

# BIJU PATNIK UNIVERSITY OF TECHNOLOGY

## Environmental Engineering

<u>3<sup>rd</sup> SEMESTER</u>				<u>4<sup>th</sup> SEMESTER</u>			
<i>THEORY</i>		<i>Contact Hours</i>		<i>THEORY</i>		<i>Contact Hours</i>	
<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>	<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>
BSCM1205	Mathematics – III	3-1-0	4	BSCM1210	Mathematics – IV	3-1-0	4
BSCC1208	Chemistry - II	3-0-0	3	BSCP1206	Physics II	3-0-0	3
BECS2212	C++ & Object Oriented Programming	3-0-0	3	BECS2208	Database Management System	3-0-0	3
HSSM3204	Engg. Economics & Costing	3-0-0	3	HSSM3205	Organizational Behaviour	3-0-0	3
	OR				OR		
HSSM3205	Organizational Behavior			HSSM3204	Engg. Economics & Costing		
BEME2209	Fluid Mechanics & Machines	3-0-0	3	PCEV4202	Industrial Technology	3-0-0	3
PCEV4201	Principles of Civil Engg.	3-0-0	3	PCEV4203	Environmental Chemistry	3-0-0	3
	<b>Credits (Theory)</b>		<b>19</b>		<b>Credits (Theory)</b>		<b>19</b>
<b><i>PRACTICALS/SESSIONALS</i></b>				<b><i>PRACTICALS/SESSIONALS</i></b>			
BECS7212	C++ & Object Oriented Programming Lab	0-0-3	2	BECS7208	Database Managements System Lab	0-0-3	2
PCME7202	Mechanical Engg. Lab	0-0-3	2	PCEV7203	Environmental Chemistry Lab	0-0-3	2
PCEV7201	Principles of Civil Engg. Lab	0-0-3	2	HSSM7203	COMMUNICATION AND INTERPERSONAL SKILLS FOR CORPORATE READINESS	0-0-3	2
	<b>Credits (Practicals/ Sessionals)</b>		<b>6</b>		<b>Credits (Practicals/Sessionals)</b>		<b>6</b>
<b>TOTAL SEMESTER CREDITS</b>			<b>25</b>	<b>TOTAL SEMESTER CREDITS</b>			<b>25</b>

## BSCM1205 **Mathematics - III**

### **Module-I**

**(18 hours)**

Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge's method, Second order partial differential equation

The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

### **Module-II**

**(12 hours)**

Complex Analysis:

Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping, Complex integration: Line integral in the complex plane, Cauchy's integral theorem, Cauchy's integral formula, Derivatives of analytic functions

### **Module –III**

**(10 hours)**

Power Series, Taylor's series, Laurent's series, Singularities and zeros, Residue integration method, evaluation of real integrals.

### **Text books:**

1. E. Kreyszig, "Advanced Engineering Mathematics:", Eighth Edition, Wiley India  
Reading Chapters: 11,12(except 12.10),13,14,15
2. B.V. Ramana, "Higher Engineering Mathematics", McGraw Hill Education, 2008  
Reading chapter: 18

### **Reference books:**

1. E.B. Saff, A.D.Snyder, "Fundamental of Complex Analysis", Third Edition, Pearson Education, New Delhi
2. P. V. O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

# BSCC1208 Chemistry - II

## **Module I**

**1. Water Technology:** Hardness of Water : Types of hardness, Units of hardness and their interrelation, Determination of hardness(EDTA method only). Disadvantage of hard water . Water softening technology (internal and external (limesoda,zeolite,and ion exchange methods ) Desalination(electrodialysis, reverse osmosis, Sterilization of water by bleaching power, chlorine, ozone, chloramine. Determination of B.O.D and C.O.D of water sample.

**2. Corrosion:** Theories of corrosion , Types of corrosion , Factors affecting corrosion, Corrosion Control: (Proper design and fabrication procedure, Cathodic protection, Passivation).

