## SCHEME OF TEACHING & EXAMINATION
## B.E (ENVIRONMENTAL ENGINEERING)
## III SEMESTER (2010-11)

| Sl. No. | Subject Code | Title | Teaching Dept. | Teaching Scheme Hours/Week | | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Th. | Practical /Drawing | Duration (Hours) | Th. / Pr. | I.A. Max. Marks | Total Marks |
| 1 | 10 MAT 31 | Engineering Mathematics – III | MATHS | 4 | - | 3 | 100 | 25 | 125 |
| 2 | 10 EV 32 | Environmental Chemistry – I | EV | 4 | - | 3 | 100 | 25 | 125 |
| 3 | 10 EV 33 /10CV33 | Strength of Materials | EV | 4 | - | 3 | 100 | 25 | 125 |
| 4 | 10 EV 34 /10CV34 | Surveying – I | EV | 4 | - | 3 | 100 | 25 | 125 |
| 5 | 10 EV 35 | Environmental Fluid Mechanics-I | EV | 4 | - | 3 | 100 | 25 | 125 |
| 6 | 10 EV 36 | Environmental Biology | EV | 4 | - | 3 | 100 | 25 | 125 |
| 7 | 10 EVL 37 | Environmental Analysis Laboratory – I | EV | - | 3 | 3 | 50 | 25 | 75 |
| 8 | 10 EV L 38 | Surveying Practice - I | EV | 1 | 3 | 3 | 50 | 25 | 75 |
| **Total** | | | | **25** | **6** | **24** | **700** | **200** | **900** |

## SCHEME OF TEACHING & EXAMINATION
## B.E (ENVIRONMENTAL ENGINEERING)
## IV SEMESTER (2010-11)

| Sl. No. | Subject Code | Title | Teaching Dept. | Teaching Scheme Hours/Week | | Examination Scheme | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Th. | Practical /Drawing | Dur-ation (Hours) | Th. / Pr. | I.A. Max. Marks | Total Marks |
| 1 | 10 MAT-41 | Engineering Mathematics – IV | MATHS | 4 | - | 3 | 100 | 25 | 125 |
| 2 | 10 EV42 | Advanced Materials of Construction | EV | 4 | - | 3 | 100 | 25 | 125 |
| 3 | 10 EV43 | Environmental Chemistry - II | EV | 4 | - | 3 | 100 | 25 | 125 |
| 4 | 10 EV44 | Elements of Environmental Protection | EV | 4 | - | 3 | 100 | 25 | 125 |
| 5 | 10 EV 45 | Environmental Fluid Mechanics-II | EV | 4 | - | 3 | 100 | 25 | 125 |
| 6 | 10 EV46 | Applied Engineering Geology | EV/GEO | 4 | - | 3 | 100 | 25 | 125 |
| 7 | 10 EVL47 | Environmental Analysis Laboratory – II | EV | - | 3 | 3 | 50 | 25 | 75 |
| 8 | 10 EVL48 | Environmental Hydraulics Lab | EV | - | 3 | 3 | 50 | 25 | 75 |
| **Total** | | | | **24** | **6** | **24** | **700** | **200** | **900** |

**SCHEME OF TEACHING AND EXAMINATION**
**B.E. (ENVIRONMENTAL ENGINEERING)**
**V SEMESTER (2010-11)**

| Sl. No. | Subject Code | Title of the Subject | Teaching Dept. | Teaching Hrs / Week | | Examination | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical | Duration (Hrs) | Marks | | |
| | | | | | | | IA | Theory / Practical | Total |
| 1 | 10 EV 51 | Municipal Solid Waste Management | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 2 | 10 EV 52 | Origin and Characterization of Environmental Pollution | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 3 | 10 EV 53 | Hydraulics of Water Supply System | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 4 | 10 EV 54 | Environmental Geotechnology | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 5 | 10 EV 55 | Hydrology and Water Resources Engineering | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 6 | 10 EV 56 | Water Treatment Technology | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 7 | 10 EVR57 | Computer Aided Design and Drawing of Environmental Systems-I | EV | -- | 03 | 03 | 25 | 50 | 75 |
| 8 | 10 EVL 58 | Environmental Process Laboratory I | EV | | 03 | 03 | 25 | 50 | 75 |
| **TOTAL** | | | | **24** | **06** | **24** | **200** | **700** | **900** |

**SCHEME OF TEACHING AND EXAMINATION**
**B.E. (ENVIRONMENTAL ENGINEERING)**
**VI SEMESTER (2010-11)**

| Sl. No. | Subject Code | Title of the Subject | Teaching Dept. | Teaching Hrs / Week | | Examination | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical | Duration (Hrs) | Marks | | |
| | | | | | | | IA | Theory / Practical | Total |
| 1 | 10 AL 61 | Management & Entrepreneurship | Any dept. | 04 | -- | 03 | 25 | 100 | 125 |
| 2 | 10 EV 62 | Environmental Transport Processes | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 3 | 10 EV 63 | Atmospheric Environmental Engineering | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 4 | 10 EV 64 | Wastewater Collection and Drainage Systems | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 5 | 10 EV 65 | Wastewater Treatment Technology | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 6 | 10 EV 66 | Elective-I (Group A) | EV | 04 | -- | 03 | 25 | 100 | 125 |
| 7 | 10 EVL 67 | Noise and Air Pollution Measurement Lab | EV | -- | 03 | 03 | 25 | 50 | 75 |
| 8 | 10 EVL 68 | Environmental Process Laboratory -II | EV | -- | 03 | 03 | 25 | 50 | 75 |
| **TOTAL** | | | | **24** | **06** | **24** | **200** | **700** | **900** |

**Elective-I (Group A)**

10EV661 Environmental Economics
10EV662 Natural Energy Resources
10EV663 Environmental Systems Optimization

**SCHEME OF TEACHING AND EXAMINATION**
**B.E. (ENVIRONMENTAL ENGINEERING)**

**VII SEMESTER (2010-11)**

| Sl. No. | Subject Code | Title of the Subject | Teaching Dept. | Teaching Hrs / Week | | Examination | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical | Duration (Hrs) | Marks | | |
| | | | | | | | IA | Theory / Practical | Total |
| 1 | 10 EV71 | Computer Applications in Environmental Engineering | EV | 4 | - | 3 | 25 | 100 | 125 |
| 2 | 10 EV72 | Ecology and Environmental Impact Assessment | EV | 4 | - | 3 | 25 | 100 | 125 |
| 3 | 10 EV73 | Industrial Pollution Control Technology | EV | 4 | - | 3 | 25 | 100 | 125 |
| 4 | 10 EV74 | Estimation, Specifications & Financial Aspects of Environmental Facilities | EV | 4 | - | 3 | 25 | 100 | 125 |
| 5 | 10 EV75 | Elective - II (Group B) | EV | 4 | - | 3 | 25 | 100 | 125 |
| 6 | 10 EV76 | Elective - III (Group C) | EV | 4 | - | 3 | 25 | 100 | 125 |
| 7 | 10 EVR77 | Computer Aided Design and Drawing of Environmental Systems – II | EV | - | 3 | 3 | 25 | 50 | 75 |
| 8 | 10 EVL78 | Computer Applications Lab | EV | - | 3 | 3 | 25 | 50 | 75 |
| **TOTAL** | | | | **24** | **6** | **24** | **200** | **700** | **900** |

**Elective - II (Group B)**

10EV751 - Nuclear, Radioactive & Biomedical Waste Technology
10EV752 - Occupational Safety and Health
10EV753 – Rural Public Health Engineering

**Elective - III (Group C)**

10EV761 - Environmental Aspects of Developmental Projects
10EV762 - Environmental Applications of Remote Sensing & GIS
10EV763 – Bioremediation Technology

**SCHEME OF TEACHING AND EXAMINATION**
**B.E. (ENVIRONMENTAL ENGINEERING)**

**VIII SEMESTER (2010-11)**

| Sl. No. | Subject Code | Title of the Subject | Teaching Dept. | Teaching Hrs / Week | | Examination | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Theory | Practical | Duration (Hrs) | Marks | | |
| | | | | | | | IA | Theory / Practical | Total |
| 1 | 10 EV81 | Management for Environmental Engineers | EV | 4 | - | 3 | 25 | 100 | 125 |
| 2 | 10 EV82 | Water Quality Assessment in Natural Systems | EV | 4 | - | 3 | 25 | 100 | 125 |
| 3 | 10 EV83 | Elective - IV (Group D) | EV | 4 | - | 3 | 25 | 100 | 125 |
| 4 | 10 EV84 | Elective - V (Group E) | EV | 4 | - | 3 | 25 | 100 | 125 |
| 5 | 10 EV85 | Project Work | EV | - | 6 | 3 | 100 | 100 | 200 |
| 6 | 10 EV86 | Seminar | EV | - | 3 | - | -- | 50 | 50 |
| **TOTAL** | | | | **16** | **9** | **15** | **200** | **550** | **750** |

**Elective - IV (Group D)**

10EV831 – Climate Change and Carbon Trading
10EV832 - Environmental Management Systems
10EV833 - Hazardous Waste Technology

**Elective - V (Group E)**

10EV841 - Operation and Maintenance of Environmental Facilities
10EV842 - Non-point Pollution Sources & Management
10EV843 – Recovery Recycle and Reuse Technology

**ENVIRONMENTAL CHEMISTRY – I**

**Sub Code : 10 EV 32** **IA Marks : 25**
**Hrs/ Week : 04** **Exam Hours : 03**
**Total Hrs. : 52** **Exam Marks : 100**

**PART – A**

**UNIT 1** **4 Hours**

1.1 Significance of Environmental Chemistry for Water Supply Engineering
1.2 Significance of Environmental Chemistry for Wastewater Engineering
1.3 Importance of Environmental Chemistrty for Solid and Hazardous Wastes

**UNIT 2** **8 Hours**

**Basic Concepts from Physical Chemistry**

2.1. Osmosis
2.2. Dialysis
2.3 Principles of Solvent Extraction
2.4. Oxidation and Reduction
2.5. Electrochemistry
2.6. Catalysis
2.7. Adsorption
2.8. Colourimetry
2.9. Light Absorption and Beer's Law.

**UNIT 3** **10 Hours**

**Basic Concepts of Equilibrium and Colloidal Chemistry**

3.1 Introduction
3.2 Solution to equilibrium problems
3.3 Acids and Bases
3.4 Buffers.
3.5 Introduction to colloidal chemistry
3.6 Colloidal dispersions in liquids
3.7 Colloidal dispersions in air

**UNIT 4** **4 Hours**

**pH – General Considerations**

4.1 Theoretical considerations,
4.2 Measurement of pH, and interpretation of pH data

**PART – B**

**UNIT 5** **8 Hours**

**Pollution Parameters of Wastewater**

Definitions and estimation of ;
5.1 COD
5.2 BOD
5.3 DO
5.4 TOC
5.5 Nitrogen – 5.5.1 Different Forms, 5.5.2 Environmental Significance, 5.5.3 Methods of Analysis.

**UNIT 6** **4 Hours**

**Fluoride**

6.1 General considerations
6.2 Chemistry of fluoride and its compounds

6.3 Methods of determining Fluoride.

**UNIT 7** **6 Hours**

**Sanitary Significance of Sulphate, Nitrate and Phosphate**

7.1 Phosphorous Cycle
7.2 Carbon Cycle
7.3 Nitrogen Cycle
7.4 Sanitary significance N & P

**UNIT 8** **8 Hours**

**Instrumental Methods of Analysis**

Optical Methods, Electrical Methods,
Chromatographic Methods and other Instrumental Methods
Description of UV-Vis Spectrophotometer, GC, HPLC with MS, AAS and
Plasma Emission Spectrometer

**QUESTION PAPER PATTERN**

In the examination EIGHT full questions shall be set out of which the
students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEXT BOOKS**

1. Sawyer G.N., McCarty, P.L. and Parkin, G.F., and Science, (2003),**Chemistry for Environmental Engineering**, 5th Edition, Tata McGraw Hill
2. Stumn & Morgan, (1981), **Aquatic Chemistry,** Second Edition, John Wiley Publisher

3. Banerjee (2008), **Environmental Chemistry**, 2nd Edition, PHI Learning Publications

**REFERENCES**

1.American Water Works Association, (2001), "**Standard Methods for Examination of Water and Wastewater**", 20th Edition.
2. Khopkar S.M**, (2007) Basic Concepts of Analytical Chemistry,**. New Age Science ltd
3. De, A.K **, (**1989**),Environmental Chemistry,**., Wiley Eastern Ltd.,
4. Ronald L Droste, **(**1996),**Textbook of Environmental Engineering**
5. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering**, McGraw Hill Book Co.

**STRENGTH OF MATERIALS**
**(COMMON TO CV/TR/EV/CTM)**

| | | | | | |
|---|---|---|---|---|---|
| ***Sub Code*** | **:** | **10 CV 33/ 10EV33** | ***IA Marks*** | **:** | **25** |
| **Hrs/ Week** | **:** | **04** | **Exam Hours** | **:** | **03** |
| **Total Hrs.** | **:** | **52** | **Exam Marks** | **:** | **100** |

**PART – A**

## UNIT 1:
## Simple Stress and Strain

1.1 Introduction, 1.2 Properties of Materials, 1.3 Stress, Strain, Hook's law, Stress – Strain Diagram for structural steel and non ferrous materials, 1.4 Volumetric strain, expression for volumetric strain, 1.5 Elastic Constants: Relationship among elastic constants, 1.6 Total elongation of tapering bars of circular and rectangular cross sections. Elongation due to self weight.

**7 Hours**

## UNIT 2:
## Simple Stress and Strain **continued…**

2.1 Composite section, 2.3 Thermal stresses (including thermal stresses in compound bars).

**6 Hours**

UNIT 3:
Compound stresses

**3.1 Introduction, 3.2 Stress components on inclined planes, 3.3 General two-dimensional stress system, 3.4 Principal planes and stresses, 3.5 Mohr's circle of stresses.**

8 Hours

UNIT 4:
Bending moment and shear force in beams

**4.1 Introduction, 4.2 Shearing force and Bending moment in beam, 4.3 Sign convention, 4.4 Relationship between loading, shear force and bending moment, 4.5 Shear force and bending moment equations, SFD and BMD with salient values for cantilever beams, simply supported beams and overhanging beams considering gravity loads(point, udl and uvl) and Couple.**

7 Hours

PART – B

UNIT 5:
Bending stress, shear stress in beams

**5.1 Introduction – Bending stress in beam, 5.2 Assumptions in pure bending theory, 5.3 Derivation of Pure bending equation, 5.4 Modulus of rupture, section modulus, 5.5 Flexural rigidity, 5.6 Expression for horizontal shear stress in beam, 5.7 Shear stress diagram for rectangular, 'I' and 'T' section (Flitched beams not included).**

6 Hours

UNIT 6:
Deflection of beams

**6.1 Introduction – Definitions of slope, deflection, 6.2 Elastic curve-derivation of differential equation of flexure, 6.3 Sign convention 6.4 Slope and deflection for standard loading classes using Macaulay's method for prismatic beams and overhanging beams subjected to point loads, UDL and Couple.**

6 Hours

UNIT 7:
Torsion of circular shafts
**7.1 Introduction – Pure torsion-torsion equation of circular shafts, 7.2 Strength and stiffness, 7.3 Torsional rigidity and polar modulus, 7.4 Power transmitted by shaft of solid and hollow circular sections.** 6 Hours

UNIT 8:
Elastic stability of columns
**8.1 Introduction – Short and long columns, 8.2 Euler's theory on columns, 8.3 Effective length slenderness ratio, 8.4 Radius of gyration, buckling load, 8.5 Assumptions, derivations of Euler's Buckling load for different end conditions, 8.6 Limitations of Euler's theory, 8.7 Rankine's formula, problems.**

6 Hours

TEXT BOOKS:
1. Strength of Materials, **Subramanyam, Oxford University Press, Edition 2008**
2. Mechanics of Materials**, B.C Punmia Ashok Jain, Arun Jain, Lakshmi Publications, New Delhi.**
3. Strength of Materials**, Basavarajaiah and Mahadevappa Universities Press (2009).**

REFERENCE BOOKS:
1. Strength of Materials**, Singer Harper and Row Publications.**
2. Elements of Strength of Materials**, Timoshenko and Young Affliated East-West Press.**

Mechanics of Materials, **James M. Gere, Barry J.Goodno (India Edition), Cengage Learning.**

## SURVEYING – I
## (COMMON TO CV/TR/EV/CTM)

| | | | | | |
|---|---|---|---|---|---|
| ***Sub Code*** | **:** | **10 CV 34 10EV34** | ***IA Marks*** | **:** | **25** |
| **Hrs/ Week** | **:** | **04** | **Exam Hours** | **:** | **03** |
| **Total Hrs.** | **:** | **52** | **Exam Marks** | **:** | **100** |

**PART – A**

**UNIT 1:**
**Introduction**
1.1 Definition of Surveying, 1.2 Classification of Surveys, 1.3 Uses of Surveying Units of Measurements, 1.4 Map & Classification, 1.5 Survey of India topographical Maps and their numbering., 1.6 Basic principles of surveying, 1.7 Errors, Classification, 1.8 Precision and accuracy.

**04 Hours**

**UNIT 2:**

**Measurement of horizontal distances.**

2.1 Chain and types, 2.2 Tape and types, 2.3 EDM devices, 2.3 Ranging of lines 2.4 Direct and Indirect, 2.5 Measurement of distances over sloping grounds, 2.6 Chain and Tape corrections - Numerical problems.

**5 Hours**

**UNIT 3:**

**Chain Surveying**

3.1 Accessories required, 3.2 Selection of stations and lines, 3.3 Offsets and types 3.4 Setting out of right angles, 3.5 Working principle and use of optical square, prism square, cross staff., 3.6 Linear methods of setting out right angles, 3.7 Booking of chain survey work, 3.8 Field book, entries, conventional symbols, 3.9 Obstacles in chain survey, Numerical problems, 3.10 Errors in chain survey and precautions to be taken. **7 Hours**

**UNIT 4:**

**Compass Surveying**

4.1 Meridians and bearings, 4.2 Principle, working and use of - Prismatic compass 4.3 Surveyor's compass, 4.4 Magnetic bearing, true bearings, 4.5 WCB and Reduced bearing. 4.6 Dip and Declination

4.7 Accessories required for compass surveying, 4.8 Traverse - closed and open traverse 4.9 Computation of bearings of legs of closed traverse given the bearing of one of the legs, 4.10 Computation of included angles given the bearings of legs of a closed traverse.

**6 Hours**

**PART – B**

**UNIT 5:**

**Compass Traversing** continued….

5.1 Local attraction, determination and corrections, 5.2 Dependent and independent co-ordinates, 5.3 Checks for closed traverse and determination of closing error and its direction 5.4 Bowditch's graphical method of adjustment of closed traverse, 5.5 Bowditch's rule and transit rule, 5.6 Omitted measurements (Only Length and corresponding bearing of one line).

**8 Hours**

**UNIT 6:**

**Introduction to Levelling**

6.1 Principles and basic definitions, 6.2 Fundamental axes and part of a dumpy level, 6.3 Types of adjustments and objectives, 6.4 Temporary and Permanent adjustments of a dumpy level, 6.5 Sensitiveness of bubble tube, 6.6 Curvature and refraction correction, 6.7 Type of leveling, 6.8 Simple leveling, 6.9 Reciprocal leveling, 6.10 Profile leveling, 6.11 Cross sectioning, 6.12 Fly leveling,

**7 Hours**

**UNIT 7:**

**Reduction of Levelling** continued….

7.1 Booking of levels 7.2 Rise and fall method and Height of instrument method 7.3 comparison Arithmetic checks 7.4 Fly back leveling., 7.5 Errors and precautions.

**6 Hours**

**Contouring**

7.6 Contours and their characteristics, 7.7 Methods of contouring, 7.8 direct and indirect methods, 7.9 Interpolation techniques, 7.10 Uses of contours 7.11 Numerical problems on determining intervisibility,

7.12 Grade contours and uses.

**4 Hours**

**UNIT 8:**

**Plane Table Surveying**

8.1 Plane table and accessories, 8.2 Advantages and limitations of plane table survey, 8.3 Orientation and methods of orientation, 8.4 Methods of plotting – Radiation, Intersection, Traversing, 8.5 Resection method, 8.6 Two point and three point problems, 8.7 Solution to two point problem by graphical method, 8.8 Solution to three point problem Bessel's graphical method, 8.9 Errors in plane table survey.

