EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. SECOND YEAR

 ENVIRONMENTAL ENGINEERING

(Effective from session 2019-20)
### SEMESTER – III

<table>
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<th>S.No</th>
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<th>Evaluation Scheme</th>
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<th>Total Credit</th>
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*The Mini Project or Internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.

### SEMESTER - IV

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Total: 900 21
Semester-III

Engineering Mechanics (L-T-P 3-1-0) Credit – 4

Course Outcomes: At the end of this course the student will be able to-

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Apply basic knowledge of mathematics and physics to solve real-world problems.
4. Understand basic dynamics concepts – force, momentum, work and energy;
5. Understand and be able to apply Newton’s laws of motion;


Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; [8 Hours]

UNIT- II Centroid and Centre of Gravity, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia-Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. [8 Hours]

UNIT - III Basic Structural Analysis, Equilibrium in three dimensions; Analysis of simple trusses by method of sections & method of joints, Zero force members, Simple beams and support reactions. [8 Hours]

UNIT - IV Review of particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). [8 Hours]

UNIT - V Introduction to Kinetics of Rigid Bodies, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D’Alembert’s principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, Applications of energy method for equilibrium, Stability of equilibrium. [8 Hours]

Books and References
6. Hibbler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education

**Fluid Mechanics** *(L-T-P  3-1-0)*

**Credit – 4**

**Course Outcomes:** At the end of this course the student will be able to-

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

**UNIT I** Fluid and continuum, Physical properties of fluids, Rheology of fluids. Pressure-density height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis. [8 Hours]

**UNIT II** Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, path lines, streak lines, stream tube, continuity equation for 1-D, 2-D and 3-D flows, circulation, stream function and velocity potential function. [8 Hours]

**UNIT III** Potential Flow: source, sink, doublet and half-body. Equation of motion along a streamline and its integration, Bernoulli’s equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks. [8 Hours]

**UNIT IV** Equation of motion for laminar flow through pipes, Stokes’ law, mixing length concept and velocity distribution in turbulent flow over smooth and rough surfaces, Boundary
layer thickness, boundary layer over a flat plate, displacement, momentum and energy thickness. Application of momentum equation. Laminar boundary layer, turbulent boundary layer, laminar sub-layer, separation and its control. Vortex Flow: Free & Forced. [8 Hours]

UNIT V Drag and lift, drag on a sphere, aerofoil, Magnus effect, Similarity Laws; geometric, kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham’s Pi theorem, important dimensionless numbers and their significance. Introduction to Computational Fluid Dynamics (CFD). [8 Hours]

Books and References
2. Fox & Donald, “Introduction to Fluid Mechanics” John Wiley &Sons Pvt Ltd,
15. RK Bansal “Fluid Mechanics and Hydraulic Machines” Laxmi Publication

Environmental Chemistry and Microbiology (L-T-P 3-1-0) Credit – 4

Course Outcomes: At the end of this course the student will be able to-

1. Understand basic principles of environmental chemistry.
2. Apply previous knowledge of analytical chemistry in environmental processes.
3. Understand the effect of human activities on the natural chemical processes.
4. Understand about microbial processes and their significance.
Unit-I

Introduction to environmental chemistry-concept and scope of environmental chemistry, components of environment, structure and composition of atmosphere, natural cycles of matter in the environment.

Introduction to microbiology: Concept and scope of microbiology, kinds of microorganisms, major characteristics and the role of microorganisms, interaction between biological and chemical components. [8 Hours]

Unit II:

Chemistry of water and waste water-Hydrological cycle, principles of equilibrium chemistry, pH, oxidation - reduction and the applications of principles of chemistry for solving Environmental Engineering Problems, Colloidal Chemistry, catalysis and Photo catalysis, Corrosion and its control. [8 Hours]

Unit III:

Chemistry of the air environment- combustion related air pollution, global environmental problems - chemistry of CFC, ozone depletion, greenhouse effect, acid rain, La Nino etc. Chemistry of pollution due to detergents, pesticides, polymers, trace organics, metals, petroleum and radioactive compounds. [8 Hours]

Unit IV:

Environmental Microbiology-Basic principles of microbial transformation of organic matter, microbial inhibition mechanisms, Structure and function of cell constituents, biomass – classification, nutrients and microorganisms – environmental factors, Indicator organisms, - coliforms – MPN index, M.F. technique. [8 Hours]

Unit V:

Pure and mixed cultures, Aerobic and anaerobic metabolism, microbial growth and dynamics, Microbial taxonomy, classification and morphological aspects of bacteria, fungi, protozoa, algae and other higher aquatic life forms, Bioassay tests for toxicity evaluation, Role of microorganisms in water and waste water engineering, Microbiology applied to air pollution control (Bio scrubbers and bio-filters). [8 Hours]

Books and References :

1. A.K. De: Environmental Chemistry
3. Krueger and Johansson: Microbiology
4. Larinzar – General Biochemistry
5. Manahan: Environmental Chemistry
6. McKinney: Microbiology for Sanitary Engineers
7. Pelczar, Chan, and Krieg: General Microbiology
10. Sawyer, McCarty, and Parkin: Chemistry for Environmental Engineering
11. Sharma: Microbiology
12. Tortora, Funke and Case: Microbiology
Environmental Sampling and Analysis Lab  (L-T-P  0-0-2)  Credit – 1

1. Collection of grab and composite sample from a water/wastewater stream
2. Flow measurement in a wastewater drain in field.
3. Determination of moisture content and pH of soil.
4. Digestion of samples for metal analysis.
5. Determination of Na and K by flame photometer.
8. Determination of metals in samples.

Microbiology Lab  (L-T-P  0-0-2)  Credit – 1

1. Use of microscope: Bacterial morphology and staining methods.
3. Quantitative plating method.
5. Indicator and Indices: Fecal streptococci, anaerobic bacteria
7. Biochemical activities of bacteria: hydrolysis of polysaccharides,
8. Determination of Biodiversity index.

Reference:
Sirockin and Cullimore: Practical Microbiology

Fluid Mechanics Lab  (L-T-P  0-0-2)  Credit – 1

Note: Students will perform minimum 10 experiments from the following:

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. Verification of Bernoulli’s Theorem
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, ‘f’ for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement, sudden contraction and losses in bend.
13. Flow Visualization - Ideal Flow
14. To make studies in Wind Tunnel (Aerofoil and circular cylinder)
Semester-IV

Materials, Testing & Construction Practices

(L-T-P 3-0-0) Credit – 3

Course Outcomes: At the end of this course the student will be able to-

1. Identify various building materials and to understand their basic properties.
2. Understand the use of non-conventional civil engineering materials.
3. Study suitable type of flooring and roofing in the construction process.
4. Characterize the concept of plastering, pointing and various other building services.
5. Exemplify the various fire protection, sound and thermal insulation techniques, maintenance and repair of buildings.

UNIT I


Stones: Requirement of good building stone, characteristics of building stone sand their testing. Common building stones.


Gypsum: properties of gypsum plaster, building products made of gypsum and their uses.


Cement Concrete: Constituent materials and their properties, Grades of concrete, Factors affecting strength, Properties of concrete at fresh and hardened stage, Testing of concrete, Methods of Curing of concrete.


Asphalt: Bitumen and Tar: Terminology, specifications and uses, Bituminous materials. [8 Hours]

UNIT II

Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in construction.


UNIT III

Building Construction: Components of building area considerations, Construction Principle and Methods for layout, Damp proofing, anti termite treatment in buildings, Vertical circulation: stair cases and their types and planning. Different types of floors, and flooring
materials. Bricks and stone masonry construction. Cavity wall & hollow block construction. [8 Hours]

UNIT IV Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof and roof treatments, Lintel sand Chhajja, Principles of building Planning. [8 Hours]


Books and References
1. SK Duggal, “Building Materials” New Age International
3. PC Varghese, “Building Materials” PHI
5. Sushil Kumar, “Building Construction” Standard Publisher.
10. Sahu, “Building Materials and Construction” Mc Grew Hill Education
15. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO etc.
Course Outcomes: At the end of this course the student will be able to-

1. Improve decision making in the field environmental engineering.
2. Apply integration of information from multiple sources.
3. Understand elimination of redundant data.
4. Minimize duplication in the data

