking Site; Convergent media, Multimedia platforms, Scope of convergent journalism for Development; Characteristics of convergent journalism; Different types of convergent journalism: precision journalism; annotative and open-source journalism; wiki journalism; open source journalism; citizen journalism; back-pack journalism, Convergent technologies and applications; Multimedia convergence and Interactivity | 14L |