**5 Hours**

**TEXT BOOKS:**

1. **'Surveying'** Vol–1 – B.C. Punmia , Laxmi Publications, New Delhi.
2. **Surveying and Levelling** – R Subramanian. Oxford University Press (2007)

**Text Book of Surveying** – C. Venkataramiah. Universities Press.(2009 Reprint)

.

**REFERENCE BOOKS:**

1. **Fundamentals of Surveying -** Milton O. Schimidt – Wong, Cengage Learning.
2. **Fundamentals of Surveying** - S.K. Roy – Prentice Hall of India.
3. **Surveying** Vol. I, S.K. Duggal, Tata McGraw Hill - Publishing Co. Ltd., New Delhi.

* Survey of India Publication on maps.

**ENVIRONMENTAL FLUID MECHANICS - I**

**Sub Code : 10 EV35** **IA Marks : 25**
**Hrs/ Week : 04** **Exam Hours : 03**
**Total Hrs. : 52** **Exam Marks : 100**

**PART – A**

**UNIT 1** **9 Hours**

**INTRODUCTION**

1.1 Scope and importance of Subject
1.2 Definition of Fluid, Distinction between solids & fluid
1.3 Distinction between liquid & gas fluid continuum

**FLUID PROPERTIES AND CLASSIFICATION OF FLUID**

1.4 Mass density, Specific Volume
1.5 Specific Weight Relative density
1.6 Definition, units and Dimensions
1.7 Viscosity, Newton's law of viscosity
1.8 Newtonian and Non-Newtonian Fluids
1.9 Ideal and Real fluids
1.10 Compressibility
1.11 Vapour pressure
1.12 Surface tension, Definitions, units and dimensions
1.13 Equation for stability of bubble
1.14 Capillarity, theory and problems

1.15 Problems on Newton's law of viscosity

**UNIT 2** **6 Hours**

**FLUID PRESSURE AND ITS MEASUREMENT**

2.1 Definition of pressure, units and dimensions
2.2 Pressure at a point
2.3 Pascal's law
2.4 Hydrostatic pressure law
2.5 Absolute and Gauge pressure
2.6 Measurement of pressure, Simple Manometer theory and problems
2.7 Differential manometer theory & Problems
2.8 Mechanical pressure gauges

**UNIT 3** **6 Hours**

**HYDROSTATICS**

3.1 Definition of total pressure, Center of pressure, Centroid, centroidal depth, depth of center of pressure
3.2 Equation for hydrostatic force and depth of center of pressure on plane surfaces (vertical and inclined)
3.3 Problems on hydrostatic force vertically submerged surfaces
3.4 Problems on inclined submerged surfaces
3.5 Hydrostatic force on submerged curved surfaces, problems, 3.6 Pressure diagram, problems

**UNIT 4** **7 Hours**

**KINEMATICS OF FLUIDS**

4.1 Description of fluid flow
4.2 Lagrangian and Eulerian approaches
4.3 Classification of flow, steady & unsteady, uniform and non-uniform
4.4 Definition of path line, streamline, streak line, stream tube, one, two, three dimensional flows Rotational and irrotational flow
4.5 Acceleration of flow
4.6 One dimensional flow, derivation of continuity equation in differential form
4.7 Definition of velocity potential, stream functions, stream line, equipotential line
4.8 Relation between velocity potential and stream function, Laplace equation
4.9 Problem on continuity equation
4.10 Problem on velocity potential and stream function

**PART – B**

**UNIT 5** **7Hours**

**DYNAMICS OF FLUID FLOW**

5.1 Concept of Inertia force and other forces causing motion
5.2 Derivation of Euler's equation and Bernoulli's equation with assumption and limitation
5.3 Modification of Bernoulli's equation, problem on Bernoulli's equation without and with losses
5.4 Application of Bernoulli's equation - Pitot tube, problems
5.5 Venturimeter, problems
5.6 Momentum equation, problems

**UNIT 6** **7 Hours**

**FLOW THROUGH PIPES**

6.1 Flow through pipes, Reynolds number, classification of flow
6.2 Definition of hydraulic gradient, energy gradient
6.3 Major and minor losses in pipe flow
6.4 Equation for head loss due to friction (Darcy-Weishbach equation ). –Friction factor for commercial pipes
6.5 Minor losses (types), equation for head loss due to sudden expansion. – Problem on minor losses
6.6 Pipes in series, pipes in parallel and equivalent pipe
6.6 Problems

**UNIT 7** **5 Hours**

**FLOW MEASUREMENTS**

7.1 Flow through Orifices; classification
7.2 Hydraulic co-efficients of an Orifice and relation between them.
7.3 Equation for co-efficient of velocity, problems
7.4 Submerged and large rectangular Orifices
7.5 Flow through mouth pieces, classification, equation for discharge and pressure head for an external cylindrical mouth piece

**UNIT 8** **5 Hours**

**FLOW MEASUREMENTS** **Continued…**

8.1 Flow over notches, classification
8.2 Equation for discharge over rectangular and trapezoidal notches
8.3 Equation for discharge over Vnotch, problems
8.4 Cippoletti notch, problems
8.5. Types of Nappe, ventilation of weirs
8.6 Broad crested weirs, problems
8.7.Submerged weirs, equation for discharge, problems

**QUESTION PAPER PATTERN**

In the examination EIGHT full questions shall be set out of which the
students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEXT BOOKS**

1.. Modi P.N and. Seth, S.M., (2002), **Hydraulics and Fluid Mechanics,** Standard Book House, New Delhi.
2. Bansal, R.K. (2005), **Fluid Mechanics and Hydraulic Machines**, Lakshmi Publications, New Delhi.
3. Jain, A.K. (2004), **"Fluid Mechanics"**, 37th Edition, Khanna Publishers, New Delhi.
4. Mohanty A.K., (2009), **"Fluid Mechanics",** 2nd Edition, PHI Learning Pvt. Ltd., New Delhi

**REFERENCE BOOKS**

1. James F Cruise, Vijay P. Singh, Mohsan M. Sherif,(2006), **Elementary Hydraulics ,**1st Edition**,**Civil engineering publishers.
2. Arora, K.R. (2005), **Fluid Mechanics, Hydraulic and Hydraulics** , Standard Book House, New Delhi.
3. John F. Douglas et al**, (**2005), **Fluid Mechanics**, Pearson Prentice Hall, India.

**ENVIRONMENTAL BIOLOGY**

**Sub Code : 10 EV 36** **IA Marks : 25**
**Hrs/ Week : 04** **Exam Hours : 03**
**Total Hrs. : 52** **Exam Marks : 100**

**PART – A**

**UNIT 1** **6 Hours**

**Introduction to Environmental Biology**

1.1 Concepts of Environment, Public Health and Eco system health
1.2 General Microbiology.
1.2.1 Microscopic fauna and flora concern to Environmental Engineers, Water as their natural habitat.
1.2.2 Systematic study of important group / subgroups for sizing the problems they cause.

**UNIT 2** **8 Hours**

**Plant Kingdom**

2.1 Algae – basic characteristics and classification upto classes.
2.2 Salient characteristics of Chlorophyceae – Bascillariophyceae, Cyanophyceae and Euglinaeceae,
2.3 Economic importance of Algae. Problems caused by algae and methods of control.
2.4 Water Hyacinth – Morphology, anatomy and life cycle.
2.5 Environmental significance of plant kingdom.

**UNIT 3** **8 Hours**

3.1 **Animal Kingdom**: Group Protozoa - basic character. Group Rotifers - basic character. Subgroup Crustaceans - basic character.
3.2 **Group Fungi**: Basic characteristics of the group and classification upto classes and class schizomycetes.
3.3 **Morphology of Bacteria**: Bacteria exhibiting variation in shapespherical, rod and helices. Cytoplasmic appendages of bacteria, celia and flagella, spore and spore formation.

**UNIT 4** **8 Hours**

**Metabolism and Principles**

4.1 Nutritional requirements of bacteria.
4.2 Autotrophic and heterotrophic requirements. Photosynthesis.
4.3 Definition of Metabolism - Difference of anabolism and catabolism.
4.4 Dependence of metabolism on biological catalysts and enzymes.

**PART – B**

**UNIT 5** **6 Hours**

**Air and Water Microbiology**

5.1 Bacteria in water and air
5.2 Indicator organisms and their testing techniques – MPN, Multiple Fermentation and membrane filter methods:
5.3 Importance in Environmental Studies.

**UNIT 6** **8 Hours**

**Microbiology of Soil**

6.1 Physical Characteristics,
6.2 Microbial flora,
6.3 Interaction among microorganisms,

6.4 Biogeochemical roles of soil microorganisms.

**UNIT 7** **4 Hours**

**Virology**

7.1 Types,
7.2 Characteristics and enumeration methods.
7.3 Effects of virus on cells.

**UNIT 8** **8 Hours**

**Microbial Metabolism of Heavy Metals and pesticides**

8.1 General interaction between Mircobes and Metals.
8.2 Microbial transformation of Arsenic, Mercury, Lead, Cadmium, Selenium, Tin, Tellurium.
8.3 Microbial metabolism of Hydrocarbons (HC) and Pesticides – Petroleum, HC, Benzene, toluene, xylene, DDT, BHC.
8.4 Bioconcentration, Biomagnification and Depuration.

**QUESTION PAPER PATTERN**

In the examination EIGHT full questions shall be set out of which the
students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEXT BOOKS**

1. Mckinney R.E, (1962**), Microbiology for Sanitary Engineers**, McGraw Hill.
2. Pelczar Michael, (2004**, Microbiology,** Tata McGraw Hill.
3. Atlas R.M. and Bortha R., (1998), "**Microbial Ecology – Fundamentals and Applications",** Pearson Education (Singapore) Pvt. Ltd.,

**REFERENCES**

1. Gopal B.,(1987), **Water Hyacinth, (**1987**),** Elsevier Publishers, Amsterdam.
2. Mishustin Y., and Petrobvskaya M.,(1979), **Sanitary Microbiology of Soil,** NAUKA Publishers, Russia.
3. Verschueren K, Van Nostrand, (1983),**Handbook of Environmental Data on Organic Chemicals,** II Edition,.
4. Mitchell R, (1978), **Water Pollution Microbiology**,Vol. 2, , Wiley Interscience, New York.
5. Philip Herries Gregory, (1976), **Aerobiology,** , Oxford University Press, London.

## ENVIRONMENTAL ANALYSIS LABORATORY – I

**Sub Code : 10 EVL 37** **IA Marks : 25**
**Hrs/ Week : 03** **Exam Hours : 03**
**Total Hrs. : 42** **Exam Marks : 50**

Introduction – Lab layout, lab apparatus, washing & sterilization methods.

Preparation of culture media.

Plate count, multiple tube fermentation and membrane filter technique for coliforms.

Different Coliform groups – faecal coliform and faecal streptococci.
Bacteriological examination of recreational water. Rapid detection methods for coliform.
Bacterial cell immobilization and mixed culture tests. Detection of fungi.
Microscopic Identification of aquatic organisms – Blue-green algae, Diatoms, Green Algae. Microscopic Identification of Plankton, Periphyton, Macrophytes.

**REFERENCES**

1.American Water Works Association, (2001), "**Standard Methods for Examination of Water and Wastewater**", 20th Edition.
2.Pepper, Gerba and Brendecke, ,(1995), **Environmental Microbiology: A laboratory manual** Academic Press, San Diego.
3. **Relevant I.S. codes**.

**SURVEYING PRACTICE**

**Sub Code : 10 EVL 38** **IA Marks : 25**
**Hrs/ Week : 03** **Exam Hours : 03**
**Total Hrs. : 42** **Exam Marks : 50**

Exercise – 1
a) To measure distance between two points using direct ranging
b) To set out perpendiculars at various points on given line using cross staff, optical square and tape.
Exercise – 2
Setting out of rectangle, hexagon using tape/chain and other accessories
Exercise – 3
Measurement of bearing of the sides of a closed traverse & adjustment of closing error by Bowdich method and Transit method
Exercise – 4
To set out rectangles, pentagon, hexagon, using tape /chain and compass.
Exercise – 5
To determine the distance between two inaccessible points using chain/tape & compass.
Exercise – 6
To locate points using radiation and intersection method of plane tabling
Exercise – 7
To solve 3-point problem in plane tabling using Bessel's graphical solution
Exercise –8
To determine difference in elevation between two points using fly leveling technique & to conduct fly back leveling. Booking of levels using both HI and Rise & Fall methods.
Exercise – 9
To determine difference in elevation between two points using reciprocal leveling and to determine the collimation error
Exercise – 10
To conduct profile leveling for water supply /sewage line and to draw the longitudinal section to determine the depth of cut and depth of filling for a given formation level.

**Demonstration**

Minor instruments – Clinometer, Ceylon ghat tracer, Hand level, Box sextant, Planimeter and Pantagraph, Total Station.

**TEXT BOOKS**

1. Punmia , B.C. (1991**),'Surveying'** Vol.–1 **,** Laxmi Publications, New Delhi.
2. Chandra, A.M. (2002) **"Plane Surveing"** Vol-1-, Newage International ® Ltd.
3. ALAK , (2000),**"Plane Surveying"**, S. Chand and Company Ltd., New Delhi.

**REFERENCE BOOKS**

1. Roy, S.K. (2009), **Fundamentals of Surveying**, Prentice Hall of India.
2. Milton O. Schimidt, Milton O Wong**, (**1985), **Fundamentals of Surveying**-, Thomson Learning.
4. Duggal, S.K. (2000), **Surveying Vol. I**, Third edition,Tata Macgraw Hill Publishing Company Limited

## ENGINEERING MATHEMATICS - IV

| | | | | | |
|---|---|---|---|---|---|
| ***Sub Code*** | **:** | **10MAT41** | ***IA Marks*** | **:** | **25** |
| **Hrs/ Week** | **:** | **04** | **Exam Hours** | **:** | **03** |
| **Total Hrs.** | **:** | **52** | **Exam Marks** | **:** | **100** |

**ADVANCED MATERIALS OF CONSTRUCTION**

**Sub Code : 10 EV 42** **IA Marks : 25**
**Hrs/ Week : 04** **Exam Hours : 03**
**Total Hrs. : 52** **Exam Marks : 100**

**PART – A**

**UNIT 1: BUILDING STONES**

1.1. Common building stones and their uses
1.2. Quarrying of stones
1.3. Deterioration of stones
1.4. Preservation of stones
1.5. Dressing of stones

**7 Hours**

**UNIT 2: BRICKS & TILES**

2.1. Classification of bricks
2.2. Manufacture of bricks
2.3. Tests on bricks
2.4. Types of tiles
2.5. Quality of tiles & their uses **7 Hours**

**UNIT 3: TIMBER**

3.1. Varieties & uses
3.2. Defects in Timber
3.3. Tests for good Timber
3.4. Seasoning of timber
3.5. Plywood & its uses
3.6. Wood wool boards **7 Hours**

**UNIT 4: LIME & CEMENT**

4.1. Types of lime
4.2. Manufacture of Hydraulic & Fat Limes
4.3. Activated Lime – Pozzolana mixture
4.4. Chemical Composition of Portland Cement and Hydration of Cement
4.5. Manufacture of Portland Pozzolana Cement
4.6. Types of Cements and their uses
4.7. Lime & cement mortar **7 Hours**

**PART – B**

**UNIT 5: CONCRETE INGREDIENTS**

5.1. Testing of Cement-field testing, fineness by sieve test and Blaine's air permeability test.
5.2. Normal consistency, setting time, soundness.
5.3. Compression strength of cement and grades of cement, quality of mixing water.
5.4. Fine aggregate – grading, analysis.
5.5. Specific gravity, bulking, moisture content, deleterious materials.
5.6. Coarse aggregate- importance of size, shape and texture.
5.7. Grading of aggregates-sieve analysis, specific gravity. Flakiness and elongation index, crushing impact and abrasion tests.

**6 Hours**

**UNIT 6: FRESH CONCRETE**

6.1. Workability – factors affecting workability,
6.2. Measurement of workability – slump. Flow tests.
6.3. Compaction factor and vee-bee consistometer tests.
6.4. Segregation and bleeding.
6.5. Process of manufacture of concrete: Batching .
6.6. Mixing.
6.7. Transporting
6.8. Placing
6.9. Compaction
6.10. Curing
6.11. Chemical admixtures- plasticizers, accelerators, retarders and air entraining agents.
6.12. Mineral admixtures – fly ash.
6.13. Silica fumes and rice husk ash.

**6 Hours**

**UNIT 7: HARDENED CONCRETE**

7.1. Factors affecting strength, w/c ratio, gel/space ratio, maturity concept.
7.2. Effect of aggregate properties, relation between compressive strength, and tensile strength, bond strength, modulus of

rupture.
7.3. Accelerated curing, aggregate-cement bond strength.
7.4. Elasticity- Relation between modulus of elasticity, Poission ratio.
7.5. Shrinkage – plastic shrinkage and drying shrinkage, factors affecting shrinkage.
7.6. Creep- measurement of creep, factors affecting creep, effect of creep.
7.7. Durability – definition, significance, permeability, sulphate attack, chloride attack, carbonation, freezing and thawing..
7.8. Factors contributing to cracks in conrete-plastic shrinkage, settlement cracks, construction joints
7.9. Thermal expansion, transition zone, structural design deficiencies.
7.10. Testing of hardened concrete-compressive strength, split tensile strength.
7.11. Flexural strength, factors influencing strength test results.
**6 Hours**

**UNIT 8: OTHER BUILDING MATERIALS:** Properties & uses of
8.1. Reinforcing steel, structural steel
8.2. Cast Iron, Plain carbon steel
8.3. Glasses
8.4. Electrical, Thermal & Sound Insulating Materials
8.5. Paints, Varnish & Enamels
8.6. Plastics, Composites, Polymers, Geosynthetics
8.7. Rubber and water proofing materials
8.8. Bitumen & Asphalt **6 Hours**

**QUESTION PAPER PATTERN**

In the examination EIGHT full questions shall be set out of which the
students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEST BOOKS**

1. Rangawala R.C., (2000), **Engineering Materials,** Charotar Publishing House, Anand, India.
2. Sushil Kumar, **Engineering Materials,** , Standard Publication and Distributors, New Delhi
3. Shetty M..S, (2002), **Concrete technology – Theory and practice,** , S. Chand and Co, New Delhi.
4. Varghese P.C., (2007), **Building Construction**, PHI Learning Pvt. Ltd.,

**REFERENCE BOOKS**

1. Varghese. P.C. (2007), **A Text Book Building Materials** , Prentice-Hall of India Pvt. Ltd., Publication.
2. Mohan Rai and M.P. Jain Singh (1986**), Advances in Building Materials and Construction,** CBRI Publication, Roorkee.
3. Neville A.M and Brooks J.J ,(1987), **Concrete Technology,** ELBS Edition, London
4. Gambhir M.L , (1995), **Concrete Technology,** Tata McGraw-Hill Publishing Company Limited, New Delhi.