## **MODULE-II**

**1. Fuels:** Classification of fuels, calorific value, (Determination by Dulong's formula),G.C.V&N.C.V

Liquid fuel: Classification of petroleum, Refining of petroleum , Cracking, Knocking and anti knocking,cetane and octane numbers . Unleaded petrol, synthetic petrol, power alcohol

Gaseous Fuel : Producer gas, Water gas, LPG , CNG, Kerosene gas

Combustion Calculation.

### **2. Battery technology**

Introduction, Batteries and cells, Basic components of battery, its Classification characteristics,Chemical batteries(dry, Lead acid & gel batteries) Alkaline batteries(zinc-air,aluminium-air,Nickel metal hydride battery) Reserve batteries(magnesium-copper,Gordan-magnesium battery) Nickel cadmium battery

## **Module III**

**1. POLYMER .** Polymer: Types, polymerization process and mechanisms

Conducting polymers(poly aniline, poly acetylene),polymer composite(carbon fiber)

Preparation. Properties and uses of following polymer(polyethylene,PMMA,PTFE

Bakelite,polyurethanes,polycarbonate)

### **2 Nano materials**

Nano material; Carbon nano tube,(synthesis, properties and application.) Application of nano material in medicine, fuel cell, catalysis (only general idea)

Text Books:

1. Engineering chemistry by Putti R.vljayasararhy ,PHI Ltd
2. Engineering chemistry by P.C jain and M. jain

Reference Books:

1. Engineering chemistry by N Krishnamurthy ,p vallinaygam, Dmadhavan, PHI Ltd
2. Engineering chemistry by mary,jane.shultz ,Cengage learning publication
3. Engineering chemistry by R.Gopalan,D.venkaapaya,and SNagarajan, Vikas publishing house.

# BECS2212 C++ & Object Oriented Programming

## Module I

(08 hrs)

Introduction to object oriented programming, user defined types, structures, unions, polymorphism, encapsulation. Getting started with C++ syntax, data-type, variables, strings, functions, default values in functions, recursion, namespaces, operators, flow control, arrays and pointers.

## Module II

(16 hrs)

Abstraction mechanism: Classes, private, public, constructors, destructors, member data, member functions, inline function, friend functions, static members, and references.

Inheritance: Class hierarchy, derived classes, single inheritance, multiple, multilevel, hybrid inheritance, role of virtual base class, constructor and destructor execution, base initialization using derived class constructors.

Polymorphism: Binding, Static binding, Dynamic binding, Static polymorphism: Function Overloading, Ambiguity in function overloading, Dynamic polymorphism: Base class pointer, object slicing, late binding, method overriding with virtual functions, pure virtual functions, abstract classes.

Operator Overloading: This pointer, applications of this pointer, Operator function, member and non member operator function, operator overloading, I/O operators.

Exception handling: Try, throw, and catch, exceptions and derived classes, function exception declaration.

## Module III

(08 hrs)

Dynamic memory management, new and delete operators, object copying, copy constructor, assignment operator, virtual destructor.

Template: template classes, template functions.

Namespaces: user defined namespaces, namespaces provided by library.

## Text Books:

1. Object Oriented Programming with C++ - E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ - Ashoke N. Kamthane, Pearson Education

## Reference Books:

1. Big C++ - Wiley India
2. C++: The Complete Reference- Schildt, McGraw-Hill Education (India)
3. "C++ and Object Oriented Programming" – Jana, PHI Learning.
4. "Object Oriented Programming with C++ "- Rajiv Sahay, Oxford
5. Mastering C++ - Venugopal, McGraw-Hill Education (India)
6. "Object Oriented Programming with C++", David Parsons, Cengage Learning.

# HSSM3204 **Engineering Economics & Costing**

## **Module-I: (12 hours)**

Engineering Economics – Nature and scope, General concepts on micro & macro economics. The Theory of demand, Demand function, Law of demand and its exceptions, Elasticity of demand, Law of supply and elasticity of supply. Determination of equilibrium price under perfect competition (**Simple numerical problems to be solved**). Theory of production, Law of variable proportion, Law of returns to scale.

