

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Civil & Environmental Engineering
(Applicable from the academic session 2023-2024)

SEMESTER VII

ENVIRONMENTAL ENGINEERING

CODE: CE 701

CONTACT: 2L

CREDITS: 2

- | | |
|---|----|
| 1 Water Demand Water demands; Per capita demand; Variations in demand; Factors affecting demand; Design period; Population Forecasting | 3L |
| 2 Sources of Water Surface water sources; ground water sources | 2L |
| 3 Water Quality Impurities in water; Water quality parameters; Standards for potable water | 2L |
| 4 Conveyance of Water Hydraulic design of pressure pipes | 2L |
| 5 Water Treatment Typical flow chart for surface and ground water treatments; Aeration, Plain sedimentation, Sedimentation with coagulation, Water Softening, Filtration, Disinfection. | 8L |
| 6 Water Distribution Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs | 4L |
| 7 Sewage and Drainage Definition of Common Terms, Quantity estimation for sanitary sewage and storm sewage | 3L |
| 8 Sewer Design Hydraulic design of sewers, Partial flow diagrams and Nomograms | 3L |
| 9 Wastewater Characteristics Physical, chemical and biological characteristics, DO, BOD and COD | 3L |
| 10 Wastewater Treatment Typical flow chart for wastewater treatment; Primary Treatments; Secondary Treatments: Activated Sludge Process, Trickling Filter Process, Septic Tank | 6L |

References:

- 1 Environmental Engineering, M.P. Poonia, Khanna Publishing House, 2018.
- 2 Environmental Engineering, S.K. Garg, Khanna Publishers
- 3 Water Supply, Waste Disposal and Environmental Pollution Engineering, A.K. Chatterjee Khanna Publishers.
- 4 Environmental Engineering, Vol.II, P. N. Modi,
- 5 Environmental Modelling, Rajagopalan Oxford University Press.
- 5 Environmental Engineering P. V. Rowe TMH

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WATER RESOURCE ENGINEERING

CODE: CE 702

CONTACT: 2L

CREDITS: 2

CE 702	Water Resources Engineering		2L+0T	2 Credits
Module1	Open Channel Flow: Channel Characteristics and parameters, Energy-depth relationships, Specific Energy concept, Critical Flow, Hydraulic Jump, Uniform flow, Efficient sections, Slope profiles, Gradually Varied Flow, Water surface profiles.			8L
Module2	Irrigation: Definition, Necessity, Scope, Benefits of Irrigation; Types, techniques and sources of irrigation; Development of irrigation in India.			4L
Module3:	Soil-water-plant Relationship: Types of crops, cropping seasons, water requirement of crops, base period, kor period, Duty, Delta, Commanded area, Net Irrigation Requirement, Field Irrigation Requirement, Gross Irrigation Requirement, Intensity of irrigation, Consumptive use of water, estimation of evapotranspiration, Blaney-Criddle method, Modified Penman's method, Irrigation efficiencies, Frequency of irrigation.			8L
Module4:	Canal irrigation: Classification of irrigation canals, canals in alluvium; Design of unlined canals: Kennedy's method, Lacey's method; Lined canals: advantages, materials used, typical sections, design of lined canals, economics of canal lining; Canal sections—filling, cutting, partial cutting and partial filling.			8L
Module5:	Land drainage: Water logging issues in irrigation, provision of drains, design and maintenance of open drains, closed drains, discharge and spacing of closed drains.			4L
Module6	Ground water: Occurrence of groundwater– Aquifers, Various Types of Aquifers, Aquifer Parameters: Specific Yield, Specific Retention, Storage Coefficient, Transmissivity.			4L
Reference	Sl.	Book Name	Author	Publishing House
	1	Irrigation and Water Power Engineering	B. C. Punmia, A.K. Jain and P. B. Lal	Laxmi Publications (P) Ltd. ,New Delhi, 2019.
	2	Irrigation, Water Resources and Water Power Engineering	P. N. Modi	Standard Book House, New Delhi, 2019.
	3	Irrigation Engineering and Hydraulic Structures	S. K. Sharma	S Chand Publishing, New Delhi, 2017.2012.
	4	Irrigation Engineering	N.N. Basak	Tata Mc Hill Graw Education Private India Limited, 2017.
	5	Open Chanel Flow	Saiful Islam	Khanna Publishing House
	6	Irrigation and Water Resources Engineering	G.L. Asawa	New Age Publishers, New Delhi, 2005.