**ENVIRONMENTAL CHEMISTRY - II**

**Sub Code : 10 EV 43** **IA Marks : 25**
**Hrs/ Week : 04** **Exam Hours : 03**
**Total Hrs. : 52** **Exam Marks : 100**

**PART – A**

**UNIT 1: Basic concepts from organic chemistry**

1.1 Aliphatic
1.2 Aromatic
1.3 Carbocyclic
1.4 Heterocyclic compounds

**6 Hours**

**UNIT 2: Basic properties of organic compounds**

2.1 Equations for estimation of Molecular Weight.
2.2 Molecular volume
2.3 Critical volume
2.4 Boiling and melting points
2.5 Density

**10 Hours**

**UNIT 3: Environmental characteristics of organic compounds**

3.1 Methods for calculation of saturation concentration
3.2 Solubility
3.3 Octanal / water distribution coefficient

**5 Hours**

**UNIT 4: Properties and applications of common organic compounds**

4.1 Ethyl benzene
4.2 Carbon tetra chloride
4.3 DDT.
4.4 BHC.
4.5 Aldehydes
4.6 Ketones

**5 Hours**

**PART – B**

**UNIT 5: Basic concepts of stability and reactivity of organic compounds**

5.1 Reaction mechanisms
5.2 Structure – Activity relationships.

**6 Hours**

**UNIT 6: Toxicity estimation from structure activity**

6.1 Toxic substances, Introduction
6.2 Principal physico – chemical components and analysis

**8 Hours**

**UNIT 7: Estimation of chemical loss rate**

7.1 Hydrolysis
7.2 Photolysis
7.3 Volatilization and decay
7.4 Half-life concept

**6 Hours**

**UNIT 8: Types of nuclear and radioactive waste**

8.1 Low level

8.2 Medium level
8.3 High level
8.4 Environmental effects of the above
**6 Hours**

**QUESTION PAPER PATTERN**
In the examination EIGHT full questions shall be set out of which the
students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEXT BOOKS**

1. Sawyer C.N., McCarty P.L. and Parkin G.F**(.,** 2003),.**Chemistry for Environmental Engineering and Science,** , 5th Edition, Tata McGraw Hill,
2. Morrison and Boyd., (1992), **Organic Chemistry,(**, 5th Edition, Eastern Economy Edition, Prentice Hall of India, New Delhi.


**REFERENCES**

1. Lymann W.J., Reehl W.F., and Rosenblatt D.H. (Eds.), **(**1982), **Handbook on Chemical Property Estimation Methods – Environmental Behaviour of Organic Compounds,** McGraw Hill, New York.
2. Verschueren K, (1983), **Handbook of Environmental Data on Organic Chemicals,** 2nd Ed. New York, NY: ***Van Nostrand*** Reinhold Co.
3. Tewari, Mehrotra and Vishnoi **, (**1980), **A Text Book of Organic Chemistry,** Vikas Publishing House Pvt. Ltd., New Delhi, India.
4. Bahl and Bahl, (2001), **Text Book of Organic Chemistry**,.16th Edn., S. Chand & Company Ltd., New Delhi.


**ELEMENTS OF ENVIRONMENTAL PROTECTION**

| | |
|---|---|
| **Sub Code : 10 EV 44** | **IA Marks : 25** |
| **Hrs/ Week : 04** | **Exam Hours : 03** |
| **Total Hrs. : 52** | **Exam Marks : 100** |

**PART – A**

**UNIT 1: Definition of Environment, Engineering and Environmental Engineering**
1.1 Environmental Systems
1.2 Environmental Ethics
1.3 Definition of Pollution and Contamination. Water, Air and Land Pollution
1.4 Engineering Activities and Environmental Control – Protection Environmental Legislation and Regulation
1.5 Role of Environmental Protection in India and Karnataka
**8 Hours**

**UNIT 2: Human Population**
2.1 Growth and Trend in Developed and Developing Countries in India.
2.2 Projection of Food and Resource Needs and Related Environmental Effects.
2.3 Environment and Human Health
2.4 Food Chain, Chemicals in Food
2.5 Hazardous Wastes
**6 Hours**

**UNIT 3:Quality Factors for Environmental Protection**

3.1 Epidemiology,
3.2 Water Resources – Human Needs,
3.3 Residential Wastewater Collection and Disposal,
3.4 Industrial Water Needs and Wastewater Generation.
3.5 Air and Noise Environment in Work Place and Community.
3.6 Occupational Hazards and their effects.

**6 Hours**

**UNIT 4:Vector Control**

4.1 Host-Vector Relationship
4.2 Mechanism of Transmission
4.3 Malaria and Filariasis Management
4.4 Rodents and their Control Measures
4.5 Guinea Worm Disease and Eradication
**8 Hours**

**PART – B**

**UNIT 5: Milk and Food Sanitation**

5.1 Milk-borne Diseases
5.2 Testing and Sanitation Measures.
5.3 Food Protection from Source to Use
5.4 Sanitizing Food Processing Equipment
5.5 Tests and Inspection for Food Protection
**6 Hours**

**UNIT 6: Ionizing Radiation and Control**

6.1 Origin
6.2 Emissions
6.3 Damage to Human Beings
6.4 Radiation Protection.
**5 Hours**

**UNIT 7:Environmental Sanitation**

7.1 Swimming Pool Sanitation
7.2 Institutional Sanitation – School and College
7.3 Health Centre and Hospital
7.4 Sanitation in Markets, Shopping Areas and Bus Stand
7.5 Fair and Festival Sanitation
**8 Hours**

**UNIT 8: Energy of Heat and Sound**

8.1 Effects on Human Body,
8.2 Changes
8.3 Developments.
**5 Hours**

**QUESTION PAPER PATTERN**

In the examination EIGHT full questions shall be set out of which the
students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEXT BOOKS**

1. Salvato J.A., (1982), **Environmental Engineering Sanitation,** 3rd edition, J. Wiley & sons, New York.
2. Masters Gilbert M, (2004), **Introduction to Environmental Engineering and Science,**

Pearson Education Limited.
3. Chanlett E.T., (1979), **Environmental Protection,** McGraw Hill Co., New York, NY
3.

**REFERENCES**

2 Turk J.,(1985), **Introduction to Environmental Studies** , 2nd Edition, Holt Saunders, International Edition.
3 Taylor Miller Jr., (1994), **Living in the Environment – Concepts,** Wordsworth, California,
4. Ehlers V.M.,and Steel E.W., (1972), **Municipal and Rural Sanitation**, McGraw Hill, New York.
6 Awata, **Environmental Sanitation**
7 Glynn Henry, J.n and Gary W. Heinke (1996), **Environmental Science and Egineering**Prentice Hall Publication.

**ENVIRONMENTAL FLUID MECHANICS-II**

**Sub Code : 10 EV 45** **IA Marks : 25**
**Hrs/ Week : 04** **Exam Hours : 03**
**Total Hrs. : 52** **Exam Marks : 100**

**PART – A**

**UNIT 1: FLOW IN OPEN CHANNELS**

1.1 Definition of open channels
1.2 classification
1.3 difference between pipe flow & open channel flow
1.4 types of flow, 1.5 Geometric properties of open channels
1.6 Uniform flow in open channels
1.7 Chezy's and Manning's formulae
1.8 Problems on uniform flow, Most economical open channels
1.9 Derivation of conditions for rectangle, triangle and trapezoidal sections, Problems on most economical sections, Most economical circular channels derivations and problems

**7 Hours**

**UNIT 2: FLOW IN OPEN CHANNELS**

2.1 Specific energy, definitions, specific energy curve, conditions for minimum specific energy and maximum discharge
2.2 Critical flow in rectangular channels, problems
2.3 Hydraulic jump in rectangular channels, derivations with Froude number concept, 2.4 Problems on Hydraulic Jump, venturi flume

**WATER HAMMER IN PIPES**

2.5 Definition, Equation for pressure rise due to gradual closure of valves
2.6 Equation for pressure due to sudden closure of valves in rigid & Elastic pipes, problems
2.7 Surge tanks, their functions & types

**7 Hours**

**UNIT 3: DIMENSIONAL ANALYSIS & MODEL SIMILITUDE**

3.1 Introduction to Dimensional Analysis, units & dimensions, table of Dimensions
3.2 Dimensional Homogeneity
3.3 Methods of Analysis (Raleigh's & Buckingham's method
3.4 Problems on Raleigh's & Buckingham's methods
3.5 Model Studies, Introduction, comparison with Dimensional Analysis
3.6 Similitude, Dimensionless parameters
3.7 Types of models
3.8 Froude's models theory & problems
3.9 Reynold's models,Theory problems, Scale effects

**6 Hours**

**UNIT 4: IMPACT OF JET ON FLAT VANES**

4.1 Introduction to Impulse – momentum equation and its applications
4.2 Force exerted by a jet on a fixed target, Derivations
4.3 Force exerted by a Jet on a moving target, Derivations

**6 Hours**

**PART – B**

**UNIT 5: IMPACT OF JET ON CURVED VANES** **Continued….**

5.1 Force exerted by a jet on a series of curved vanes
5.2 Concept of velocity triangles
5.3 Equation for work done & efficiency
5.4 Problems o force exerted by a Jet on a series of curved valves

**HYDRAULIC TURBINES (Impulse turbines)**

5.5 Introduction, Types and classifications
5.6 Pelton Wheel, theory, equation for work done and efficiency, design parameters
5.7 Problems on Pelton Wheel

**6 Hours**

**UNIT 6: HYDRAULIC TURBINES (Reaction turbines)**

6.1 Francis Turbine – Theory, equation for work done and efficiency, design parameters
6.2 Problems on Francis turbine
6.3 Kaplan turbine – Theory, equation for work done & efficiency, Design parameters
6.4 Problems on Kaplan turbine

**6 Hours**

**UNIT 7: HYDRAULIC TURBINES (Performance)**

6.5 Draft tubes: types, Equation for efficiency problems
6.6 Cavitations in turbines, Governing of turbines, Governing of turbines
6.7 Specific speed of a turbine, Equation for the specific speed, problems
6.8 Unit quantities of a turbine, definitions, equations and problems
6.9 Characteristics curves of a turbine, general layout of an hydroelectric plant

**7 Hours**

**UNIT 8: CENTRIFUGAL PUMPS**

8.1 Definition of pump, classification
8.2 Description & general principle of working, priming & methods
8.3 Work done & efficiencies of a centrifugal pump
8.4 Minimum starting speed

8.5 Cavitation in centrifugal pumps
8.6 Multistage pumps
8.7 Problems on Centrifugal pumps
**7 Hours**

**QUESTION PAPER PATTERN**

In the examination EIGHT full questions shall be set out of which the
students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEXT BOOKS**


1. Modi & Seth., (2002), **Hydraulics & Fluid Mechanics ,**Standard Book House, New Delhi
2. Raghunath. H M., (1987), **Fluid Mechanics & Machinery,**CBS Publishers & Distributors, Delhi
3. Bansal R.K., (2002), **Text Book on Fluid mechanics & Hydraulic Machines,** Laxmi publications Pvt. Ltd.
4. Mohanty A.K., (2009), **"Fluid Mechanics",** 2nd Edition, PHI Learning Pvt. Ltd., New Delhi


**REFERENCE BOOKS**


1. Gupta, S.C., (2006), **Fluid Mechanics and Hydraulic Machines,** Pearson Education, India
2. **Elementary Hydraulics'(2006),** 1st Edition, James F Cruise, Vijay P. Singh, Mohsan M. Sherif, CL Engineering Publisher.
3. Arora **K.R., (2005), Hydraulics & Fluid Mechanics,** Standard Book house, New Delhi.


## APPLIED ENGINEERING GEOLOGY

**Sub Code : 10 EV 46** **IA Marks : 25**
**Hrs/ Week : 04** **Exam Hours : 03**
**Total Hrs. : 52** **Exam Marks : 100**

**PART – A**

**UNIT 1**

**INTRODUCTION**

Geology and its importance in Civil Practices, – Internal structure of the earth and its Composition

**MINERALOGY**

Rock forming and economic minerals, - Physical properties of minerals, chemical composition and uses of the following minerals.

**Description of** Quartz varieties, Rock crystal, Rose quartz, Milky quartz, Amethyst, Agate, Flint, chert, chalcedony, jasper, bloodstone and opal.Feldspars: orthoclase, plagioclase & Mirocline,

**5 Hours**

**UNIT 2**

Mica group: Muscovite, Biotite.Amphibole Group: Hornblende, Pyroxene Group: Augite, Silicates: Olivine, serpentine, Asbestos, Kaoline,Talc, Garnete, Sulphites: Barite, Gypsum, Oxides: Corundum.Carbonate Group: Calcite, Dolomite, Magnesite., Ore- Minerals: Magnetite, Haematite, Limonite, Iron pyrite, Chalcopyrite, Pyrolusite, Chromite, Galena & Bauxite

**5 Hours**

**UNIT 3**

**PETROLOGY**

Introduction, Definition and Classification, – IGNEOUS ROCKS: Forms, Classifications, Textures, Descriptions and Engineering uses of Granite, Syenite, Dionite, Gabbro, Dunite, Porphyries, Pegmatite, Dolerite, Basalt, Rhyolite, and Pumice – SEDIMENTARY ROCKS: Definition Classification, Primary structures. Description and engineering uses of Sandstones, Limestones, shale, Conglomerate, Breccia, & Laterite. – METAMORPHIC ROCKS: Definition kinds of Metamorphism, Description and Engineering uses of Gneiss, Quartzite, Marble, Slate, Phyllite, Schists, and Charnokite.

**8 Hours**

**UNIT 4**

**GEOMORPHOLOGY AND GEODYNAMICS**:

Epigine and Hypogene geological agents, weathering of Rocks and its, Soil and Soil Profile, Classification, Erosion, Conservation, Marine Geology Geological actions of Rivers & wind – Land slides - Causes and Remedial measures, – Earth Quakes - Causes and effects, Concept of Plate tectonics, Engineering consideration and Seismic resistant structures.

**7 Hours**

**PART – B**

**UNIT 5**

**STRUCTURAL GEOLOGY**

Definition – Outcrops, Dip and strike, Compass clinometer. – Description of Folds, Faults, Joints, Unconformities and their recognition in field and Considerations in Civil engineering Projects.

**6 Hours**

**UNIT 6**

**GEOLOGICAL SITE INVESTIGATION**

Selection of sites for Dams and Reservoir, Silting up of Reservoirs and remedies.s – Selection of sites for Tunnels, – Selection of sites for Bridges and Highways. – Rocks as a materials for Construction as Foundation, Decorative, Flooring and Roofing, Concrete, Aggregate, Road Metal, Railway Ballast with examples.

**8 Hours**

**UNIT 7**

**GROUND WATER GEOLOGY**

Hydrological cycle, water Bearing Properties of Rocks and Soils. Aquifer and its types, – Geological and Geophysical methods of Ground water Exploration. – Electrical Resistivity method. Seismic method. Interpretation of resistivity curves for ground water studies and Civil Engineering Works, – Selection of Well sites, Artificial Recharge of Ground Water by different method

**7 Hours**

**UNIT 8**

**GEOMATICS AND ENVIRONMENTAL GEOLOGY**

Application of Remote Sensing and GIS Techniques in Civil Engineering Projects. – GPS (Global Positioning System) and its uses, – Study of Toposheets – Impact of Mining, Quarrying and Reservoirs on Environment

**6 Hours**

**QUESTION PAPER PATTERN**

In the examination EIGHT full questions shall be set out of which the students shall answer FIVE full questions, selecting atleast TWO questions from each Part

**TEXT BOOKS**


1. Blyth F. G. H and M.H. De Freitas **A Geology for Engineers,(1984)** (7th Edition) by, Elsevier Science Pub., New York.
2. **A Text Book of Geology,(1998),** P.K. Mukerjee, World Press Pvt., Ltd.,Calcutta.
3. **Engineering and General Geology, (1987),** Parbin Singh, Katson Publishing House, Ludhiana


**REFERENCE BOOKS**


1. **Engineering Geology for Civil Engineers, (1995),** D. Venkat Reddy, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2.. **Principles of Petrology, (1963)** by G.W. Tyrrell, Asia Publishing House -Bombay
3.. Ravi P. Gupta, (2003**), Remote Sensing Geology)**, Springer Verlag New York.
4. Billings M.P. (1972), **Structural Geology, 3rd Edition,** Prentice-Hall, NJ

5**. Physical Geology,(1978)** by Arthur Holmes, Wiley Publisher
6.. Valdiya K.S **, (2004),Environmental Geology,** Universities Press
7. Wlathom T, (2009), **Foundations of Engineering Geology**, Universitites Press

**ENVIRONMENTAL ANALYSIS LABORATORY – II**

**Sub Code : 10 EVL 47** **IA Marks : 25**
**Hrs/ Week : 03** **Exam Hours : 03**
**Total Hrs. : 42** **Exam Marks : 50**

Analysis of Water and Wastewater Samples
Laboratory layout and equipment. Safety precautions.
1. Determination of Colour and Turbidity.
2. Determination of Solids – suspended, dissolved, inorganic, volatile and total.
3. Alakalinity, Acidity, pH.
4. Determination of Chloride and Conductivity.
5. Hardness – Total, permanent and temporary, Ca and Mg hardness.
6. Estimation of Manganese.
7. Determination of Fluoride.
8. Ammonia, Nitrite, Nitrate and Total Kjeldahl Nitrogen.
9. Determination of Sulphate.
10.Determination of Phosphorous.

**REFERENCE BOOKS:**

1. American Water Works Association, (2001), "**Standard Methods for Examination of Water and Wastewater**", 20th Edition.
2.Sawyer, C.N., Mc Carty, P.L., and Parkin, G.F., (2003), "**Chemistry for Environmental Engineering and Science**", V Edn., Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. **I.S. Codes –** 2490 (1974), 3306 (1974), 3307 (1976), 10,500 (1990).
4. **Manual on Water and Wastewater Analysis,** NEERI, Nehru Marg, Nagpur.
5. Kotaiah, B., **Examination of water and wastewater manual.**

**ENVIRONMENTAL HYDRAULICS LABORATORY**

**Sub Code : 10 EVL 48** **IA Marks : 25**
**Hrs/ Week : 03** **Exam Hours : 03**
**Total Hrs. : 42** **Exam Marks : 50**

1. Experiments on Orifices and Mouthpieces: Determination of hydraulic coefficient of circular orifice and internal and external mouth pieces –
2. Determination of co-efficient of discharge of submerged orifice.
3. Calibration of Notches: Rectangular, triangular and Cippoletti notches.
4. Calibration of Weirs: Broad crested weir and ogee weir.
5. Calibration of venturi meter and orifice meter.
6. Friction in pipes.
7. Experiments on venturi flume.
8. Determination of minor losses in pipes due to sudden expansion, sudden contraction, bends and elbows.
9. Impact of jet on vanes (flat, conical and hemispherical)
10. Test on centrifugal pumps: Single stage and multi stage centrifugal pumps.
11. Demonstration of: (1) flow visualization apparatus and (2) Apparatus for verification of Bernoulli's equation
12. Demonstration of pitot tube and current meters, turbines

**REFERENCES:**


1. **Relavent I.S. Codes**.
2. **"Hydraulics and Fluid Mechanics",(2002),** Modi P.N., and Seth S.M., Standard Book House, New Delhi.
3. **"Hydraulics"**, Jagadish Lal, Metropolitan Book Company Pvt. Ltd., New Delhi.
4. **"Engineering Fluid Mechanics",(1995),** Kumar K.L., - Eurasia Publishing House Pvt. Ltd., New Delhi.


**V SEMESTER**
**MUNICIPAL SOLID WASTE MANAGEMENT**

Subject Code : **10 EV 51** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

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**PART - A**

**UNIT - 1**

**INTRODUCTION:** Definition, Sources – household, street, demolition, construction. Composition and Properties of Municipal Solid Wastes.
Legislation and its impact.

**4 Hours**

**UNIT - 2**

**ENGINEERING PRINCIPLES:** Generation rates, Collection, waste handling and separation, storage and processing at the source.

**6 Hours**

**UNIT - 3**

**COLLECTION, TRANSFER AND TRANSPORTATION:** Types, equipment, personnel requirements, analysis & collection system, collection routes, types of transfer stations, transport means and methods, location of transfer stations.

**8 Hours**

**UNIT - 4**

**DISPOSAL:** Dumping, Landfill - classifications, Siting Considerations, Generation, movement and control of gases and leachates, layout and preliminary design of landfills, closure and rehabilitation of landfills.

**6 Hours**

**PART - B**

**UNIT - 5**

**SEPARATION, TRANSFORMATION AND RECYCLING:** Unit operations for separation and processing, size reduction, separation, density separation, fundamentals of thermal processing – combustion, pyrolysis, gasification, energy recovery system.

**8 Hours**

**UNIT - 6**

**BIOLOGICAL AND CHEMICAL CONVERSION TECHNOLOGIES:** Principles, Aerobic &, anaerobic composting and energy recovery.

**6 Hours**

**UNIT - 7**

**INCINERATION:** Process, Types, Heat Recovery, Incineration Products, Design of Incinerators, Air Pollution Control.

**6 Hours**

**UNIT - 8**

**PLANNING, SITING AND WASTES MANAGEMENT FACILITIES:** Screening, Planning and developing a site for solid waste management. Separation of wastes – benefits, reuse and recycle material recovery.