Unit - I

Unit - II
Remote Sensing: Physics of remote sensing, Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC  [8 Hours]

Unit - III
Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Unsupervised and Supervised Classification, Applications of remote sensing. [8 Hours]

Unit - IV
Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications [8 Hours]

Unit - V
Global Navigation Satellite System (GNSS), GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Datum, coordinate system and map projection, Static, Kinematic and Differential GPS, GPS Applications. [8 Hours]

Books and References
4. B C Punamia: Higher Surveying Laxmi Publication
5. T M Lillesand et al: Remote Sensing & Image Interpretation
6. B. Bhatta: Remote Sensing & GIS
11. GS Srivastava “An Introduction to Geoinformatics” TMH.
Course Outcomes: At the end of this course the student will be able to-

1. Understand technical aspects of drinking water treatment
2. Design water supply network.
4. Design water supply system for rural areas.

Unit-I
Characteristics of water: Physical, chemical and biological standards. Theory, Operation and design of aeration system, sedimentation, coagulation, and clariflocculation. Design of clariflocculator. [8 Hours]

Unit-II
Filtration: Slow and rapid gravity filter, multi-media filters and pressure filters. Design of slow sand filter and rapid sand filter. Disinfection: theory and application of chlorine. Miscellaneous methods of water treatment- removal of iron and manganese, hardness, fluorides, colour, taste and odour, dissolved metals and gases. [8 Hours]

Unit-III
Adsorption, ion-exchange, membrane processes. Operation and Maintenance of water treatment plants, Industrial water treatment. [8 Hours]

Unit-IV
Water Supply Engineering: Water demand, design period, population forecasting, sources of water; hydrological concepts, ground-water and its development. [8 Hours]

Unit-V
Conveyance of water; pipe materials, corrosion, laying of pipes, pipe appurtenances, pumps for water supply, distribution system, planning of water supply projects. Design of water distribution network. Rural water supply distribution system. [8 Hours]

Books and References
3. Peavy, Rowe and Tchobanoglous: Environmental Engineering
5. Garg, SK: Water Supply Engineering (Environmental Engineering Vol.-I)
6. Raju: Water Supply and Wastewater Engineering
7. Kshirsagar: Water Supply and Treatment
8. Punnia: Water Supply and Wastewater Engineering
Geoinformatics Lab  (L-T-P  0-0-2)  Credit – 1

1. Demonstration and working on Electronic Total Station. Measurement of distances, horizontal & vertical angle and coordinates.
3. To layout a precise traverse in a given area and to compute the adjusted coordinates of survey stations.
4. Demonstration and working with Mirror stereoscopes, Parallax bar and Aerial photographs.
5. Visual Interpretation of standard FCC (False colour composite).
6. Digitization of physical features on a map/image using GIS software.
7. Coordinates measurement using GPS.

Water Supply and Treatment Lab  (L-T-P  0-0-2)  Credit – 1

1. Sampling Techniques
2. Determination of pH, conductivity.
3. Determination of colour, turbidity.
4. Determination of total solids, total dissolved solids, total suspended solids and volatile solids.
5. Determination of hardness, chloride.
6. Determination of alkalinity, acidity.
7. Determination of iron, sulphate.
8. Determination of fluoride, nitrate.
10. Determination of fluoride.
12. Application of laboratory and pilot plant scale units for evaluation of design criteria of:
    - Settling analysis studies.
    - Water treatment by slow sand filter / rapid gravity filter.

References:
1. Sawyer, McCarty and Parkin: Chemistry for Environmental Engineering
2. Mathur: Water and Wastewater Testing

Material Testing Lab  (L-T-P  0-0-2)  Credit – 1

Testing of various properties of following materials as per BIS specifications

I. Cement
1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier’s apparatus.
5. Soundness of cement.
6. Tensile strength

II. Coarse Aggregate
1. Water absorption of aggregate
2. Sieve Analysis of Aggregate
3. Specific gravity & bulk density
4. Grading of aggregates.

**III Fine Aggregate:**
1. Sieve analysis of sand
2. Silt content of sand
3. Bulking of sand

**IV Bricks:**
1. Water absorption.
2. Dimension Tolerances
3. Compressive strength
4. Efflorescence