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PROFESSIONAL ELECTIVE –II

SOIL STABILIZATION AND GROUND IMPROVEMENT TECHNIQUES

CODE: CVE 701 A

CONTACT: 1L

CREDITS: 1

Soil Stabilization: Introduction, Stabilization of soil with granular skeleton and soil without granular skeleton, common nomenclature of stabilized soil systems and stabilization methods, specific methods of soil stabilization: Stabilization with cement, lime fly-ash 8L

Insitu densification: Introduction, Compaction: methods and controls *Densification of granular soil:* Vibration at ground surface, Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth. *Densification of Cohesive Soils:* Preloading and dewatering, Design of Sand drains and Stone columns, Electrical and thermal methods. 12L

Geo-textiles: Over view: Geotextiles as separators, reinforcement. Geotextiles in filtration and drainage, geotextiles in erosion control. 6L

Grouting: Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes. 6L

Soil stability: Reinforced earth fundamentals, Soil nailing, Soil and Rock Anchors, Underpinning 4L

1 Foundation Analysis & Design J.E. Bowels McGraw Hill

2 Principles of Foundation Engineering B.M. Das Thomson Book

3 Foundation Design Manual N. V. Nayak Dhanpat Rai Publication Pvt. Ltd

4 Construction and Geotechnical methods in foundation engineering R.M. Koener McGraw Hill

5 Technology in tunnelling and dam construction A.V. Shroff. & D.L. Shah Oxford and IBH Publishing Co.Pvt.Ltd

6 Reinforced Earth T S Ingold Thoam Telford

7 Designing with Geosynthetics R M Koerner Prentice Hall

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ADVANCED HIGHWAY & TRANSPORTATION ENGINEERING

CODE: CVE 701B

CONTACT: 1L

CREDITS: 1

1 Traffic Engineering: Road user and vehicle characteristics; Traffic flow characteristics – Traffic Volume, Speed, Headway, Concentration and Delay; Traffic surveys & studies; Traffic estimation; Statistical applications in traffic engineering analysis; Parking; Road intersections – Basic traffic conflicts, classification of at-grade intersections, channelization, rotaries, traffic signals, signs and marking; Road Safety; Traffic System Management. 12L

2 Transportation planning : Transportation planning at different levels; Transport Project planning– Planning studies and investigation; Elements of Urban Transportation Planning; Transport Demand Analysis; Preparation of Project Report 8L

3 Railway Engineering : Location surveys & alignment, Permanent way components, Gauges, Geometric Design, Points & crossings, Stations & Yards, Signalling, Track Maintenance 8L

4 Airport Engineering : Functional areas of airports: Runways, Taxiways, , Aprons, Terminal buildings; Classification of Airports; Airport site selection; Design of Runway, Runway orientation, Wind Rose diagram; Design of Taxiway and Terminal Building 8L

References

- 1 Transportation Engineering Khisty and Lal PHI
- 2 Transportation Engineering, L.R. Kadiyali, Khanna Book Publishing Company.
- 3 A Text Book of Railway Engineering S.P. Arora& S.C. Saxena
- 3 Railway Engineering Satish Chandra Oxford University press
- 4 Transportation Engineering Vazirani & Chandola
- 5 Airport planning and Design S.K.Khanna&M.G.Arora
- 6 Airport Transportation Planning & Design-. Virendra Kumar & Satish, Chandra Galgotia Publication Pvt. Ltd. New Delhi

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PROFESSIONAL ELECTIVE III

ADVANCED STRUCTURAL ANALYSIS

CODE: CVE 702A

CONTACT: 1L

CREDITS: 1

1 Review of analysis of indeterminate structures; Force methods: Statically indeterminate structures (method of consistent deformations; theorem of least work) Displacement Methods: Kinetically indeterminate structures (slope-deflection method; moment distribution method). Matrix concepts and Matrix analysis of structures: Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches. Matrix analysis of structures with axial elements: Plane Truss; Analysis by flexibility method Space trusses: Matrix analysis of beams and grids: Flexibility method for fixed and continuous beams: Stiffness method for grids: Matrix analysis of plane and space frames: Flexibility method for plane frames: Stiffness method for space frames. 18L

2 Theory of Elasticity : Three dimensional stress and strain analysis, stress - strain transformation, stress invariants; equilibrium and compatibility equations, boundary conditions; Two dimensional problems in Cartesian, polar and curvilinear co-ordinates, bending of a beam, thick cylinder under pressure, complex variable, harmonic and bi-harmonic functions; Torsion of rectangular bars including hollow sections, bending problems; Energy principles, variational methods and numerical methods. 18L

References:

- 1 Matrix Methods of Structural Analysis M.B. Kanchi.
- 2 Analysis of Structures T.S. Thandavamoorthy Oxford University Press
- 3 Intermediate Structural Analysis C.K. Wang Mc Graw Hill
- 4 Theory of Elasticity Timoshenko & Goodier McGraw-Hill
- 5 Structural Analysis, R. Agor, Khanna Publishing House, New Delhi (AICTE Recommended - 2018).