**8 Hours**

**REFERENCES**

1. George Tchobanaglous, Hilary Theissen and Samuel A. Vigil, (1993), **Integrated Solid Waste Management: Engineering Principles and Management Issues** –, McGraw-Hill Science Engineering.

2. Bhide and Sundaresan (1983), **Solid Waste Management in Developing Countries,** Indian National Scientific Documentation Centre. New Delhi.

3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986),**Environmental Engineering,** McGraw Hill Publishing company, New York.

4. Sincero, A.P., and Sincero, G.A., (1999), **Environmental Engineering – A Design Approach,** Prentice- Hall of India Pvt. Ltd., New Delhi.

5. Sasikumar K and Krishna S. G., (2009), **Solid Waste Management**, PHI Learning Pvt. Ltd., New Delhi.

6. CPHEEO (2000),"**Manual on Municipal Solid Waste Management**", Central Public Health and Environmental Engineering Organisation, Ministry of Urban Development, New Delhi.

## ORIGIN AND CHARACTERIZATION OF ENVIRONMENTAL POLLUTION

Subject Code : **10 EV 52** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

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### PART - A

**UNIT - 1**

**INTRODUCTION:** Sources of Pollution, Point and non-point, natural and man made sources. Methodology for Characterization of Pollutants: Concept of Flow Sheets, Grab and Composite Sampling, Flow Measurement and Concentration of Pollutants.

**6 Hours**

**UNIT - 2**

Mass balance approach, Pollutant load calculation, methods of estimating unit loadings from point and Non- point sources. Statistical Analysis of data for Mean and Standard Deviation, significance tests – chi-squared,'t' & 'f'tests

**6 Hours**

**UNIT - 3**

**CHARACTERIZATION OF AIR POLLUTANTS:** Construction Activities, Automobile Emissions, Mining and Industries (Steel, Cement and Thermal Power Plant)

**6 Hours**

**UNIT - 4**

**CHARACTERIZATION OF NOISE POLLUTION:** Units of Measurement, Measuring Instruments, Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise– General Control Measures.

**6 Hours**

### PART - B

**UNIT - 5**

**CHARACTERIZATION OF WATER POLLUTANTS:** Domestic Wastewater, Thermal and Nuclear power plants, radioactive wastes, Mining and Industrial Units, (Pulp and paper, Pharmaceutical, Distillery, Food Processing, Fertilizer, Tannery, Chloralkali and small scale Industries).

**8 Hours**

**UNIT - 6**

**CHARACTERIZATION OF SOLID WASTES:** Domestic, Commercial and Industrial sources, Chemical Manufacturing, Food processing, Small Scale Industries and Biomedical Wastes.

**6 Hours**

**UNIT - 7**

**SUBSURFACE SOURCES OF POLLUTION:** Soak Pits, Septic Tanks, Low Cost Sanitation Units, Underground Oil Storage Tanks, Municipal Solid Waste Dumps. Nuclear and radioactive waste sources and characterization.

**8 Hours**

**UNIT - 8**

Characteristics of Pollutants from water and Wastewater Treatment Plants, and Air Pollutants Recovered from Pollution Control Units. (eg. Bag Filters, Cyclones, Scrubbers, Precipitators etc.)

**6 Hours**

**REFERENCES**


1. Metcalf and Eddy, (2003), **Wastewater Engineering, Treatment and Reuse**, 4th Edition, Tata McGraw Hill Edition, Tata McGraw Hill Publishing Co. Ltd.

2. Novotny V., and Chester G., (1981), **Handbook of Non-point Pollution Sources and Management,** Van Nostrand Reinhold Co. NY

3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986),**Environmental Engineering**, Mc Graw Hill Book Co.

4. Sincero, A.P., and Sincero, G.A., (1999),**Environmental Engineering – A Design Approach,** Prentice Hall of India Pvt. Ltd., New Delhi.

5. Noel De Nevers, (2000), **Air Pollution Control Engineering,** McGraw Hill International Editions, Civil Engineering Series

6. Wark K., Warner C.F., and Davis. W.T., (1998), **Air Pollution, Its Origin and Control,** 3rd Edition Addison Wesley Longman, Inc., USA.

7. Todd D.K. , (2006), **Ground Water Hydrology**, 2nd Edition, John Wiley Publishers.

8. Patwardhan A.D., (2009), **Industrial Wastewater Treatment**, PHI Learning Pvt. Ltd., New Delhi.

9. Nathanson J.A., (2009), **Basic Environmental Technology**, PHI Learning Pvt. Ltd., New Delhi.

10. Sawyer G.N., McCarty, P.L. and Parkin, G.F., (2003), **Chemistry for Environmental Engineers**, 5th Edition, Tata McGraw Hill,

**HYDRAULICS OF WATER SUPPLY SYSTEM**

Subject Code : **10 EV 53** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

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**PART - A**

**UNIT - 1**

**INTRODUCTION:** Necessity of Water Supply Schemes, Historical Development, Hydrologic Cycle, Surface and Groundwater Sources, Global Water Resources. Drinking and Industrial Water Quality Standards.

**6 Hours**

**UNIT - 2**

**WATER DEMAND:** Various uses and methods of estimation of demand, Forecasting of Population, Fluctuation in Demand, factors affecting fluctuation in demand, Total Demand of Water based on Population – rural and urban.

**8 Hours**

**UNIT - 3**

**COLLECTION AND CONVEYANCE:** Types of Intakes, Conveyance of Water, Pipes, Joints, etc., Selection of Materials. Basic design principles of conduits, types of reservoirs, Pump and Pumping Station, Classification, Selection, Centrifugal, Reciprocating and Submersible, Jet Pumps, Head- Discharge Characteristics, Pumps in Series and Parallel Operation.

**9 Hours**

**UNIT - 4**

**HYDRAULICS OF FLOW THROUGH CONDUITS:** Inter connection of Parallel Pipes, Raising Main Economics, Hydraulic Transients. Water hammer analysis and its preventive measures.

**5 Hours**

**PART - B**

**UNIT - 5**

**PIPE LINES:** Pipeline Friction, Hazen William Equation and Modified Form. Manning's Equation, Cole Brook - White equation, Cathodic Protection, Thawing of Frozen Pipes.

**4 Hours**

**UNIT - 6**

**DESIGN ASPECTS OF PIPE NETWORKS:** Hardy-Cross and Newton- Raphson methods, including Computer Programmes – LOOP, Branch and WADISO.

**8 Hours**

**UNIT - 7**

**PLUMBING AND OPERATION:** Laying of waterlines, Maintenance and testing of water supply schemes, Control of operation, leak detection, water conservation, Preventive Maintenance.

**6 Hours**

**UNIT - 8**

**RURAL WATER SUPPLY SYSTEM:** Necessity, Types of supply for individual, community and Regional Schemes. Rainwater harvesting, minor tanks, subsurface sources.

**6 Hours**

**REFERENCES**

1. Hammer, M.J.,and Hammer M.J., Jr. (2008), **Water and Wastewater Technology,** SI Version, 6th Edition, John Wiley and Sons.

2. McGhee T.J., (1991), **Water Supply and Sewerage**, McGraw Hill International Editions, Civil Engineering Series.

2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering,** McGraw Hill Book Co.

3. Raju, B.S.N., (1995), **Water Supply and Wastewater Engineering,** Tata McGraw Hill Pvt. Ltd., New Delhi.

4. Sincero, A.P., and Sincero, G.A., (1999), **Environmental Engineering – A Design Approach,** Prentice Hall of India Pvt. Ltd., New Delhi.

5. Steel, E.W., and McGhee, T.J., (1979), **Water Supply and Sewerage,** 5th Edition, McGraw Hill, New York.

6. Modi R. N. and Seth. H.N., (2003),**Hydraulics and Hydraulic Machinery**, McGraw Hill Book Co.

7. Nathanson J.A., (2009), **Basic Environmental Technology** : **Water Supply, Waste Management and Pollution Control**, PHI Learning Pvt. Ltd., New Delhi.

## ENVIRONMENTAL GEOTECHNOLOGY

Subject Code : **10 EV 54** IA Marks : 25
No of Lecture Hours/ Week : 04 Exam Hours : 03
Total No of Lecture Hours : 52 Exam Marks : 100

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### PART - A

**UNIT -1**

**INTRODUCTION:** History of soil mechanics, Definition, origin and formation of soil. Phase Diagram, Void ratio, Porosity, Percentage Air Voids, Air content, Degree of saturation, Water content, Specific gravity, Bulk density, Dry density, Saturated density, Submerged density and their inter relationships.

**6 Hours**

**UNIT - 2**

**INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION:**

Index Properties of soils- Water content, Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, insitu density, Activity of Clay, Laboratory methods of determination of index properties of soils: Water content, Specific gravity, Particle size

distribution (Seive analysis and Hydrometer analysis only), Liquid Limit- Casagrande and cone penetration methods, Plastic limit and shrinkage limit determination.

**7 Hours**

**UNIT - 3**

**CLASSIFICATION OF SOILS:** Purpose of soil classification, basis for soil classification, Particle size classification IS classification, Plasticity chart and its importance, Field identification of soils.

**CLAY MIERALOGY AND SOIL STUCTURE:** Single grained, honey combed, flocculent and dispersed structures, Valence bonds Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphus substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite.

**8 Hours**

**UNIT - 4**

**FLOW OF WATER THROUGH SOILS:** Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, quick sand phenomenon, Capillary Phenomenon**.**

**7 Hours**

**PART - B**

**UNIT - 5**

**COMPACTION OF SOILS**: Definition, Principle of compaction, Standard and Modified Proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control, Proctor needle, Compacting equipment.

**6 Hours**

**UNIT - 6**

**CONSOLIDATION OF SOILS:** Definition, Mass-spring analogy, Normally consolidated, under consolidated and over - consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (Compression Index and Coefficient of Consolidation) and their determination in laboratory.

**6 Hours**

**UNIT - 7**

**SHEAR STRENGTH OF SOILS:** Concept of shear strength, Mohr-Coulomb theory, Concept of pore pressure, factors affecting shear strength of soils, Sensitivity and Thixotropy of clay. Determination of shear strength in laboratory and field (Direct shear test, Unconfined compression test, Triaxial compression test and Vane shear test)-

**5 Hours**

**UNIT - 8**

**Geotextiles & their applications**

Forms of Geotextile and their uses, Desirable properties of Geotextiles, Natural and synthetic geotextiles, Geotextiles as filter and drain, Geotextiles for landfills.

**7 Hours**

**REFERENCES**

1. Punmia B.C. (2005), **Soil Mechanics and Foundation Engineering,** 16th Edition, Laxmi Publications Co. New Delhi.

2.Sivakumar Babu G.L., (2006), **An Introduction to Soil Reinforcement and Geosynthetics**, Universities Press (India) Private Limited, Hyderabad.

3. Das, B. M. (2002), **Principles of Geotechnical Engineering,** Fifth Edition, Thomson Business Information India (P) Ltd., India.

4. Alam Singh and Chowdhary G.R. (1994), **Soil Engineering in Theory and Practice,** CBS Publishers and Distributors Ltd., New Delhi.

5. Murthy V.N.S. (1996), **Soil Mechanics and Foundation Engineering,** 4th Edition, UBS Publishers and Distributors, New Delhi.

6. Gopal Ranjan and Rao A.S.R. (2000), **Basic and Applied Soil Mechanics,** New Age International (P) Ltd., New Delhi.

7. Narasimha Rao A. V. and Venkaratarmaiah. C.(2000), **Geotechnical Engineering**, Universities Press

8. Craig R.F. (1983), **Soil Mechanics,** Van Nostrand Reinhold Co. Ltd.

9.. Khan I. H. (2005), **Text Book of Geotechnical Engineering,** 2nd Edition, Prentice-hall Of India Pvt Ltd, India.

## HYDROLOGY AND WATER RESOURCES ENGINEERING

Subject Code : **10 EV 55** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

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### PART - A

**UNIT - 1**

**INTRODUCTION:** Definition of hydrology. Importance of hydrology. Global water availability. India's water availability. Practical applications of hydrology. Hydrologic cycle (Horton's qualitative and engineering representations)

**2 Hours**

**PRECIPITATION**

Definition. Forms and types of precipitation. Measurement of rain fall using Symon's and Syphon type of rain gauges. Optimum number of rain gauge stations. Consistency of rainfall data (double mass curve method). Computation of mean rainfall (arithmetic average, Thiessen's polygon and Isohyetal methods). Estimation of missing rainfall data (Arithmetic average, normal ratio and regression methods). Presentation of precipitation data (moving average curve, mass curve, rainfall hyetographs, intensity – duration - frequency curves).

**7 Hours**

**UNIT - 2**

**LOSSES FROM PRECIPITATION**

INTRODUCTION. EVAPORATION**:** Definition, Process, factors affecting, measurement using IS Class A Pan. Estimation using empirical formulae.

INFILTRATION : Definition, factors affecting infiltration capacity, measurement (double ring infiltrometer). Harton's infiltration equation, infiltration indices.

**7 Hours**

**UNIT - 3**

**RUNOFF**

Definition. Concept of catchment. Water budget equation. Components. Factors affecting. Rainfall - runoff relationship using simple regression analysis.

**3 Hours**

**HYDROGRAPHS**

Definition. Components of Hydrograph. Unit hydrograph and its derivation from simple storm hydrographs. Base flow separation. S – curve and its uses.

**4 Hours**

**UNIT - 4**

**GROUND WATER HYDROLOGY AND WELL HYDRAULICS**

Scope and importance of ground water hydrology. Aquifer parameters. Steady radial flow into wells in unconfined and confined aquifers. Types of wells, Methods of construction.

**6 Hours**

**PART - B**

**UNIT - 5**

**STREAM FLOW MEASUREMENT:** Introduction. Measurement of stage. Measurement of discharge by Area – Velocity method and slope area
method. Simple stage discharge relation.

**6 Hours**

**UNIT - 6**

**RESERVOIR SEDIMENTATION:** Introduction. Process of erosion. Factors affecting erosion. Sediment yield. Reservoir Sediment control. Determination of Sediment Yield at a reservoir site (Using sample recorder).

**6 Hours**

**UNIT - 7**

**WATER RESOURCES:** Introduction. Water wealth. River basins and their potential. Importance of water resources projects in India. Water resources development in Karnataka.

**6 Hours**

**UNIT - 8**

**RAINWATER HARVESTING:** Introduction. Small scale and small tank harvesting. Urban rainwater harvesting. Methods of ground water recharge.

**5 Hours**

**REFERENCES**

1. Subramanya K, (2008), **Engineering Hydrology** Tata McGraw Hill, New Delhi.

2. Jaya Rami Reddy,(1988) **A Text Book of Hydrology**,Laxmi Publications, New Delhi.

3. H.M. Raghunath ,(1985), **Hydrology-Principle analysis and design**, Wiley Eastern Publication, New Delhi.

4. Ven Te Chow, Larry W. Mays, David R. Maidment, (1988), **Hand Book of Hydrology,** McGraw Hill.

5. R.K. Sharma and Sharma (1969), **Hydrology and Water Resources Engineering** –, Oxford and IBH, New Delhi.

6. Linsley, Kohler and Paulhus, (1949), **Applied Hydrology**. McGraw-hill, New York.

7. Todd D.K., (2006), **Ground Water Hydrology, 2nd Edition,** John Wiley India, New Delhi.

## WATER TREATMENT TECHNOLOGY

Subject Code : **10 EV 56** IA Marks : 25
No of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

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### PART - A

**UNIT - 1**

**INTRODUCTION:** Necessity of Water Treatment Units. Classification of Treatment Systems. Typical Flow sheets for Rural and Urban Water Treatment Systems and their distinguishing features.

**6 Hours**

**UNIT - 2**

**PHYSICAL, CHEMICAL AND BACTERIOLOGICAL**

**QUALITY OF WATER:** Surface and Ground Water Sources, Water Quality Standards for various uses. Raw water quality impacts on treatment.

**4 Hours**

**UNIT - 3**

**AERATION:** Gas Transfer theory, Factors Governing Aeration System. Types of Aeration Units, Design Criteria.

**SEDIMENTATION:** Types of Settling, Newton's and Stoke's equations, short circuiting and dispersion pattern, Design criteria for sedimentation tank, Tube and Plate Settlers.

**8 Hours**

**UNIT - 4**

**COAGULATION AND FLOCCULATION:** Stability and Destabilisation of Colloids, Coagulation Theory, Types of Flocculators and their Design Aspects.

**8 Hours**

**PART - B**

**UNIT - 5**

**FILTRATION:** Hydraulics of Flow through Porous Media, types of filters, theory of filtration, Rate Control Pattern, Slow and Rapid Sand Filtration, Pressure Filter, Design Aspects, backwashing of filters.

**8 Hours**

**UNIT - 6**

**HARDNESS REMOVAL:** Types, Ions causing hardness, Lime Soda Treatment, Ion Exchange Process and Zeolite process, problems associated with hardness.

**4 Hours**

**UNIT - 7**

**DISINFECTION PROCESS:** Mode of Disinfection, Rate of Disinfection, Factors affecting Processes, Chemical and Non-chemical Methods of Disinfection. Fluoridation and Defluoridation, Desalinization.

**6 Hours**

**UNIT - 8**

**CORROSION AND CORROSION CONTROL PROCESS:** Electro Chemical and Thermodynamic Methods of Corrosion Control. Langmuir Index, Wastes from Water Treatment Units - Treatment, Reuse and Recycle, Disposal, Operation and Maintenance of Water Treatment System. Water Reuse options.

**8 Hours**

**REFERENCES**


1. Fair G.M., Geyer H.C., and Okun D.A., (1968), **Water and Wastewater Engineering** –Vol. I & II, John Wiley and Sons.

2. Hammer, M.J and Hammer M. J., Jr. (2009), **Water and Wastewater Technology** –SI Version, 6th Edition, PHI Learning Pvt. Ltd., New Delhi.

3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering,** Mc Graw Hill Book Co.

4. Raju, B.S.N., (1995), **Water Supply and Wastewater Engineering** Tata McGraw Hill Pvt. Ltd., New Delhi.

5. Sincero, A.P., and Sincero, G.A., (1996), **Environmental Engineering – A Design Approach** – Prentice Hall of India Pvt. Ltd., New Delhi.

6. Steel, E.W., and Mc Ghee, T.J., (1979), **Water Supply and Sewerage** –5th Edition, International Student Edition, Mc Graw Hill Kogakusha Ltd.

7. Weber W.J., Junior, (1972), **Physico-Chemical Processes for Water Quality Control,** John Wiley and Sons.

## COMPUTER AIDED DESIGN AND DRAWING OF ENVIRONMENTAL SYSTEMS – I

Subject Code : **10 EVR 57** IA Marks : 25
No of Lecture Hours/ Week : 03 Exam Hours : 03
Total No. of Lecture Hours : 42 Exam Marks : 50

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**PART - A**

Layout of Typical Water Supply System

Design and Drawing of Hydraulic Profile for Water Treatment Unit.

Design and Drawing of Canal, River and Reservoir Intakes.

Drawing of Bore Well / Infiltration Well for Rural Areas.

Design and Drawing of Distribution Systems for simple network.

Design and Drawing of Ground Level Service Reservoir, Overhead Tank and Underground Clear Water Sump.

**PART - B**

Design and Drawing of Cascade Aeration Unit.

Design and Drawing of Flocculator and Sedimentation Units (Circular and Rectangular)

Plan and Sectional Elevation, Clariflocculator.

Design and Drawing of Rapid Sand Filters (Plan and Section).

Design and Drawing of Defluoridation & Softening Units.

Layout showing hydrants, valves, bends and chlorination point in water treatment plant.

**REFERENCES**


1. **Water Treatment Plant Design** – ASCE, (1995).

2. Clark, Viessman and Hammer, (1992),**Water Supply and Pollution Control** Harper Collins.

3. Fair, Geyer, and Okun, (1968),**Water & Wastewater Engineering,** Vol. I & II, John Wiley and Sons.

4. Quasim, S.R., (1985),**Wastewater Treatment Plants – Planning, Design and Operation , H**olt Rinehart and Winston, CBS College Publishing.
5. Schutlz R.C., (1984), **Water Supply in Developing Countries**, Wiley Publications.