## **Module-II: (12 hours)**

Time value of money – Simple and compound interest, Cash flow diagram, Principle of economic equivalence. Evaluation of engineering projects – Present worth method, Future worth method, Annual worth method, internal rate of return method, Cost-benefit analysis in public projects. Depreciation policy, Depreciation of capital assets, Causes of depreciation, Straight line method and declining balance method.

## **Module-III: (12 hours)**

Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)

Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

### **Text Books:**

1. Riggs, Bedworth and Randhwa, "Engineering Economics", McGraw Hill Education India.
2. M.D. Mithani, Principles of Economics.

### **Reference Books :**

1. Sasmita Mishra, "Engineering Economics & Costing ", PHI
2. Sullivan and Wicks, " Engineering Economy", Pearson
3. R.Paneer Seelvan, " Engineering Economics", PHI
4. Gupta, " Managerial Economics", TMH
5. Lal and Srivastav, " Cost Accounting", TMH

# HSSM 3205 **Organizational Behaviour**

## **Module I :**

The study of Organizational Behaviour : Definition and Meaning, Why Study OB

Learning – Nature of Learning, How Learning occurs, Learning and OB.

Foundations of Individual Behaviour : Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB.

Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation – Nature and Importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations.

## **Module II :**

Organizational Behaviour Process : Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness, Groups in Organizations – Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision-making Managerial Implications, Effective Team Building. Leadership-Leadership & Management, Theories of Leadership-Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Followership, How to be an effective Leader, Conflict-Nature of Conflict and Conflict Resolution. An Introduction to Transactional Analysis (TA).

## **Module-III :**

Organization : Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management-Selection, Orientation, Training and Development, Performance Appraisal, Incentives Organizational Change – Importance of Change, Planned Change and OB techniques. International Organisational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective.

## **Text Books :**

1. Keith Davis, Organisational Behaviour, McGraw-Hill.
2. K.Aswhathappa, Organisational Behaviour, Himalaya Publishing House.

## **Reference Books :**

1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
2. Pradip N. Khandelwal, Organizational Behaviour, McGraw-Hill, New Delhi.
3. Uma Sekaran, "Organizational Behaviour", TATA McGraw-Hill, New Delhi.
4. Steven L McShane, Mary Ann Von Glinow, Radha R Sharma" Organizational Behaviour" , TATA McGraw- Hill.
5. D.K. Bhattachayya, "Organizational Behaviour", Oxford University Press
6. K.B.L.Srivastava & A.K.Samantaray, "Organizational Behaviour" India Tech

# BEME2209 **Fluid Mechanics & Machines**

## **Module I (12 Lectures)**

Introduction : Scope of fluid mechanics and its development as a science

Physical property of Fluid: Density, specific gravity, specific weight, specific volume, surface tension and capillarity, viscosity, compressibility and bulk modulus, Fluid classification.

Fluid static Pressure, Pascal's Law, Pressure variation for incompressible fluid, atmospheric pressure, absolute pressure, gauge pressure and vacuum pressure, manometer.

Hydrostatic process on submerged surface, force on a horizontal submerged plane surface, force on a vertical submerged plane surface.

Buoyancy and flotation, Archimedes' principle, stability of immersed and floating bodies, determination of metacentric height.

Fluid kinematics : Introduction, description of fluid flow, classification of fluid flow. Acceleration of fluid particles, flow rate and continuity equation, differential equation of continuity,

## **Module II (10 Lectures)**

Fluid dynamics : Introduction, Euler's equation along a streamline, energy equation, Bernoulli's equation,

Hydraulic Measurements: Water level measurements, velocity measurements, discharge measurements, venturimeter, orifice meter, current meter, pitot tube, orifice, notch and weir.

## **Module III (14 Lectures)**

Hydraulic turbines and pumps: Impulse and reaction turbines, construction and working principle of tangential, radial and axial type turbines. Power of turbines, efficiency of turbines. Construction and working principles of centrifugal type pumps. Power and efficiency of the pump. Positive displacement pump.