HYDRAULIC STRUCTURES

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CODE: CVE 702B

CONTACT: 1L

CREDITS: 1

1 Diversion Head works: Necessity, Difference between weir and Barrage, Type of Weirs, Selection of site, layout and description of each part, Effects of construction of a weir on the river regime, causes of failure of weirs on permeable foundation and their remedies 4L

2 Theories of seepage and Design of weirs and Barrages: Failure of Hydraulic Structures Founded on Pervious foundations: i) By piping ii) By Direct uplift, Bligh's creep theory of seepage flow, Khosla's theory & concept of flownets, concept of exit gradient and critical exit gradient, Khosla's method of independent variable for determination of pressures and exit gradient for seepage below a weir or a barrage, necessary corrections, examples. 6L

3 Hydraulic structures for canals: Canal falls – necessity, locations, types and description of Ogee fall, Trapezoidal-notch fall, Syphon well drop. Examples. 4L

4 Cross-Drainage Works: Necessity, types, selection of a suitable type (Introduction only) 4L

5 Dam (General): Definition, classification of Dams, factors governing selection of type of dam, selection of suitable site for a dam. 2L

Earthen Dams: Introduction, Types of Earthen Dams, Methods of Construction, Causes of failure, Design Criteria, Determination of line of seepage or phreatic line in Earthen Dam, seepage control in Earthen Dam, Examples. 6L

6 Gravity Dam: Definition, Typical cross- section, Forces acting on Gravity Dam, Combination of forces for design, Mode of failure and criteria for structural stability of Gravity Dams, Principal and shear stresses. Elementary profile of a Gravity Dam, Concept of High and low Gravity Dam, Examples. 6L

Spillways: Types, Location, Essential requirements, spillway capacity. Components of spillway, Energy Dissipators, Stilling basins (Indian standard). 4L

References

1 Irrigation Engineering and hydraulic structures. Santosh Kumar Garg Khanna Publishers.

2 Irrigation, water Resources and Water Power Engg. Dr.P.N. Modi, Standard Book House, Delhi-6

3 Water Resources Engineering Principle and practice By SatyaNarayana Murthy Challa. New Age International (P) Ltd. Publishers. New delhi,

4 Design of Small Dams. US Department of the Interior Bureau of Reclamation. McGraw Hill

5 Concrete Dams R.S. Varsney, Oxford & I & H Publishing Co. New Delhi

CLIMATE & OCEAN CURRENTS

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CODE: CVE702C

CONTACTS: 1L

CREDITS: 1

Objective of the course: Be familiar with climate and ocean currents to understand the real issues of global warming

Pre-requisite: Basic physics, chemistry and world geography

Detailed Course Outlines:

- | | |
|----------|---|
| Module 1 | Weather and climate, earth-sun geometry, geo-clock [10L] |
| Module 2 | Surface energy budget, atm. Moisture [10L] |
| Module 3 | Cloud droplets and raindrops, cyclones and hurricanes[9L] |
| Module 4 | Ocean currents and their impact on climate[9L] |
| Module 5 | Climate variability and change, world climates, global effects [8L] |

FREE ELECTIVE - II

ENGINEERING MATERIALS

CODE: CVE 703A CONTACT:

1L

CREDITS: 1

- 1. Introduction:** Material Science—its importance in engineering; Classification of Materials—metals, polymers, ceramics, composites; Advanced materials—semiconductors, smart materials, nano-materials; Review atomic structure, Atomic bonding in solids—bonding forces and energies; ionic/covalent/metallic bonding. 2L
- 2. Crystal Structure:** Fundamental concepts; Unit cells; seven crystal systems; single crystal, polycrystalline and non-crystalline materials; Metallic crystal structures—FCC, atomic packing factor, BCC & HCP structures. 2L
- 3. Imperfections in Metals:** Point defects due to vacancy & impurities, alloys, solid solutions; Dislocations—linear defects, interfacial defects, grain boundaries. 2L
- 4. Phase Diagrams:** Definition and basic concepts; solubility limit; Phase equilibria, on component phase diagram, binary phase diagram, interpretation of phase diagrams. 3L
- 5. Iron-carbon System:** allotropy of iron, iron-iron carbide phase diagram, properties and uses of plain carbon steel. 2L
- 6. Classification of Metals and Alloys- compositions, general properties and uses:**
Ferrous alloys: Classification –low carbon steels, medium carbon steels, high carbon steels, stainless steels, alloy steels, tool and die steel, cast irons.
Non-ferrous alloys: Copper & Copper alloys; Aluminum alloys; Zinc alloys; Nickel alloys; Lead & Tin alloys; 6L
- 7. Mechanical Properties of Materials:** Elastic properties of materials—tensile and