6. CPHEEO (1999),"**Manual on Water Supply and Treatment**", Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, New Delhi.

## ENVIRONMENTAL PROCESS LABORATORY-I

Subject Code : **10 EVL 58** IA Marks : 25
No. of Practical Hours/Week : 03 Exam Hours : 03
Total No. of Practical Hours 42 Exam Marks : 50

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Introduction to Process Laboratory, equipment and their applications. Sampling (Grab, Composite and Integrated) and Flow Measurements.

Aeration for Iron Removal.

Batch Experimental Studies on Colour Removal.

Determination of Dissolved Oxygen.

Experimental Studies on Water Softening Process.

Experimental Studies on Coagulation.

Experimental Studies on Flocculation and Sedimentation Processes. (Jar Test, Column Test, Pebble Bed Flocculator)

Experimental Studies on Disinfection Process.

a. Chlorine Demand
b. Available Chlorine in Bleaching Powder.
c. Residual Chlorine in Water.

Grain Size Analysis: Effective Size and Uniformity Co-efficient.

Filtration – Single Media and Dual Media Filters.

Experiments on Household Level Water Treatment Units. – Reverse Osmosis, Aqua Guard, Membrane Filtration, etc.,

**REFERENCES**

1. **Standrd Methods for Examination of Water and Wastewater: 1998**, 20th edition Published by AWWA.

2. Sawyer G.N., McCarty, P.L. and Parkin, G.F., (2003), **Chemistry for Environmental Engineers**, 5th Edition, Tata McGraw Hill,

3. **Lab Manual** – Published by NEERI, Nagapur.

4. Clark, Viessman and Bisset, ( ), **Water Supply, Treatment and Distribution**.

## VI SEMESTER

## MANAGEMENT & ENTREPRENEURSHIP

Subject Code : **10AL61** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### MANAGEMENT

**UNIT - 1**

**MANAGEMENT:** Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management – Management as a science, art or profession – Management & Administration – Roles of Management, Levels of Management, Development of Management Thought – early management approaches – Modern management approaches.

**7 Hours**

**UNIT - 2**

**PLANNING:** Nature, importance and purpose of planning process - objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans.

**6 Hours**

**UNIT - 3**

**ORGANIZING AND STAFFING:** Nature and purpose of organization – principles of organization – Types of organization – Departmentation – Committees – Centralisation Vs Decentralisation of authority and responsibility – Span of control – MBO and MBE (Meaning only) Nature and importance of Staffing – Process of Selection & Recruitment (in brief).

**6 Hours**

**UNIT - 4**

**DIRECTING & CONTROLLING:** Meaning and nature of directing – Leadership styles, Motivation Theories, Communication – Meaning and importance – Coordination, meaning and importance and Techniques of Co-ordination. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief).

**7 Hours**

**PART - B**

**ENTREPRENEURSHIP**

**UNIT - 5**

**ENTREPRENEUR:** Meaning of Entrepreneur, Evolution of Concept, Functions of Entrepreneur, Types of Entrepreneur, Entrepreneur – An emerging class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship, Stages in entrepreneurial process, Role of Entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

**7 Hours**

**UNIT - 6**

**SMALL SCALE INDUSTRY**: Definition; Characteristics; Need and rationale: Objectives, Scope, role of SSI in Economic Development. Advantages of SSI. Steps to start an SSI – Government policy towards SSI, Different Policies of SSI., Government Support on SSI., during 5 year plans. Impact of Liberalization, Privatisation, Globalization on SSI. Effect of WTO / GATT Supporting Agencies of Government for SSI Meaning. Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only).

**7 Hours**

**UNIT - 7**

**INSTITUTIONAL SUPPORT**: Different Schemes, TECKSOK, KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI, NSIC, SIDBI, KSFC.

**6 Hours**

**UNIT - 8**

**PREPARATION OF PROJECT:** Meaning of Project, Project Identification, Project Selection, Project Report, Need and significance of Project, Contents, formulation, Guidelines by Planning Commission for Project Report, Network Analysis, Errors of Project Report, Project Appraisal. Identification of Business Opportunities. Market Feasibility Study: Technical Feasibility Study, Financial Feasibility Study & Social Feasibility Study.

**6 Hours**

**TEXT BOOKS:**


1. **Principles of Management** – P.C. Tripathi, P.N. Reddy, 4th Edition, Tata McGraw Hill, New Delhi.
2. **Dynamics of Entrepreneurial Development & Management** – Vasant Desai – Himalaya Publishing House
3. **Entrepreneurship Development** – Small Business Enterprises – Poornima M. Charantimath – Pearson Education – 2006.


**REFERENCE BOOKS:**


1. **Management Fundamentals** – Concepts, Application, Skill Development – Robert Lusier – Thomson.
2. **Entrepreneurship Development** – SS Khanka – S Chand & Co.
3. **Management** – Stephen Robbins – Pearson Education / PHI – 17th Edition, 2003.
4. **Management & Entrepreneurship** by N V R Naidu & T Krishna Rao – I K International Publishing House Pvt. Ltd. 1st edition

## ENVIRONMENTAL TRANSPORT PROCESSES

Subject Code : **10EV62** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**INTRODUCTION:** Different transport mechanisms. Process Dynamics: Transport and Reaction Process, Material Balance Relationships, Kinetic Approach to Equilibrium. Factors Affecting Equilibrium Concentration and Temperature Effects.

**8 Hours**

**UNIT - 2**

**MECHANICS OF MASS TRANSPORT:** Diffusive Mass Transport & Convective Mass Transport in Molecular and Turbulent Flow Regimes (without proof). Combined Convective-Diffusion Equation for 1, 2 & 3 Dimensions. Analytical Solutions for 1-D & 2-D Cases & Simple Problems for Instantaneous Cases.

**8 Hours**

**UNIT - 3**

**CHEMICAL THERMODYNAMICS:** Free Energy Formation, Entropy Formation, Non-identity correction, Ionic Strength Considerations, Theoretical Equations for the Active Co- efficients, Effect of Ionic Strength on the Value of Equilibrium Constant, Simultaneous Reactions.

**10 Hours**

**UNIT - 4**

**FUNDAMENTALS OF PROCESS KINETICS:** Mass Law Relationships, Reaction Orders, Limitations of Mass Law Relationships, Application of First Order Reaction, Parallel, Reversible and Enzyme reactions.

**8 Hours**

### PART - B

**UNIT - 5**

Gas Absorption and Adsorption – Two film theory, Ion Exchange, Electro dialysis.

**4 Hours**

**UNIT - 6**

Membrane Filters and Ultra filtration Process.

**4 Hours**

**UNIT - 7**

**GROUNDWATER QUALITY:** Basic differential equations with analytical solutions for 1-D and 2-D for instantaneous cases.

**4 Hours**

**UNIT - 8**

**DESCRIPTION OF WATER QUALITY PROCESSES IN NATURAL**
**WATER BODIES:** Lake, River, Estuary and Oceans.

**6 Hours**

**REFERENCES**

1. Benefield, L.D., Judkins (Jr) J.F., and Weand B.L.(1985), **Process Chemistry for Water and Wastewater Treatment** .

2. Freeze R.A. and Cherry, J.A., (1979), **Groundwater** Prentice Hall, New Jersey.

3. Rich, L.G., (1973), **Environmental Systems Engineering** –Mc Graw Hill.

4. Thomann & Mueller, (1987), **Principles of Water Quality Modelling and Control** – Harper & Row.Publishers.

5. Treybul, R.E., (1960), **Mass Transfer Operation** –McGraw Hill, Kogakusha.
6. Weber, W.J., (1972), **Physico - Chemical processes for Water Quality,** John Wiley & Sons.

## ATMOSPHERIC ENVIRONMENTAL ENGINEERING

Subject Code : **10EV63** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**INTRODUCTION**: Definitions and terminologies, atmospheric structure and composition, scales of air pollution problem - local, urban, regional, continental and global. Air pollution episodes- Bhopal Gas Tragedy, Los Angeles and London smog.

**6 Hours**

**UNIT - 2**

**SOURCES AND CLASSIFICATION OF AIR POLLUTANTS:** Natural and anthropogenic, emission inventory, source classification, primary and secondary pollutants, properties of major air pollutants along with sources and sinks, particulates and gases. Units of measurements of air pollutant. Simple problems on Unit conversion. Photochemical air pollutants, Air pollution due to automobiles. Smoke and its measurement.

**6 Hours**

**UNIT - 3**

**EFFECTS OF AIR POLLUTION:** Effects on human health and welfare, vegetation, animals, materials and structure/monuments, visibility and related atmospheric characteristics, Acid rain, Green house effect, Ozone depletion and Heat island effect.

**4 Hours**

**UNIT - 4**

**AIR POLLUTION METEOROLOGY:** Scales of meteorology,meteorological factors- heat, solar radiation, temperature, lapse rate, wind, humidity, precipitation, mixing height, pressure, atmospheric stability conditions, wind velocity profile, wind rose diagram. Inversion–types, plume behaviour under different atmospheric stability, effect of topography on pollutant dispersion, Effect of air pollutants on meteorology. Land/sea breeze effects, Industrial plant location and city planning.

**10 Hours**

### PART - B

**UNIT - 5**

**MEASUREMENT OF AIR POLLUTANTS AND AIR POLLUTION LAWS:** Measurement of gaseous (CO, HC, NOx, SO2) and particulate pollutants, sampling devices, sampling train, sampling methods/techniques, stack sampling techniques. Air pollution laws and standards, air pollution indices determination by different methods.

**8 Hours**

**UNIT - 6**

**ATMOSPHERIC DISPERSION OF STACK EFFLUENTS:** Plume rise, effective stack height, plume rise formulations, guide lines for fixing stack height, problems on plume rise calculations. Gaussian plume model- for point source. Gaussian dispersion coefficients, Pasquil –Gifford atmospheric stability classification. Downwind ground-level concentration computation, maximum ground level concentration. Infinite line source Gaussian model. Instantaneous puff dispersion model. Estimate for various sampling times and decay of pollutant.

**8 Hours**

**UNIT - 7**

**AIR POLLUTION CONTROL EQUIPMENT :** General methods, control by process changes, Design of particulate control devices - settling chambers, inertial separators, cyclones, fabric filters, scrubbers (wet collectors), electrostatic precipitators. Control of gaseous pollutants- adsorption,absorption, combustion and condensation.

**6 Hours**

**UNIT - 8**

**NOISE POLLUTION:** Sources of noise, effects of noise pollution, units & measurement of noise, control of noise pollution, standards. Equations & Applications.

**4 Hours**

**REFERENCES**


1. Boubel, R.W., Donald, L.F., Turner, D.B., and Stern, A.C., (1994), **Fundamentals of Air Pollution** –Academic Press.

2. Crawford, M., (1980), **Air Pollution Control Theory** –TMH Edition, Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.

3. Perkins H.C., (1980), **Air Pollution,** McGraw Hill.

4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering** –Mc Graw Hill Book Co.

5. Sincero, A.P and Sincero, G.A., (1999), **Environmental Engineering - A Design Approach** –Prentice Hall of India.

6. Wark, K., Warner, C.F. and Davies, W.T., (1998), **Air Pollution- Its Origin and Control** –Harper & Row Publishers, New York.

7. Noel de Nevers, (2000), "**Air Pollution Control Engineering",** Second Edition, McGraw- Hill International Editions, Civil Engineering Series

8**.** Nathanson J.A., (2008), "**Basic Environmental Technology : Water Supply, Waste Management and Pollution Control"**, PHI Learning Private Limited New Delhi.

9. Glynn Henry J and Heinke G.W., (1996), **"Environmental Science and Engineering"**, Second Edition, PHI Learning Private Limited, New Delhi

## WASTEWATER COLLECTION AND DRAINAGE SYSTEMS

Subject Code : **10EV64** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

Types of Surface and Under ground Drainage Systems and their Merits and Demerits. Types of Sewers – Lateral, Sub-main, Main, Intercepting and Outfall Sewers.

**6 Hours**

**UNIT - 2**

**QUANTITY OF DOMESTIC WASTEWATER:** Sources - Domestic Wastewater Flow Fluctuation, Infiltration and Exfiltration, Design Flow., Sullage quantification.

**5 Hours**

**UNIT - 3**

**STORM WATER RUN -OFF:** Estimation of Run- off, Design Principles of Drains and Sewers.

**4 Hours**

**UNIT - 4**

**DESIGN OF SEWERS AND DRAINS:** Self Cleansing and Non-scouring Velocities. Design using Different Formulae, types (L, U and V Drains) suitable for Rural and Urban Areas, Pressure Sewers.

**8 Hours**

### PART - B

**UNIT - 5**

**APPURTENANCES:** House Drainage Connection, Manholes, Lamp Holes, Street Inlets, Inverted Syphon, , Sewer Junction and Transitions. Wastewater Pumping: Necessity, Types of Pumps, Location of Pumping Station, Operation problems and solutions.

**10 Hours**

**UNIT - 6**

**RURAL WASTEWATER MANAGEMENT:** Disposal Methods – Septic Tank and Soak Pits, Disposal in Natural Valley, Agricultural Land , Low Lying Area, etc., Development of Disposal Sites.

**8 Hours**

**UNIT - 7**

Measuring and Sampling of Flow in Sewers, Laying, Jointing and Testing of Sewer Lines, Loads on buried pipes.

**6 Hours**

**UNIT - 8**

**MAINTENANCE OF DRAINAGE AND SEWERAGE SYSTEMS:** Inspection, Cleaning, Repair and Rehabilitation. Preventive Maintenance.

**5 Hours**

**REFERENCES**


1. Hammer, M.J., (1986), **Water and Wastewater Technology** –, SI Version, 2nd Edition, John Wiley and Sons.

2. Fair G.M., Geyer H.C., and Okun D.A., (1968), **Water and Wastewater Engineering** –Vol. I & II, John Wiley and Sons.

3. Metcalf and Eddy, (2003), **Wastewater Engineering, Treatment and Reuse,** 4th Edition, Tata McGraw Hill Edition, Tata McGraw Hill Publishing Co. Ltd.

4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986), **Environmental Engineering** –Mc Graw Hill Book Co.

5. **National Building Codes** (NBC) and Bureau of Indian Standards (BIS) Codes.

**6.** Nathanson J.A., (2008), "**Basic Environmental Technology : Water Supply, Waste Management and Pollution Control"**, PHI Learning Private Limited, New Delhi

7. Glynn Henry J and Heinke G.W., (1996), **"Environmental Science and Engineering"**, Second Edition, PHI Learning Private Limited, New Delhi

8. Hammer M.J. and Hammer Jr. M.J., (2008), **"Water and Wastewater Technology"**, 6th Edition, PHI Learning Private Limited, New Delhi


## WASTEWATER TREATMENT TECHNOLOGY

Subject Code : **10EV65** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**INTRODUCTION:** Objectives of Wastewater Treatment, Unit Operations and Processes. Process Flow Sheets for Wastewater Treatment Systems.

**5 Hours**

**UNIT - 2**

**UNIT OPERATIONS:** Screening, Comminutor, Grit Chamber, Primary Sedimentation, Design Criteria and Design Examples.

**8 Hours**

**UNIT - 3**

**UNIT PROCESSES:**, Aerobic & Anaerobic Systems, Suspended & attached Growth Systems, Activated Sludge Process and its Modifications, Trickling Filters, Rotating Biological Contactor, Biofilters, Secondary Sedimentation Tank, Design criteria and Design Examples.

**10 Hours**

**UNIT - 4**

Stabilization Ponds – Aerobic, Facultative & Anaerobic Lagoons, Septic Tanks and their Design Aspects.

**5 Hours**

**PART - B**

**UNIT - 5**

**SLUDGE TREATMENT:** Sludge Pumping, Sludge Thickening, Stabilization, Conditioning, De-watering, Design of Sludge drying beds.

**8 Hours**

**UNIT - 6**

**SLUDGE DIGESTION:** Aerobic and Anaerobic Digesters, Design Criteria with examples. Composting.

**6 Hours**

**UNIT - 7**

**ENERGY RECOVERY FROM DIGESTERS:** Methane quantification. Biogas Plant design.

**04 Hours**

**UNIT - 8**

**OPERATION AND MAINTENANCE OF TREATMENT UNITS:** Inplant Monitoring, Operational Problems and Solutions, Preventive Maintenance, Disposal of Wastes from various Units.

**6 Hours**

**REFERENCES**


1. Hammer, M.J., (1986), **Water and Wastewater Technology** –SI Version, 2nd Edition, John Wiley and Sons.

2. Karia, G.L., and Christian, R.A., (2006), **Wastewater Treatment – Concepts and Design Approach,** Prentice Hall of India Pvt. Ltd., New Delhi.

3. Metcalf and Eddy, (2003), **Wastewater Engineering, Treatment and Reuse ,**4th Edition, Tata McGraw Hill Edition, Tata McGraw Hill Publishing Co. Ltd.

4. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., (1986),**Environmental Engineering**–Mc Graw Hill Book Co.

5. Raju, B.S.N., (1995), **Water Supply and Wastewater Engineering, T**ata McGraw Hill Pvt. Ltd., New Delhi.

6. Sincero, A.P., and Sincero, G.A., (1999), **Environmental Engineering – A Design Approach**–Prentice Hall of India Pvt. Ltd., New Delhi.

## ENVIRONMENTAL ECONOMICS

Subject Code : **10EV661** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART A

Introduction – Environment and Development Environment and Sustainable Development Economics and Environmental Principles Environmental Policies and their Economics Environmental Legislation – Acts, Rules, Amendments

### PART B

Environmental Valuation – Theory and Application, Different techniques.
Externalities, Internalization, Valuation Techniques, Social Cost, Analysis, Benefits & Costs of Pollution Control, Contingent Valuation of Economics.

Natural Resources Economics Ecological Niche and Footprint Environmental Analysis – Cost benefit ratio

Case Studies

### REFERENCES

1. Conand J.M., (1999), Resource Economics, Cambridge University Press.
2. Kolstad C.D., (2003), Environmental Economics, Oxford University Press.
3. Field B.C., and Field M.K., (2006), Environmental Economics, McGraw Hill Irwin.
4. zlaganathan Shankar, (2003), Environmental Economics, Oxford University Press.

5. Ecology and Economics – An Approach to Sustainable Development (2002), Oxford Unviersity Press.
6. Battacharya R.N., (2002), Environmental Economics, Oxford University Press.

## NATURAL ENERGY RESOURCES

Subject Code : **10EV662** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**INTRODUCTION TO ENERGY SOURCES:** Global Energy, Environmental Resources, Energy necessity and energy crisis. Indian Energy Scenario: Energy Consumption, needs and crisis, energy sources and availability.

**6 Hours**

**UNIT - 2**

**RENEWABLE SOURCES OF ENERGY AND ENVIRONMENT:** Biomass – introduction, energy plantation, bio-mass conversion technologies (wet and dry process), agricultural waste derived energy, urban waste derived energy.

**6 Hours**

**UNIT - 3**

**Bio-Gas:** Generation, factors affecting bio-digestion, advantages of anaerobic digestion, classification of bio-gas plants.

**5 Hours**

**UNIT - 4**

**HYDROPOWER:** Site selection for hydroelectric power plants, classification of hydroelectric power plants, submergence, ecological imbalance, catchment area treatment, advantages and disadvantages of hydroelectric power plants.

**10 Hours**

### PART - B

**UNIT - 5**

**TIDAL ENERGY:** OTEC (Ocean Thermal Electric Conversion), methods of ocean thermal electric power generation, site selection. Energy from tides – basic principles of tidal power, components of tidal power plant.

**SOLAR ENERGY:** Solar constants, solar radiation at earth surface, physical principles of conversion of solar radiation into heat. Concentrating collectors (focusing and non-focusing).

**10 Hours**

**UNIT - 6**

**WIND ENERGY:** Introduction, basic principles of wind energy conversion. Site selection considerations. Basic components of wind energy conversion system. Wind energy collectors. Natural gas – classification and comparison of different gas turbine power plants, Associated Environmental Effects.