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compressive stress and strain, stress-strain behaviour, modulus of elasticity (Young's modulus), yield strength, tensile strength, plastic deformation, true stress and strain; Ductility; Resilience; Toughness, impact tests; Hardness- Brinell, Rockwell and Vickers hardness and their testing procedures, correlation between hardness and tensile strength; Fatigue strength; Effect of temperature on tensile strength & impact properties, creep failure. 6L

8. **Heat Treatment:** Definition and purposes; Heat treatment processes for steels—Hardening, structural change during heating and cooling, factors affecting hardening; Tempering; Austempering; Normalizing; Annealing—full annealing, spheroidising annealing, stress-relieving, recrystallisation annealing; Precipitation or Age Hardening of non-ferrous alloys. 4L

9. **Polymers & Elastomers:** Definition; How polymers are made- polymerization; Polymer molecular structures; Thermoplastics & Thermosets; Special characteristics like low sp. gravity, optical, electrical & thermal property, decorative color, easy formability, low corrosion etc; Uses of polymers and elastomers. 2L

10. **Ceramic Materials:** What is ceramics; common ceramic materials and their characteristics; How ceramics are made—sintering and vitrification process; Ceramic structures; Properties and applications. 2L

11. **Composite materials:** What is composites; Polymers matrix and their applications; Metal matrix and ceramic matrix composites and their applications; How composites are made. 2L

12. **Corrosion and Degradation of Engineering Materials:** Definition; Types of corrosion—uniform, pitting, crevice, galvanic, stress corrosion cracking and erosion; Corrosion control — material selection, environment control, proper design. 2L

13. **Materials Selection Methodology:** Selection of material based on required properties, availability and cost of material, environmental issues. 1L

Books Recommended

1. Materials Science and Engineering by W.D. Callister and adapted by R. Balasubramaniam, Willey India, 2010 Ed.
2. Engineering Materials: properties and selection by Budinski & Budinski, 9th Ed., Prentice Hall India
3. Engineering Materials and Metallurgy by R.Srinivasan, 2nd Ed., Tata McGraw Hill.
4. Materials & Processes in Manufacturing by E.P.Degarmo and adapted by Black & Kosher, 10th Ed., Wiley India.
5. Materials Science and Engineering by V.Raghavan, 5th Ed., Prentice Hall India.

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ELECTRICAL & ELECTRONIC MEASUREMENT

CODE: CVE 703 B

CONTACT: 1L

CREDITS: 1

Module-I [9L]

Measurements:

- Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, Classification of errors, loading effect due to shunt and series connected instruments.

Analog meters:

- General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments
- Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.

Module-II [11L]

Instrument transformer:

- Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors.

Measurement of Power:

- Principle of operation of Electrodynamic & Induction type wattmeter. Wattmeter errors.

Measurement of resistance:

- Measurement of medium, low and high resistances, Megger.

Module-III [11L]

Measurement of Energy:

- Construction, theory and application of AC energy meter, testing of energy meters.

Potentiometer:

- Principle of operation and application of Crompton's DC potentiometer, Polar and Coordinate type AC potentiometer. Application.

AC Bridges:

- Measurement of Inductance, Capacitance and frequency by AC bridges.

Module-IV [10L]

Cathode ray oscilloscope (CRO):

- Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO.

Electronic Instruments:

- Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator.

Sensors & Transducers:

- Introduction to sensors & Transducers, Strain gauge, LVDT, Temperature transducers, Flow measurement using magnetic flow measurement.

Text Books:

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1. A course in Electrical & Electronic Measurements & Instrumentation, A.K. Sawhney, Dhanpat Rai & sons.
2. Electrical Measurement & Measuring Instruments, E.W. Golding & F.C. Wides, Wheeler Publishing.
3. Electronic Instruments, H.S. Kalsi, Tata Mc-Graw hill, 2nd Edition.
4. Electronics Measurement and Instrumentation, J.G. Joshi, Khanna Publishing House, New Delhi, (AICTE Recommended 2018).

Reference Books:

1. Sensors & Transducers, D. Patranabis, PHI, 2nd edition.
2. Digital Instrumentation, A.J. Bouwens, Tata Mc-Graw hill.
3. Modern Electronic instrumentation & Measuring instruments, A.D. Heltric & W.C. Copper, Wheeler Publication.
4. Instrument transducers, H.K.P. Neubert, Oxford University press.

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PRACTICAL

ENVIRONMENTAL ENGINEERING & DESIGNING LAB

CODE: CE 791

CONTACT: 3P

CRDIT: 2

1. Determination of turbidity for a given sample of water Physical
2. Determination of color for a given sample of water
- 3 Determination of solids in a given sample of water: Total Solids, Suspended Solids and dissolved Solids
- 4 Determination of pH for a given sample of water Chemical
- 5 Determination of concentration of Chlorides in a given sample of water
- 6 Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water
- 7 Determination of hardness for a given sample of water
- 8 Determination of concentration of Fluorides in a given sample of water
- 9 Determination of concentration of Iron in a given sample of water
- 10 Determination of the Optimum Alum Dose for a given sample of water through Jar Test
- 11 Determination of the Residual Chlorine in a given sample of water
- 12 Determination of the Chlorine Demand for a given sample of water
- 13 Determination of the Available Chlorine Percentage in a given sample of bleaching powder
- 14 Determination of amount of Dissolved Oxygen (DO) in a given sample of water
- 15 Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater
- 16 Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater
- 17 Determination of bacteriological quality of water: presumptive test, confirmative test and Determination of MPN Bacteriological

Note That,

Physical: Exp No.1 to 3.

Chemical: Exp. No. 4 to 16

Bacteriological: Exp. No. 17

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FREE ELECTIVE LAB

MATERIAL TESTING LAB

CODE: CVE 792 A

CONTACT: 3P

CREDITS: 2

Impact tests: Charpy and Izod tests; Test for drawability of sheet metals through cupping test; Fatigue test of a typical sample.

Sample preparation and etching of ferrous and non-ferrous metals and alloys for metallographic observation; Experiments on heat treatment of carbon steels under different rates of cooling including quenching, and testing for the change in hardness and observing its micro structural changes through metallographic studies.

Observation of presence of surface/ sub-surface cracks using different non-destructive techniques, such as dye penetration (DP) test, magnaflux test, ultrasonic or eddy current test.

(At least six experiments must be conducted)

ELECTRICAL & ELECTRONICS MEASUREMENT LAB

CODE: CVE 792B

CONTACT: 3P

CREDITS: 2

List of Experiments:

1. Instrument workshop- Observe the construction of PMMC, Dynamometer, Electrothermal and Rectifier type of instruments, Oscilloscope and Digital multimeter.
2. Calibrate moving iron and electro-dynamometer type ammeter/voltmeter by potentiometer.
3. Calibrate dynamometer type wattmeter by potentiometer.
4. Calibrate AC energy meter.
5. Measurement of resistance using Kelvin double bridge.
6. Measurement of power using Instrument transformer.
7. Measurement of power in Polyphase circuits.
8. Measurement of frequency by Wien Bridge.
9. Measurement of Inductance by Anderson bridge
10. Measurement of capacitance by De Sauty Bridge.
11. Measurement of capacitance by Schering Bridge.

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CLIMATE & OCEAN CURRENTS LAB

CODE: CVE792C

CONTACTS: 3P

CREDITS: 2

Objective of the course: Develop Hands-on experience on climate studies

Pre-requisite: CVE 703

Detailed Course Outlines:

- | | |
|----------|---|
| Module 1 | Geoclock
Surface energy budget |
| Module 2 | Atmospheric moisture, cloud droplets |
| Module 3 | Weather map analysis, cyclones and hurricanes |

PROJECT PART 1

CODE: CVE 782

CONTACTS: 0

CREDITS: 2

Objective of the course: Be familiar with Civil Engineering projects with environmental importance

Pre-requisite: All courses in the syllabus up to Semester 6

- | | |
|----------|--|
| Module 1 | Civil Engineering Projects of Environmental Importance |
| Module 2 | Example 1: Dams and their environmental impact |
| Module 3 | Example 2: Design of environmentally favored buildings |
| Module 4 | project to be selected by the student |
| Module 5 | Project assigned to the student |