**6 Hours**

**UNIT - 7**

**NUCLEAR ENERGY:** necessity, general components of nuclear reactors, different types of reactors, breeding reactors, location of nuclear power plants, disposal of nuclear wastes, Associated Environmental Effects.

**5 Hours**

**UNIT - 8**

**GEO-THERMAL ENERGY:** introduction, nature of geothermal fields, geo-thermal sources, binary fluid geo-thermal power system and arrangement for hybrid plants.

**4 Hours**

**REFERENCES**

1. Mathur, A.N., and Rathore, N.S., (1990), **Renewable Energy and Environment** – Proceedings of the National Solar Energy, Himanshu Publications, Udaipur.

2. Rao and Parulekar B.B., (1977), **Energy Technology–Non-conventional, Renewable and Conventional** –2nd Edition, Khanna Publishers.

3. Rai. G.D.,(2002), **Non-conventional Energy Sources**–Khanna Publications.

4. Saha, H., Saha, S.K., and Mukherjee, M.K., (1990),**Integrated Renewable Energy for Rural Development** –Proceedings of the National Solar Energy Convention, Calcutta, India.

5. Wilber, L.C., (1989), **Handbook of Energy Systems Engineering** –Wiley and Sons. The Energy Research Institute (TERI), New Delhi, Publications. Ministry of Environment and Forests, Government of India, Annual Reports.

## ENVIRONMENTAL SYSTEMS OPTIMIZATION

Subject Code : **10EV663** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**INTRODUCTION:** Definition and Engineering Applications of Optimization. Statement of an Optimization Problem, Classification of Optimization Problems.

**6 Hours**

**UNIT - 2**

**CLASSICAL OPTIMIZATION TECHNIQUES:** Single Variable Optimization, Multivariable Optimization with No Constraints, with Equality Constraints and Inequality Constraints. (Statement of Theorem without Proof).

**6 Hours**

**UNIT - 3**

**LINEAR PROGRAMMING:** Graphical Method, Simplex and Two-phase Method, Big-M Technique.

**6 Hours**

**UNIT - 4**

Duality in Linear programming, Sensitivity Analysis and Parametric analysis.

**6 Hours**

### PART - B

**UNIT - 5**

**TRANSPORTATION PROBLEM:** Definition & Applications of Transportation Model. Solution of the Transportation Problem, North West Corner Rule and Vogels Approximation Methods, Application to Wastewater Reuse and Solid Waste Management.

**8 Hours**

**UNIT - 6**

**APPLICATION OF LINEAR PROGRAMMING TO:** Problems on Air Pollutant Transport, Air Pollution Control, Wastewater Treatment Problem, Formulation for Non-point Source Pollution from Dairy Farms and Combined Sources from Urban Areas.

**10 Hours**

**UNIT - 7**

**NUMERICAL SEARCH METHODS:** Elimination Methods, Dichotomous Search and Fibonacci Methods.

**4 Hours**

**UNIT - 8**

**SIMULATION:** Basic Concepts, Development & Implementation of Simulation Process, Pre-simulation Activities, Developmental & Operational Activities and Random Number Generation Techniques.

**6 Hours**

**REFERENCES**

1. Frederick Hillier, Gerald Lieberman (2005), **Introduction To Operations Research:concepts And Cases**– Tata McGraw Hill.

2. CPHEEO(1999), Manual on **Water Supply and Treatment**–Central Public Health and Environmental Engineering Organization. Ministry of Urban Development , New Delhi.

3. Jewell, T.K., (1986), **A Systems Approach to Civil Engineering Planning and Design,** Harper & Row Publishers.

4. Novotny V., and Chesters G., (1981), **Handbook of Non-point Pollution Sources and Management,** Van Nostrand Reinhold Co.

5. Rao, S.S., (1984), **Optimization Techniques** –Wiley Publications.
6. Ravindram, Phillips & Solberg, (1987), **Operations Research - Principles & Practice,** Wiley Publications.
7. Rich, L.G., (1973), **Environmental Systems Engineering,** McGraw Hill.

## AIR AND NOISE POLLUTION MEASUREMENT LAB

Subject Code : **10EVL67** IA Marks : 25
No. of Practical Hours/ Week : 03 Exam Hours : 03
Exam Marks : 50

1. Introduction to Atmospheric Monitoring : Particulate Sampling – Dust Fall, Pollution Suspended Particulates and Total Particulate Matter using HVAS.

2. Measurement of Respirable Particulate Matter (RSPM).

3. Estimating Sulphur Dioxide Oxides of Nitrogen in Ambient Air Using High Volume Air Sampler.

4. Stack Sampling Techniques and Demonstration of Stack Monitoring.

5. Ambient Gas Monitoring using GASTEC Device.

6. Demonstration of Air Pollution Control Devices – Bag Filter, Scrubber, Cyclone and ESP.

7. Auto Exhaust Emission Monitoring of Petrol and Diesel Vehicles.

8. Measurement of Noise in different zones and Indoor noise measurement in private, public and industrial buildings

9. Measurement of Smoke density using Smoke Density Meter

9. Light Intensity measuring Instrument using Luxmeter

10. Demonstration of Wind Monitoring and Analysis of Data for Wind rose Diagrams.

11. Demonstration of Rain Gauges – Digital and Mechanical.

**REFERENCES**

1. Perkins**,** H. C. (1974),**Air Pollution,** McGraw-Hill, New York.
2. Crawford M. (1976), **Air Pollution Control Theory**, McGraw Hill.
3. Stern A.C. (1986), **Air Pollution,** Vol. 3, Academic Press.
4. **Relevant IS Codes**

## ENVIRONMENTAL PROCESS LABORATORY-II

Subject Code : **10EVL68** A Marks : 25
No. of Practical Hours/ Week : 03 Exam Hours : 03
Total No. Practical Hours : 42 Exam Marks : 50

BOD and COD Analysis for Municipal, Industrial Wastewater and Solid Waste Dump Leachate.

Bench Scale Experiments – Aeration, Trickling Filter and Rotating Biological Contactor.

Oxidation Ditch, Up flow Filter Bed and Reverse Osmosis Experiments.

Estimation of Biokinetic constants in the laboratory.

Removal of Organic Contaminants and Heavy metals using natural, GAC and PAC adsorption columns.

Physico-Chemical Methods – Flocculation , Filtration and Chlorination experiments.

Application of Water Hyacinth and Duckweeds for Wastewater treatment.

Sludge Analysis and measurement of different parameters – VSS, VFA, N & Carbonate, Phosphate, pH, SVI.

Experiments on Muncipal Solid Waste – Moisture Content, Density, Calorific Value.

**REFERENCES**


1. APHA (1998), **Standard Methods for Examination of Water and Wastewater,** 20th edition.

2. Adams and Eckenfelder Jr.(1974), **Environmental, Process Design Techniques for Industrial Waste Treatment.**

3. Metcalf and Eddy, (1995)**, Wastewater Engineering** –Tata McGraw Hill.

4. **Relevant IS Codes**.

**VII SEMESTER**

## COMPUTER APPLICATIONS IN ENVIRONMENTAL ENGINEERING

Subject Code : **10EV71** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Computer Programming and Computer Aided Design, software and analytical tools, requirements and benefits of CAD, CAD languages and their requirements.

**4 Hours**

**UNIT - 2**

**POPULATION FORECAST PROGRAMS:** Arithmetic increase method, geometric increase method, incremental increase method and logistic curve method.

**4 Hours**

**UNIT - 3**

**WATER SUPPLY AND TREATMENT PROGRAMS:** Rising main design, pumping unit, service reservoir capacity calculation, Distribution network analysis & design – (One to three loops only). Water treatment units design – Cascade aerator & Spray aerator, plain sedimentation tank, clariflocculator tank, filters (rapid and slow) – Mechanical rapid mix Unit.

**10 Hours**

**UNIT - 4**

**WASTEWATER COLLECTION AND TREATMENT UNITS PROGRAMS:** Sewer Network analysis and design, wastewater treatment units – Septic tank, Screen, Grit chamber, Secondary settling tank, ASP, Trickling filter, waste stabilization pond, Oxidation ditch, Sludge digester, Sludge drying beds.

**10 Hours**

**PART - B**

**UNIT - 5**

**AQUATIC SYSTEMS PROGRAMS:** Water quality in rivers due to discharge of conservative and non-conservative waste, DO models for rivers (Streeter- Phelps equation) and lakes, Water quality in mixing zone – critical point method.

**6 Hours**

**UNIT - 6**

**AIR QUALITY PROGRAMS:** Programs on stack effective height calculation, Gaussian Plume Model for gaseous and particulate dispersion from point sources. Line source Gaussian model, Instantaneous puff dispersion model. Estimate for various sampling times and decay of pollutant. Design of particulate control devices – Settling chamber, cyclones.

**10 Hours**

**UNIT - 7**

**INTRODUCTION TO GIS:** Components of GIS, Application and benefits of GIS. GIS Operations – Spatial Data Input, Data Management Display, Exploration Analysis & GIS Modeling.

**4 Hours**

**UNIT - 8**

**Introduction to Computer graphics** – Applications.
**Introduction to DBMS** – Components of DBMS

**4 Hours**

**REFERENCES**


1. Thomann, R.V., and Mueller, J.A., (1987),**Principles of Surface Water Quality Modeling and Control** – Harper Int. Edition.
2. Krishna Murthy, C.S., and Rajeev, S., (1998),**Computer Aided Design software and Analytical Tools**– Norosa Publishing House.
3. Wark, K., Warner, G.F., and Davis, W.T., (1998), **Air Pollution its Origin and Control** – Addison-Wesley.
4. M. Crawford, (1980), **Air Pollution Control Theory**–Tata McGraw Hill Edition.
5. Mahajan, (1989), **Pollution Control in Process Industries,** Tata Mc. Graw Hill.
6. Sincero & Sincero, (1989).**Pollution Control in Process Industries**–Tata Mc. Graw Hill.
7. "**Manual on water supply and Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
8. "**Manual on Sewerage and Sewage Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1993.

## ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

Subject Code : **10EV72** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**INTRODUCTION:** Scope of Ecology**;** Sub – Divisions in Ecology, Ecosystem Concepts: Nature, Interactions, Structure and Functions. Ecological Pyramids, Food Chain and Food Webs, Measurement of Productivity.

**6 Hours**

**UNIT - 2**

**ENERGY FLOW IN ECOSYSTEM:** Perfect and Imperfect Biogeochemical Cycles, Diversity, Dominance and Evenness Indices – Problems. Aquatic Ecosystems: Lotic & Lentic Systems – Structure and Zonation. Eutrophication of Lakes: Causes, Limiting Nutrients and Control Methods.

**6 Hours**

**UNIT - 3**

**POPULATION GROWTH FORMS:** Carrying Capacity and Environmental Resistance, Maximum Sustainable Yield, Quantitative Ecology, Concepts of Modeling and Ecosystem Modelling.

**5 Hours**

**UNIT - 4**

**INTRODUCTION TO EIA:** Definition, Evaluation of EIA in India, Rapid and Comprehensive EIA, EIS, FONSI and NDS. Need for EIA Studies, Baseline data. Step – by – step procedure for conducting EIA, Advantages and Limitations of EIA. Hierarchy in EIA, Statutory Requirements in EIA, MoEF Guidelines in Siting Developmental Projects.

**9 Hours**

### PART - B

**UNIT - 5**

**OBJECTIVES AND SCOPE OF EIA:** Contents of EIA. Methodologies and Evaluation Techniques of EIA, Technique selection for Specific Projects.

**5 Hours**

**UNIT - 6**

**ENVIRONMENTAL ATTRIBUTES:** Value Functions, Prediction Equations and Mitigation of Impact on Air, Water, Land, Ecology and Socio-economic Environment. Input requirements for Computer Models.

**5 Hours**

**UNIT - 7**

**PUBLIC PARTICIPATION IN EIA:** Elements of Effective Public Participation and Benefits and Procedures. Environmental and Disaster Management Plans.
**PROJECT ACTIVITY:** Attribute - Activity Relationship, Matrices & BEES.

**9 Hours**

**UNIT - 8**

**IMPACT QUANTIFICATIONS of :** Water Resources Developmental Projects, Mass Transit Systems (MTS), Hazardous Waste Disposal Sites, Sanitary Landfilling, Mining Project,
Construction Activity, Thermal Power Plant (Coal- based), Pharmaceutical Industries.

**7 Hours**

**REFERENCES**


1. Canter L.W., (1996), **Environmental Impact Assessment,** 2nd edition–McGraw Hill Inc. New York
2. Odum (1964), **Fundamentals of Ecology** –Addison Co.

3. Jain, R. K., Urban, L. V. and Stacey, G. S. (1977) "**Environmental Impact Assessment"** Van Nostrand Reinhold.
4. Anjaneyulu Y., (2002), **Environmental Impact Assessment Methodologies** –B.S. Publications, Hyderabad.
5. Kormondy (1989), **Concepts of Ecology** –Prentice Hall, New Delhi
6. **Guidelines for EIA of Developmental Projects**. Ministry of Environment and Forests, Government of India.

## INDUSTRIAL POLLUTION CONTROL TECHNOLOGY

Subject Code : **10EV73** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**
**INTRODUCTION:** Sources of Industrial Wastewaters. Inventory of Industrial Pollution sources, Effluent and Stream standards, Assimilation capacity of a receiving body.

**4 Hours**

**UNIT - 2**
**VARIATION IN QUANTITY AND QUALITY OF INDUSTRIAL WASTEWATER:** Flow monitoring**,** Sampling and Characteristics. Concentration and mass load calculations.

**6 Hours**

**UNIT - 3**
**TOXICITY OF INDUSTRIAL WASTEWATERS TO AQUATIC BIOTA:** Testing Methods and Units, Biomonitoring of Effluents.

**5 Hours**

**UNIT - 4**
**INDUSTRIAL WASTEWATER:** Flow Quantification, Types and Categorization**,** Effects on receiving bodies (air, water and land).

**6 Hours**

### PART - B

**UNIT - 5**
**COMBINED TREATMENT:** Raw Industrial Wastes and Domestic Wastewater after Mixing Partly or fully. Selection of Treatment Methods.

**5 Hours**

**UNIT - 6**
**APPROACHES TO WASTE MINIMIZATION -** Volume Reduction, Strength Reduction, Equalization, Neutralization and Proportioning and floatation Design Examples.

**6 Hours**

**UNIT - 7**
**INDUSTRIAL WASTE - PROCESS LINE DIAGRAMS:** Characteristics, Effects and Treatment of Industrial Wastes from - Sugar & Distilleries, Pulp & Paper, Pharmaceuticals, Tanneries and Food processing, Textile, Fertilizer, Steel & Dairy Industries. Wastewater Reuse and Waste Recovery from Different Industries, Recycle options**.** **12 Hours**

**UNIT - 8**

**TREATABILITY STUDIES FOR INDUSTRIAL WASTEWATERS:** Bench-scale & pilot scale studies. Estimation of Bio Kinetic Coefficients.

**TOXIC AND HAZARDOUS WASTE –** Generation, storage, transportation, treatment and disposal options of Solid, Liquid and Gaseous wastes.

**8 Hours**

**REFERENCES**


1. Nemerow N.L. (1982), **Liquid Waste of Industry- Theories, Practice and Treatment** – Addison Wesley.
2. Rao M.N., and Datta A.K. (1987), **Wastewater Treatment –**Oxford and IBM Publishers.
3. Mahajan S.P. (1987), **Pollution Control in Process industry,** TMH Co.
4. Metcalf and Eddy, (2003), **Wastewater Engineering, Treatment and Reuse –** 4th Edition, Tata McGraw Hill Publishing Co. Ltd.
5. Lagrega M.D., Buckingham P.L., and Evans J.C. (1994), **Hazardous Waste Management** , McGraw Hill International Edition.
6. Wentz C.A. (1995), **Hazardous Waste Management** –McGraw Hill International Edition.
7. Patwardhan ,A.D.(2009),**Industrial Wastewater Treatment** – PHI Learning Pvt. Ltd., New Delhi


## ESTIMATION, SPECIFICATIONS & FINANCIAL ASPECTS OF ENVIRONMENTAL FACILITIES

Subject Code : **10EV74** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**EARTHWORK:** Volume by cross-section (including prismoidal and curvature corrections), spot levels and contour – construction of mass diagram, calculation of haul, over haul and economic haul lead and lift.

**7 Hours**

**UNIT - 2**

**WORKING OUT DATA :** Procedure for working out quantities and rates for the following items – lime and cement mortars, lime and cement concrete, brick and stone masonry, flooring, plastering, RCC works, centering and form works for different RCC items, doors, windows and ventilators

**7 Hours**

**UNIT - 3**

**SPECIFICATIONS:** Drawing up specifications for several construction materials such as coarse aggregate lime, cement, mortars, plain and reinforce concrete, brick masonry, stone masonry, flooring, roofing, plastering, wood work, earthwork and surfing, water supply distribution lines. Surface and sub-surface drainage line (including stone-ware pipes).

**8 Hours**

**UNIT - 4**

**ESTIMATION:** Methods of taking out quantities, preparation of detailed and abstract estimates for the following environmental engineering works - Septic tank, manhole, pump house, store room. Calculation for procuring steel for reinforcement for various basic components such as small slabs, chejja and lintels.

**12 Hours**

**PART - B**

**UNIT - 5**

**VALUE ENGINEERING:** Necessity, method and objections to its study.

**4 Hours**

**UNIT - 6**

**FINANCIAL ASPECTS:** Definition, purpose. Cost price – value – different forms of value – gross income – net income – outgoings – types of out goings – obsolescence, annuity, year's purchase.

**5 Hours**

**UNIT - 7**

Capital cost, operating cost, capitalized value, time value of money, sinking fund – depreciation – methods of calculation of depreciation, cost fixation on the produced commodity.

**5 Hours**

**UNIT - 8**

**FISCAL INCENTIVES FOR ENVIRONMENTAL PROTECTION:**

Exemption from IT, Investment and Depreciation Allowance, Exemption from Tax to Capital Gains, Rebate in Cess Levied on Consumption of Water.

**4 Hours**

**REFERENCES**


1. B. N. Dutta (2008), **Estimating And Costing In Civil Engineering,** Ubs Publishers Distributors Pvt.ltd
2. Mahajan S P (2006)**, Civil Estimating & Costing Valuation & Specifications** –. Satya Prakashan
3. R.K.Amin (1963),**Economics for Engineers**– Charotar Book Stall**,** .
4. Tarachand. (1996) **Engineering Economics,** Nem Chand & Brothers
5. **Manual on water supply and Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
6**"Manual on Sewerage and Sewage Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi,
7. **Current Schedule of Rates** (SR) of PWD, KUWS&DB.


## NUCLEAR, RADIOACTIVE AND BIOMEDICAL WASTE TECHNOLOGY

Subject Code : **10EV751** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Nuclear fission and fusion. Nature and sources of radiation, types of radiation on the basis of ionization. interactions of radiation with matter,

**6 Hours**

**UNIT - 2**

**MEASUREMENT METHODS:** Units of radiation and radiation standards, measurement techniques, measuring instruments, measurement procedure.

**6 Hours**

**UNIT - 3**

**EFFECTS:** General biological effects of ionizing radiation, radiation effect on aqueous environment and moist air system, effect of radiation at molecular levels, external radiation hazards.

**8 Hours**

**UNIT - 4**

**RADIATION PROTECTION:** Control of radiation hazards, survey, contamination monitoring, radiation hazards from reactors, radiological emergencies and control, protection against X-rays, quantitative risk assessment.

**8 Hours**

**PART - B**

**UNIT - 5**

**CASE STUDIES:** Chernobyl reactor accident. Hiroshima and Nagasaki Episodes. Short and long term effects of groundwater chemistry around a nuclear waste deposits.

**8 Hours**

**UNIT - 6**

Biohazard – sources, effects & control. Biohazard standards. Biological weapons, mass destruction weapons.

**4 Hours**

**UNIT - 7**

Biomedical wastes – sources, generation rate, Characterization
Biomedical wastes (Management & Handling) rules 2009.

**6 Hours**

**UNIT - 8**

Biomedical waste management – Principles & ethics, collection, transportation, treatment & safe disposal options.

**6 Hours**

**REFERENCES**


1. Chaatwal,G.R.,Mehra,S.C.Satake,M.Katya,M and Nagahiro,T. (1994), **Environmental Radiation and Thermal Pollution and their Control** –Anmol Publications, New Delhi.
2. Mookerjee A., and Bhattacharjee S.B. (1994).**Aspects of Radiation Biophysics** – Interprint publishers.
3. Lagrega M.D., Buckingham, P.L. and Evans, J.B. (1995), **Hazardous Waste Management**–McGraw Hill Inc.
4. **NEERI**, Nagpur Publications on Biomedical waste management.


## OCCUPATIONAL SAFETY AND HEALTH

Subject Code : **10EV752** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** History and Development, Occupational Safety and Health Act, Occupational Safety and Health Administration, Right to know Laws.

**6 Hours**

**UNIT - 2**

**ACCIDENT CAUSATION:** Cause of Accidents, Deaths in Work Accidents, work injuries, type of accidents, chemical and heat burn injuries.

**5 Hours**

**UNIT - 3**

Theories of Accident Causation: Domino, Human Factor, Petersew's Accident Incident, Epidemiological, Human Error Model.

**5 Hours**

**UNIT - 4**

**ERGONOMICS**: Definition, factors associated with physical stress, worksite analysis programme, hazard prevention and control. Specific ergonomic problems and problem solving strategies, economics of ergonomics.

**6 Hours**

**PART - B**

**UNIT - 5**

**OCCUPATIONAL HAZARD AND CONTROL:** Hazard Analysis, Human Error Analysis in Causation with Hazard Analysis, Fault Tree Analysis, Emergency Response, Decision for Action, Purpose and Considerations, Right Decision, Wrong Remedy

**6 Hours**

**UNIT - 6**

Engineering Versus Management Control, Hazard Control Measures, Hazards and their Control in Pharmaceutical, Construction, Textiles, Petroleum Refineries and LPG Bottling, Iron & Steel Industries

**6 Hours**

**UNIT - 7**

**FIRE PREVENTION AND PROTECTION:** Fire Development and its Severity, Effect of Enclosure, need for early Detection of Fire, Extinguishing Fire, Electrical Safety, Product Safety, Technical Requirements of Product Safety Programme.

**8 Hours**

**UNIT - 8**

**OCCUPATIONAL HEALTH:** Health and Safety Considerations, Personal Protective Equipment, Effects of Exposure and Treatment for Metal Working Trades, Municipal Solid Waste, Epoxy Resins, and Foundries. Occupational Health and Safety Considerations in Wastewater Treatment Plants.

**10 Hours**

**REFERENCES**


1. Colling D.A., (1990), **Industrial Safety Management and Technology**–, Prentice Hall, New Delhi.
2. Della D.E. and Giustina (1996),**Safety and Environmental Management**–Van Nostrand Reinhold International Thomson Publishing Inc,
3. Anand Gopal Mukherjee(1986), **Environmental Pollution and Health Hazards**–, Causes and Control, Galgotia Publications Pvt. Ltd., New Delhi
4. Trevethick R.A. (1973) **Environmental and Industrial Health Hazards**–William Heinemann Medical Books Ltd., London
5. Goetsch D.L., (1999), **Occupational Safety and Health For Technologist, Engineers & Managers** –3rd Edition, Prentice Hall,

**RURAL PUBLIC HEALTH ENGINEERING**

Subject Code : **10EV753** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART A**

**UNIT 1**
Rural Health policy, Historical perspective on rural health, Public health issues, Equity in rural health and health care, Access to health care.

6 **Hours**

**UNIT 2**
Rural sanitation, Infectious diseases, their transmission, Chronic diseases in Rural health, Rural women's health.

6 **Hours**

**UNIT 3**
Village level operation and maintenance, role of women and children in rural areas Rural occupational health and safety, Rural health and community based models

6 **Hours**

**UNIT 4**
An integrated approach to improving health and health care in rural communities Quality of care in rural communities, impact of Water supply and sanitation systems on quality of life in rural areas.

**8 Hours**

**PART B**

**UNIT 5**
Health behaviour and health threats in rural communities, Improving population health and personal health care. Role of paramedics, anganawadi workers and school teachers in rural health.

**6 Hours**

**UNIT 6**
Rural sanitation Options – Low cost sanitation systems, Septic tank and Soak Pits, garbage pits, Ecological sanitation – Ecotoilet, its features and advantages over conventional sanitation systems.

**8 Hours**

**UNIT 7**
Information, Education and Communication (IEC) activities to promote rural sanitation, Quality improvement activities in rural areas, Key components of comprehensive quality improvement program, Current status of quality improvement efforts in rural areas.

**6 Hours**

**UNIT 8**

Role of various governmental and Non-governmental agencies for promotion, implementation and sustainability of programmes, Recruiting, training and retaining Rural health professionals, Funding of rural health care, Medicare programs in Rural areas

**6 Hours**

**REFERENCES**


1. Loue, S., and Quill B.E., (2001), Handbook of Rural Health, Kluwer Academic/ Plenum Publishers, New York

2. Sinha, B.D., and Menon P.S.K., (2000), "**Environmental Sanitation Health and Panchayati Raj",** Concept Publishing Company, New Delhi

3. Ricketts T.C., (1999), "**Rural Health in United States",** Oxford University Press

4. Health Care Services (2005)**, "Quality through collaboration: The future of rural health care",** The National academies press, Washington D.C.

5. Chanlet E.W., "Environmental Protection", Tata McGraw Hill Publishers.


## ENVIRONMENTAL ASPECTS OF DEVELOPMENTAL PROJECTS

Subject Code : **10EV761** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Environment, Sustainable Development, Quality of Life (GDP, GNP), Need for Development and Environmental Protection, Ambient and Effluent Emission Standards, Regulation for Environmental Pollution Control, Environmental Ethics. Carrying capacity concept – applications for regional planning development.

**8 Hours**

**UNIT - 2**

**INFRASTRUCTURAL PROJECTS:** Highways, Airports, Water Supply and Sanitation, Wastewater Treatment – Salient Details and Environmental Aspects.

**8 Hours**

**UNIT - 3**

**CONSTRUCTION PROJECTS:** Construction activities and their environmental effects, Mitigation Measures.

**6 Hours**

**UNIT - 4**

**WATERSHED DEVELOPMENT - RESERVOIRS & DAMS:** Microclimatic changes, Submergence of land, forest & habitation – social effects.

Effects on Flora & Fauna, Pollution accumulation on Sediments, Reservoir Sedimentation.

**6 Hours**

**PART - B**

**UNIT - 5**

**IRRIGATION & AGRICULTURAL ACTIVITIES:** Water logging, Malaria Cause and Salinity Problems - Mitigative measures for Environmental Protection.
Natural – Earthquake, Tsunami, Cyclone & Land slides, Threats & their Management.

**8 Hours**

**UNIT - 6**

**POWER PROJECTS:** Hydro thermal and Nuclear projects, Power Transmission lines and Influence on Environment and Mitigation Methods.

**4 Hours**

**UNIT - 7**

**INDUSTRIAL DEVELOPMENTAL PROJECTS:** Process Flow Diagrams and Waste Generation Points for Pig Iron Plant, Coke oven, fertilizer, Textile and Food Industry.

**6 Hours**

**UNIT - 8**

Plastics and Polymer Industry, Electroplating Industry, Mining Activity. Pollution Control Measures, Recycle & Reuse, Cleaner development mechanisms

**6 Hours**

**REFERENCES**


1. Lohani B. N., (1984), **Environmental Quality Management** South Asian Publishers Pvt. Ltd.
2. Henry J.G. and Heinke G.W. (1996),**Environmental Science and Engineering**– Prentice Hall of India.
3. **Environment and Sustainable Development Journals**– UNEP/UNDP.
4. Ashwathanarayana U., (1995), **Geo-environment – An Introduction** Capital Books Pvt. Ltd., New Delhi.
5. Wilber L.C. (1989),**Handbook of Energy Systems Engineering**– Wiley and Sons.
6. R. K. Sharma & Sharma (1987), **Hydrology & Water resources Engineering**– Dhanpat Rai publishers,


## ENVIRONMENTAL APPLICATIONS OF REMOTE SENSING AND GIS

Subject Code : **10EV762** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**REMOTE SENSING:** Definition – Ideal Remote Sensing System–Sensors and Types.

**4 Hours**

**UNIT - 2**

Remote Sensing Satellite – IRS and INSAT specifications – Applications of remote sensing – DIP Techniques.

**6 Hours**

**UNIT - 3**

**GIS:** Definition, Components of GIS, Data and Types, Sources of data - Global Positioning System (GPS).

**4 Hours**

**UNIT - 4**

**DATA STRUCTURE**: Types of Analysis, Errors, Errors analysis & correction, general Applications of GIS.

**6 Hours**

**PART - B**

**UNIT - 5**

Environmental Applications of RS and GIS in Optimal Routing of Solidwastes collection system of an urban area. Environmental Siting of Industries and Zoning Atlas Development using Remote Sensing Data and GIS.

**8 Hours**

**UNIT - 6**

Re-modelling of Water Distribution & Sewer Network Systems using GIS.

**8 Hours**

**UNIT - 7**

GIS for Sustainable Urban Development Planning. Storm water system management using GIS

**8 Hours**

**UNIT - 8**

Groundwater Vulnerability Modelling using GIS. Environmental Degradation Assessment using RS and GIS (Forest covers Reservoir capacity, Catchments area).

**8 Hours**

**REFERENCES**


1. Burrough P.A., (1986), **GIS for Land Resource Assessment** –Oxford University Press, U.K.
2. Star J.L., and Estes J.E., (1990)**Geographic Information Systems; An Introduction** –, Prentice Hall Publications.
3. Laurini R. and Thompson D., (1992), **Fundamentals of Spatial Information Systems** Academic Press.
4. Mishra H.C., (1997), **GIS Handbook GIS India** –Shanthi Nivas, Hyderabad.
5. Anji Reddy, (2001), **Remote Sensing and GIS** –B.S. Publications, Hyderabad.
6. Sabine F.F., (1987), **Remote Sensing – Principles and Interpretations**, W.H. Freeman & Co. New York
7. N. Demas, (2000), **Fundamentals of GISM –**John Wiley & Sons, Inc Case Studies Reports
8. Basudeb Bhatta, (2008), **"Remote Sensing and GIS",** Oxford University Press.
9. George Joseph, (2008), **"Funadamentals of Remote Sensing**", University Press.
10. Korte, G.B.(2009), ' **The GIS Book"**, Cengage Learning, New Delhi


## BIOREMEDIATION TECHNOLOGY

Subject Code : **10EV763** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART A**

**UNIT 1**

**Bioremediation for Soil Environment -** Environment of Soil Microorganisms, Soil Organic Matter and Characteristics, Soil Microorganisms Association with Plants, Pesticides and Microorganisms, Petroleum Hydrocarbons and Microorganisms, Industrial solvents and Microorganisms.

**8 hours**

**UNIT 2**

Biotechnologies for Ex-Situ Remediation of Soil, Biotechnologies for in-Situ Remediation of Soil, Phytoremediation Technology for Soil Decontamination.

**6 Hours**

**UNIT 3**

**Bioremediation for Air Environment -** Atmospheric Environment for Microorganisms, Microbial Degradation of Contaminants in Gas Phase, Biological Filtration Processes for Decontamination of Air Stream. Biofiltration, Biotrickling Filtration and Bioscrubbers

**6 Hours**

**UNIT 4**

**Bioremediation for Water Environment -** Biochemical, Molecular, and Ecological Foundations of Bioremediation, Contaminants in Groundwater, Ex-situ Decontamination of Groundwater, Characterizing the Site and Contaminant Complexity, Selecting the Bioremediation Option, Process Optimization.

**6 Hours**

**PART B**

**UNIT 5**

In-situ Bioremediation of Groundwater, Factors Affecting Bioaugmentation, Delivery Systems for Oxygen, Nutrients, and Innoculation,

**6 Hours**

**UNIT 6**

Landfill Leachate Biotreatment Technologies, Industrial Wastewater Biotreatment Technologies Biotreatment of Surface Waters

**8 Hours**

**UNIT 7**

**Biotreatment of Metals -** Microbial Transformation of Metals, Biological Treatment Technologies for Metals Remediation.

**6 Hours**

**UNIT 8**

Bioleaching and Biobenificiation, Bioaccumulation, Oxidation/Reduction Processes, Biological Methylation, Case studies

**6 Hours**

**REFERENCES**


1. Sikdar, S.K., and Irvine R.L., (1998), "**Bioremediation Technologies: Principles and Practice**", Technomic publishing company, Inc,
2. Crawford, R.L., and Crawford D.L., 1996)**, "Bioremediation: principles and applications",** published by Press Syndicate of the university of Cambridge
3. Valdes J.J., (2000)" **Bioremediation"** , Kluwer Academic Publishers
4. Baker, K.H., and Herson D.S., (1994), "**Bioremediation",** McGraw-Hill,
5. Atlas, R.M., and Philip, J., (2005)**, "Bioremediation: applied microbial solutions for real-world environmental cleanup",** ASM press
6. Singh, S.N. and Tripathi R.D., (2007)**, "Environmental bioremediation technologies"** springer-verlag Berlin Heidelberg
7. Eweis, J.B.(1998**), Bioremediation principles, PublisherWCB/McGraw-Hill**

## COMPUTER AIDED DESIGN AND DRAWING OF ENVIRONMENTAL SYSTEMS – II

Subject Code : **10EVR77** IA Marks : 25
No. of Practical Hours/ Week : 04 Exam Hours : 03
Total No. Practical Hours : 42 Exam Marks : 50

### PART - A

**UNIT - 1**

**DESIGN & DRAWING OF STORM DRAINS:** Street Inlet and L, V and Box Drains, Manhole. Design & Drawing of Septic Tank, Dispersion Trench and Soak Pit.

**UNIT - 2**

Design & Drawing of Grit Chamber and Screens. Hydraulic Profile of Wastewater Treatment Systems.

**UNIT - 3**

Layout drawing of typical wastewater plant Design & Drawing of Secondary Treatment systems. ASP.

**UNIT - 4**

Design & Drawing of Trickling Filters, RBC, Bio Towers.

### PART - B

**UNIT - 5**

Design Principles & drawing of Aerated Lagoon, Stabilization Ponds – Oxidation pond.

**UNIT - 6**

Design & Drawing of Anaerobic Digester & Sludge Drying Beds.

**UNIT - 7**

Design & Drawing of Sanitary Landfill for Municipal Solid Waste Disposal with leachate & gas collection systems.

**UNIT - 8**

Design & Drawing of Air Pollution Control Systems – Settling Chambers, Cyclone separator, Bag Filter and Wet Scrubber.

**REFERENCES**


1. Quasim, S.R., (1985), **Wastewater Treatment Plants – Planning, Design and Operation –** Holt Rinehart and Winston, CBS College Publishing.
2. **"Manual on Sewerage and Sewage Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi
3. Sincero A.P., and Sincero G.A. (1999),**Environmental Engineering – A Design Approach–** Prentice Hall of India.
4. **Air Pollution Control Methods –** Park D


## COMPUTER APPLICATIONS LABORATORY

Subject Code : **10EVL78** IA Marks : 25
No. of Practical Hours/ Week : 03 Exam Hours : 03
Total Practical Hours : 42 Exam Marks : 50

Introduction to DOS & UNIX operating system environment along with file handling commands (like- open, copy, rename, delete etc.)

I. Writing programmes in C-language & Running for the following.

1) Exercises on data sorting and searching, matrix operation, numerical Integration and curve fitting.

2) Exercises on statistical analysis of data – mean, median, std. Deviation & variance for grouped and ungrouped data.
3) Population forecast: AM, GM, incremental and logitic curve method.
4) Rising main design, pumping UNIT design and water distribution system (two to three loops).
5) Design of water and wastewater treatment units, sewer design and septic tank design.
6) DO model for river (streeter – phelps) and lake, river mixing zone water quality – critical point method.
7) Air quality system: Gaussian Plume model for gaseous and particulate dispersion, effective stack height determination and particulate control devices design.

II. Running following application software packages:
a. WAT PLANT and DOWATTS for treatment units.
b. WADISO, BRANCH, LOOP, QUALOOP and EPANET for water Distribution system.
c. RMAIN - water rising main design.
d. SEWER – sewer network design.
e. WRPLOT (USEPA) – Wind rose plot
f. ISCST / ISCLT (USEPA) versions air quality predictions from industrial sources.
g. CALINE (USEPA) versions model for air quality near Highways.

**REFERENCES**


1**. Manual on water supply and Treatment**, CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
2. **"Manual on Sewerage and Sewage Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi,
3**.Software Package Manual on BRANCH, LOOP, SEWER –** UNDP/UNEP.
4. **WATPLANT and QUALOOP Softwares**. **–** CPHEEO – Manual.
5. **Relevant Software Manuals–** USEPA
6. Wark.K, Warner G.F. and Davis W.T (1998) **– Air Pollution its origin and control**, Addison-Wesley,
7. Thomann R.V and Mueller J.A (1987.)**–**. **Principles of surface water quality modeling and control**, Harper & Row Publishers,
8. Sincerio A.P.& Sincerio G.A. (1999.)**–**, **Environmental Engineering – A Design Approach** Prentice Hall of India.


**VIII SEMESTER**

**MANAGEMENT FOR ENVIRONMENTAL ENGINEERS**

Subject Code : **10EV81** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Historical Perspective, Contribution of HL Gantt and others to the evolution of management as scientific discipline, recent trends, relevance of management science in the Indian context.

**2 Hours**

**MANAGEMENT AND ITS FUNCTIONS:** Definition of Management, Purpose, Types of Management, Project Manager and Key Roles, Time Management, Management Style – Autocratic and Group, SWOT, Motivation of Staff and key factors of effective Management. Institutional Development.

**4 Hours**

**UNIT - 2**

**ENVIRONMENTAL LEGISLATION**- Acts and rules related to Environmental Protection, Air, Hazardous Waste and Biomedical waste, Environmental protection Act. Command and Control Agencies Central, State, Individual Industry, NGO's.

**6 Hours**

**UNIT - 3**

**TOTAL QUALITY MANAGEMENT IN ENVIRONMENTAL**

**PROTECTION:** ISO 14000 and 18000 series of standards, Preventive Environmental Policy. Environmental Audit: General Procedure, Types of Audit, Features, Effective Auditing.

**8 Hours**

**UNIT - 4**

Program Planning, Commitment by Management, Confidentiality, Audit Report of Action Plan, Water & Energy Audit, Case Studies.

**6 Hours**

**PART - B**

**UNIT - 5**

**PROJECT FORMULATION & MANAGEMENT CONCEPTS:** Levels of Projects, Characteristics, Classification and Implementation, Network analysis – Critical Path Method (CPM), Program Evaluation and Review Techniques (PERT).

**8 Hours**

**UNIT - 6**

**ENGINEERING ECONOMICS AND CONTRACTS:** Basic Concepts of Economics, Engineer – Contractor relationships, Types of Contracts, Contract procedures – Tenders and Various Deposits.

**6 Hours**

**UNIT - 7**

**FINANCIAL MANAGEMENT:** Basic Concepts in Accounting, Balancesheet, Profit – Loss Account, Water Traiff Fixation by various methods. Purchasing and Stores: Purchasing Policies, Centralized and Decentralized Purchasing, budget and Payment Procedures, Function of Stores.

**6 Hours**

**UNIT - 8**

**ENVIRONMENTAL ECONOMICS:** Externalities, Internalization, Valuation Techniques, Social Cost, Analysis, Benefits & Costs of Pollution Control, Contingent Valuation of Economics. Personnel Management: Recruitment and Selection and Training Personnel, Employer – Employee Relationship, Authority and Delegation of Powers, Career Development, performance Appraisal, Leadership Qualities and Communication Skill.

**6 Hours**

**REFERENCES**


1. Peurifoy R. L., (1979)**, Construction Planning Equipment and Methods,** McGraw Hill.
2. Lohani B. N., (1984)**, Environmental Quality Management,** South Asian Publishers, New Delhi.,
3. Koontz and Weibrich, H , (1989) ,**Management**, McGraw Hill.
4. Banga & Sharma, (2007), **Industrial Organisation and Engineering Economics**. Khanna Publishers.
5. Ulaganathan Shankar, (2001), **Environmental Economics** , Oxford University Press.
6. Richard Welford, (1999), **Corporate Environmental Management ,** Universities Press.

**WATER QUALITY ASSESSMENT IN NATURAL SYSTEMS**

Subject Code : **10EV82** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Ultimate Disposal of Wastewater in Water Bodies and on Land. Merits and Demerits. Criteria and Standards for Disposal in Water Bodies and Land. Classification of Pollution – Point Source and Non-point source

**5 Hours**

**UNIT - 2**

**WASTEWATER DISPOSAL IN RIVERS:** Effects of Oxygen Demanding Waste, Bacteria and Nutrients. One and Two Dimensional Equations. Streeter - Phelph's Equation and Expressions for Critical Point.

**6 Hours**

**UNIT - 3**

Mixing Zone Concept, Steady state Stream Tube Model Equation for Bank Outfall, and Expression for Critical Point for Conservative and Exponentially Decaying Toxic Pollutants. Pipe and Diffuser Outfalls - Mixing Patterns, Merits and Demerits. Applications to Evaluate Impacts under different Treatment Options and Stream Flow Regimes, Impacts of Combined Toxic
Pollutants.

**6 Hours**

**UNIT - 4**

**WASTEWATER DISPOSAL IN LAKES:** Steady state Dissolved Oxygen Analysis for completely Mixed and Stratified Lakes, Mass Balance Diagrams, Nutrient Loading Relationships.

**8 Hours**

**PART - B**

**UNIT - 5**

Wastewater Disposal in Estuaries: Characteristics of Estuarial Flow Regimes. 1-D Steady State Equation for fully mixed estuary. Impact of wastewater discharge on dissolved oxygen regime for different treatment options.

**6 Hours**

**UNIT - 6**

**WASTEWATER DISPOSAL IN COASTAL ZONES OF OCEANS**: One and Two Dimensional Equations. Outfall Design - Hydraulics of Diffusers and Design Example.

**6 Hours**

**UNIT - 7**

**SUBSURFACE WATER QUALITY ASSESSMENT:** Basic one and Two Dimensional Mass Balance Equations and their Analytical Solutions. Impacts of Point Source Discharges and Leachate from Land Fill Sites. Simple Problems.

**7 Hours**

**UNIT - 8**

**IMPACT OF WASTEWATER APPLICATION ON LAND:** Effects of Application Rates – Leaching Factor, Mode etc., on different types of Soils. Sodium Absorption Ratio (SAR). Microbiological Effects in different Soils with and without Treatment of Wastewater. Seasonal Effects. Design
Problems.

**8 Hours**

**REFERENCES**

1. Thomann, R.V., and Mueller, J.A., (1997), **Principles of surface water quality modelling and control,** Prentice Hall

2. Velz C.J. and Freez A. and Cherry **,** (1979), **Applied stream Sanitation ,** Prentice Hall,
3. Metcalf and Eddy, (1995)**, Wastewater Engineering, Treatment and Disposal,** Tata McGraw Hill,.
4. Steven C. Chopra , (1997), **Surface Water Quality Modeling,** McGraw Hill Inc.

5. Todd D.K., (2006), **Ground Water Hydrology, 2nd Edition,** John Wiley India, New Delhi.

**CLIMATE CHANGE AND CARBON TRADING**

Subject Code : **10EV831** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART A**

**UNIT 1**

**Energy Issues and Climate Change ,** Alternate Energy Sources
**Green-House Effect** as a Natural Phenomenon, Green House Gases GHGs) and their Emission Sources Quantification of $CO_2$ Emission, Global Warming Potential (GWP) of GHGs **8 Hours**

**UNIT 2**

Modeling Climate change, Ozone layer depletion and its control **6 Hours**

**UNIT 3**

**Impacts of climate change** – Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Inland & Coastal Flooding, Wetlands and Estuaries loss, Clinmate change Refugees **8 Hours**

**UNIT 4**

**Kyoto Protocol** – Importance, Significance and its role in Climate Change, Copen Hagen Summit and its implications **6 Hours**

**UNIT 5**

**Carbon Trading** - Carbon Credits – definition, types, Standard and Branded Credits and Mechanisms , Various Models (European, Indian) Global and Indian Scenario **6 Hours**

**UNIT 6**

**Cleaner Development Mechanisms** – Various Projects related to $CO_2$ Emission Reduction such as Power sector, agricultural sector, forestry, industry. **6 Hours**

**UNIT 7**

**Alternatives of Carbon Sequestration** – Conventional and non-conventional techniques , Role of Countries and Citizens in Containing Global Warming **6 Hours**

**UNIT 8**

Best Management Practices and Case Studies related to Global Warming and its control **6 Hours**

**REFERENCES**

1. Barry R.G., and Chorley R.L., (1992), **"Atmosphere, Weather and Climate",** 4th Edition, ELBS Publication.

2. Bolin B., (Ed.), (1981), **"Carbon Cycle Modelling",** John Wiley and Sons Publications.
3. Corell R.W., and Anderson P.A., (Eds.), (1991), **"Global Environmental Change",** Springler Verlog Publishers.
4. Francis D., (2000), **"Global Warming: The Science and Climate Change",** Oxford University Press.
5. Frame B., Medury Y., and Joshi Y., (Eds.), (1992), **"Global Climate Change: Science, Impact and Responses".**
6. Linden E., (2006), **"The Winds of Change: Climate, Weather and the Destruction of Civilizations",** Simon and Schuster Publications.
7. Mintzer I.M., (Ed.), (1982), **"Confronting Climate Change, Risks, Implications and Responses"**, Cambridge University Press.
8. Srivatsava A.K., (2007), **"Global Warming",** APH Publications.
9. Wyman R.L., (Ed.), (1991), **"Global Climate Change and Life on Earth",** Chapman and Hall Publications.
10. Yadav, Chander and Bhan, (2005), **"Global Warming: India's Response and Strategy",** RPH Publications.
11. Wood C.M. and McDonald D.G., (2005), **Global Warming : Implications for Fresh Water and Marine Fish,** Academic Press
12. Lohmann L (2006), Carbon Trading : A Critical Conversation on Climate Change, Privatization and Power, Media Print, Uddevella, Sweden

## ENVIRONMENTAL MANAGEMENT SYSTEMS

Subject Code : **10EV832** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**ENVIRONMENT AND SUSTAINABLE DEVELOPMENT**: Importance of Planning – local, regional, state and national planning concepts, site and location with reference to environmental pollution. Zoning – physical planning.

**6 Hours**

**UNIT - 2**

**ECONOMICS OF POLLUTION CONTROL:** Cost benefit ratios, total cost of development and environmental protection cost. Reliability and risk anlaysis, case studies on regional carrying capacity, National capital region – Delhi area.

**8 Hours**

**UNIT - 3**

**ENVIRONMENTAL EDUCATION:** Introduction, objectives, formal and non-formal education. Organizational structure for Environmental Management at central and state levels.

**4 Hours**

**UNIT - 4**

**LEGISLATION RELATED TO ENVIRONMENTAL MANAGEMENT**: Water, Air, Environmental protection, Wild life protection, Forest conservation, Motor vehicle act, Hazardous waste, Biomedical waste and Noise pollution.

**10 Hours**

### PART - B

**UNIT - 5**

**ENVIRONMENTAL PROTECTION:** Economic development and social welfare consideration in socio-economic development policies and planning.

**4 Hours**

**UNIT - 6**

**CLEANER TECHNOLOGIES AND THEIR ROLE IN**

**ENVIRONMENTAL MANAGEMENT:** Total Quality Management (TQM) in environmental management and protection, ISO – 14000 Series of standards.

**6 Hours**

**UNIT - 7**

**INTERNATIONAL EFFORTS FOR ENVIRONMENTAL**

**PROTECTION:** Stockholm Conference – 1972, UNEP – 1982, control of transboundary movements and disposal of hazardous wastes, Earth Summit – 1992, Montreal Protocol, Kyoto and Copen Hagen Protocols, Manila declaration.

**8 Hours**

**UNIT - 8**

**ENVIRONMENTAL AUDIT:** Air, water, soil and its importance in environmental management.

**6 Hours**

**REFERENCES**


1. Danoy G.E., and Warner R.F. (1969), **Planning and Design of Engineering Systems,** Unwin Hyman Publications.
2. Chanlet Emil T, (1973), **Environmental Protection,** Mc Graw Hill Publication.
3. Lohani B.N, (1984)**, Environmental Quality Management,** South Asian Publishers, New Delhi
4. **Environmental Sustainable Development –** UNEP / UNDP.
5. J. Glynn Henry; Gary W. Heinke**,** (1997) , Environmental Science and Engineering, American Institute of Biological Sciences.
**6. Journal of Indian Association for Environmental Management,1995-1997.**
7. **Carrying Capacity Based Developmental Planning Studies for the National Capital Region –** MOEF, Government of India (1995- 1996). NEERI (1995 and 1996)., Nagpur, Annual Reports
8. Suresh K., and Dhameja, (2000), **Environmental Engineering and Management ,** S.K. Kataria & Sons.


## HAZARDOUS WASTE TECHNOLOGY

Subject Code : **10EV833** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Definition, sources and classification, regulations for Hazardous Waste Management (Both India and USA).

**6 Hours**

**UNIT - 2**

**CHARACTERISATION OF HAZARDOUS WASTE:** Ignitability, corrosivity, reactivity, toxicity, quantification, designated hazardous waste, assessment of hazardous sites.

**6 Hours**

**UNIT - 3**

**TOXICOLOGY AND RISK ASSESSMENT:** Toxic effects, dose-response relationships, carcinogens, ecotoxicology, risk, exposure and toxicity assessment, risk characterization, ecological risk assessment.

**8 Hours**

**UNIT - 4**

**WASTE MINIMIZATION AND RESOURCE RECOVERY:** Approaches to waste reduction, development of a waste tracking system, selection of waste minimization process – case studies on by-product recovery – plating and solvent. Waste to waste compatibility for storage, treatment and disposal.

**10 Hours**

**PART - B**

**UNIT - 5**

**PHYSICO-CHEMICAL AND BIOLOGICAL TREATMENT:** Air stripping, soil vapour extraction, carbon absorption, steam stripping, stabilization and solidification – mechanisms, testing, field implementation, thermal methods – combustion, liquid injection incinerators, biological methods – conventional treatment, in-situ bio-remediation, slurry-phase treatment and solid phase treatment.

**7 Hours**

**UNIT - 6**

**TRANSPORTATION OF HAZARDOUS WASTE:** Regulations, containers for hazardous materials, bulk and non-bulk transport, hazardous substances emergency response.

**4 Hours**

**UNIT - 7**

**LAND DISPOSAL:** Landfill operations, site selection, liner and leachate collection systems, cover systems, contaminant transport through landfill barriers, landfill stability, closure and post-closure care, other types of land disposal facilities.

**7 Hours**

**UNIT - 8**

**SITE REMEDIATION:** Site assessment and inspection, remedial action, monitoring of disposal sites.

**04 Hours**

**REFERENCES**


1. Lagrega M.D., Buckingham P.L., and Evans J.C. (1994), **Hazardous Waste Management** , McGraw Hill International Edition.
2. Wentz C.A. (1995), **Hazardous Waste Management** –McGraw Hill International Edition.
3. Dawson and Mercer (1981),**Hazardous Waste Management** –John Wiley.
4. Cashman J.R. (1986), **Management of Hazardous Waste,** Technomic Publishing.
5. Lehman (1983), **Hazardous Waste Disposal** Plenum Press.
6. Fawcett (1984), **Hazardous and Toxic Materials: Safe Handling and Disposal** –John, Wiley.


## OPERATION AND MAINTENANCE OF ENVIRONMENTAL FACILITIES

Subject Code : **10EV841** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

**PART - A**

**UNIT - 1**

**INTRODUCTION:** Importance of Operation & Maintenance, Basic Principles of Operation & Maintenance – Corrective and Preventive Maintenance. Data Base of Facilities for O&M – Detailed Plans, Drawings, Operation Manuals, Computer Applications in O&M.

**6 Hours**

**UNIT - 2**

**O&M OF WATER SUPPLY FACILITIES**: Intakes, Pumps, Rising Mains, Water Treatment Process Control, Water Quantity and Water Quality Monitoring.

**6 Hours**

**UNIT - 3**

Loss of carrying capacity of pipes, Causes, Leak Detection, Projection of Pipe Break Rates, Record Keeping, Appurtenances – Valves, Hydrants and Fittings. Use of Network Models in O&M.

**8 Hours**

**UNIT - 4**

**O&M OF WASTEWATER FACILITIES:** Sewer Network: Inspection Methods for Sewers and Appurtenances – Manual and Television, Cleaning. Rehabilitation – Sealing, Repair and Replacement. Safety in Sewer Inspection**:** Monitoring, Operational Problems and Corrective Measures in Different Units of Treatment.

**8 Hours**

**PART - B**

**UNIT - 5**

**O&M OF SANITARY LANDFILLS AND HAZARDSOUS WASTE DISPOSAL SITES:**

Leachate control, gases control, closure of landfills, surface and ground water Monitoring, abandoned sites management, Operation and Maintenance of incinerators

**8 Hours**

**UNIT - 6**

**O&M OF AIR POLLUTION CONTROL FACILITIES:** Regular Inspection of Devices, SPM Control Equipment, Gravity Settlers, Cyclone Separators, Bag Filters, Scrubbers, Electrostatic Precipitators.

**6 Hours**

**UNIT - 7**

**GASEOUS EMISSION CONTROL DEVICES** – Absorption Beds and Adsorption Columns, Thermal Oxidisers, Incinerators and their Trouble Shooting.

**4 Hours**

**UNIT - 8**

**OPERATION & MAINTENANCE PLANNING:** Organizational Structure, Work Planning, Preparation and Scheduling, Cost Estimates, training – needs & planning.

**6 Hours**

**REFERENCES**


1. Hammer, M.J., (1986), **Water and Wastewater Technology**–SI Version, 2nd Edition, John Wiley and Sons.
2. Quasim, S.R., (1985), **Wastewater Treatment Plants – Planning, Design and Operation**– Holt Rinehart and Winston, CBS College Publishing Neumann W.L.,
3. William L. Heumann (1997), **Industrial Air Pollution Control Systems** – McGraw-Hill Professional;
4. **Manual on water supply and Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
5. **"Manual on Sewerage and Sewage Treatment**", CPHEEO, Ministry of Urban Development, GoI, New Delhi,
6. **Training Manual on O&M for Municipal Staff**, Asian Development Bank, Government of Karnataka.
7. Walski T.M. (1987), **Analysis of Water Distribution Systems** – CBS Publications, New Delhi.
8. Metcalf & Eddy Inc, 2003, **Wastewater Engineering, Treatment and reuse**- 4th Edition, Tata McGraw Hill Publishers Co. Ltd, New Delhi
9. Lagrega M.D., Buckingham P.L., and Evans J.C. (1994), **Hazardous Waste Management** ,

McGraw Hill International Edition.
10. Sasikumar K and Krishna S. G., (2009), **Solid Waste Management**, PHI Learning Pvt. Ltd., New Delhi.

## NON-POINT POLLUTION SOURCES & MANAGEMENT

Subject Code : **10EV842** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**INTRODUCTION:** Non-Point Sources of Pollution - Definition, Magnitude and Control laws, urban storm runoff, agricultural runoff, mining residues, leachate.

**5 Hours**

**UNIT - 2**

**HYDRAULIC AND CONSIDERATIONS:** Precipitation runoff, overland routing, interflow, groundwater flow, and surface water problems – waste assimilative capacity.

**6 Hours**

**UNIT - 3**

**POLLUTION FROM ATMOSPHERE** – Atmospheric inputs. Erosion and Sediment Yield – Definition, Sediment yield estimation, sediment delivery. Transport of pollutants and loading effects on soils, soil nitrogen and microorganisms.

**7 Hours**

**UNIT - 4**

**GROUNDWATER POLLUTION** – Sources, Ground Water movement, Factors influencing fate & transport of contaminants, groundwater quality, groundwater quality models (1, 2 & 3D models).

**6 Hours**

### PART - B

**UNIT - 5**

**POLLUTION FROM IMPERVIOUS URBAN AREAS** – deposition and accumulation of pollutants from impervious surfaces, removal of solids from street surfaces, pervious pavements.

**10 Hours**

**UNIT - 6**

**LANDUSE AND NON-POINT POLLUTION:** Landuse effects on nonpoint sources of pollution, comparative assessment of pollutants from landuses, effect of hydraulic modifications.

**8 Hours**

**UNIT - 7**

**BEST MANAGEMENT PRACTICES AND EFFECTIVE**

**MANAGEMENT PRACTICES OF STORMWATER QUALITY** – Introduction – Source control measures - ex-filtration trench, detention pond, swales.

**6 Hours**

**UNIT - 8**

**PLANNING FOR CONTROL** – Water quality planning process, selection of best alternatives, and strategy for non-point pollution control.

**4 Hours**

**REFERENCES**


1. **Novotny**, V. and G. **Chesters,**.(1995), **Hand Book on Nonpoint sources & Management.**
2. LaGrega, MD, Buckingham, PL, Evans, JC,(1991), **Hazardous Waste Management**, McGraw Hill Inc.
3. Subramanya K **,** (1985), **Engineering Hydrology**, Tata McGraw Hill, New Delhi.
4. Fair, Geyer & Okun (1968), **Water & Wastewater Engineering –**Vol-I & II, John Wiley & Sons
5. **Water Quality & Treatment,** (1971)**–** AWWA, Tata McGraw Hill.


## RECOVERY, RECYCLE AND REUSE TECHNOLOGY

Subject Code : **10EV843** IA Marks : 25
No. of Lecture Hours/ Week : 04 Exam Hours : 03
Total No. of Lecture Hours : 52 Exam Marks : 100

### PART - A

**UNIT - 1**

**WASTE AS A RESOURCE:** Resource Economics, Disposable Materials, Recovery , Recycling, Collection, Processing, Governmental Role in Waste Management, Potential for Reuse.

**6 Hours**

**UNIT - 2**

**WASTE ANALYSIS:** Sampling, Composition, Categorization, Determination of Waste Properties, Ash and Fines Analysis, Energy Content.

**5 Hours**

**UNIT - 3**

**SYSTEM DESIGN:** Design of Recycling Systems, Collection System, Process Train Design and Complexity, Product Design of Recycling, Conveyance, Transport Safety, Efficiency of Operation Systems.

**8 Hours**

**UNIT - 4**

**WATER REUSE:** Direct and Indirect Reuse, Intentional Reuse, Groundwater Recharge, Case studies of Water Reuse, Close Cycle and Open Cycle Reuse, Recreational Reuse.

**8 Hours**

**UNIT - 5**

**ENERGY RECOVERY:** Combustion, Energy Losses, Energy Recovery Analysis, Emission Control, Residue Control, In-plant Operations, Refuse Derived Fuel-cogeneration and tri generation concepts.

**8 Hours**

### PART - B

**UNIT - 6**

**METALS RECOVERY:** Ferrous Metals, Properties, Principles of Magnetic Field-ferrous Material Interactions, Magnetic Separation Equipment, Non-ferrous Metal Separation, Eddy-Current Separation – Theory and Types, Extraction of Material from a Bed.

**8 Hours**

**UNIT - 7**

**REUSE OF INDUSTRIAL EFFLUENT:** Urban Effluent Reuse for Agriculture in Arid and Semiarid Zones, Uses of in Pisciculture, Groundwater Recharge using treated Domestic wastewater.

**5 Hours**

**UNIT - 8**

**HEALTH ASPECTS OF WATER REUSE:** Guidelines for Evaluating Recreational Water Reuse, Resource Conservation and Recovery Act.

**4 Hours**

**REFERENCES**


1. R.I. Stessel (1996), **Recycling and Resource Recovery Engineering –** Springer-Verlag Berlin and Heidelberg GmbH & Co. K
2. **Proceedings of the International Symposium ICE:** Reuse of Sewage Effluent (1985), Thomas Felford, London.
3. Dean R.B., and Lund E. (1981), **Water Reuse Problems and Solutions –**Academic Press.
4. **Waste Recycling for Energy Conservation** – Kut D., and Hase G., John Wiley & Sons Inc.