Hydraulic systems: hydraulic accumulator, hydraulic intensifier, hydraulic ram, hydraulic lift, hydraulic crane, hydraulic press, hydraulic torque converter.

### **Text Books**

1. Fluid Mechanics and hydraulic machines, Modi & Seth
2. Hydraulics fluid machines and fluid machines by S. Ramamrutham

### **Reference Books:**

1. Fluid Mechanics by A.K. Mohanty, PHI
2. Introduction to Fluid Mechanics by Fox and McDonald, Willey Publications
3. Fluid Mechanics by Kundu, Elsevier
4. An Introduction to Fluid Dynamics by G.K.Batchelor, Cambridge University Press
5. Engineering Fluid Mechanics by Garde et. al., Scitech
6. Fluid Mechanics by J.F.Douglas, J.M.Gasiorek, J.A.Swaffield and L.B.Jack, Pearson Education.

# PCEV4201 **Principles of Civil Engineering**

## **MODULE-I :**

a. BUILDING MATERIALS: Introduction to building materials:

Stone, Brick, Timber, Cement, Concrete, Reinforced Cement Concrete (RCC), Glass.

b. BUILDING CONSTRUCTION:

Introduction to typical building units and components:

Foundation, Masonry wall (stone & brick), Scaffolding & form work, DPC, Stairs, Lintels, Plaster, Floor, Doors & Windows and Paint.

c. SURVEYING:

Linear measurements & chain surveying, bearing & compass, plane table, theodolite & traverse surveying, leveling & contouring.

## **MODULE-II :**

### **MECHANICS OF MATERIALS:**

a. Analysis of axially loaded members stress, strain, bars in tension & compression, strain deformation, shear force & bending moment diagrams deflections.

b. RCC Design: Beam, Slab, Column, Footing, Water tanks.

## **MODULE-III :**

### **Soil Mechanics:**

Introduction, Basic terminology, Index properties, Particle size distribution, Permeability, Consolidation, Shear strength, Earth Pressure, Slope stability, bearing capacity, Shallow foundation.

### **Text Books**

1. Building material- Rangwalla, S.c.
2. Building construction - Rangwalla, S.c.
3. Surveying Vol-1- B.C. Punmia
4. Strength of Materials – Ramamrutham.S
5. Soil Mechanics- B.C. Punmia

### **Reference Books**

1. Surveying – P.B.Sahani
2. Strength of Materials – G.S.Ryder.
3. Soil Mechanics – VNS Murthy



## BECS7212 **C++ & Object Oriented Programming Lab**

1. Programs on concept of classes and objects.(1 class)
2. Programs using inheritance.(1 class)
3. Programs using static polymorphism.(1 class)
4. Programs on dynamic polymorphism.(1 class)
5. Programs on operator overloading.(1 class)
6. Programs on dynamic memory management using new, delete operators.(1 class)
7. Programs on copy constructor and usage of assignment operator.(1 class)
8. Programs on exception handling .(1 class)
9. Programs on generic programming using template function & template class.(1 class)
10. Programs on file handling.(1 class)

## PCME7202 **Mechanical Engg. Lab**

### **Group A**

1. Determination of equilibrium of coplanar forces.
2. Determination of Moment of Inertia of Flywheel
3. Determination of tensile strength of materials by Universal Testing Machine.

### **Group B**

4. Determination of Metacentric Height and application to stability of floating bodies.
5. Verification of Bernoulli's Theorem and its application to Venturimeter.
6. Determination of Cv and Cd of Orifices.

### **Group C**

7. Calibration of Bourdon Tube Pressure gauge and measurement of pressure using manometers.
8. Study of Cut-Sections of 2 stroke and 4 stroke Diesel Engine.
9. Study of Cut-Sections of 2 stroke and 4 stroke Petrol Engine.

## PCEV7201 **Principles of Civil Engg. Lab**

1. Exposures to Building Components, such as Foundation, DPC, Wall, Beam, Roof, Cornice, Parapet.
2. Finding area of a polygonal land, using Chain and Prismatic Compass.
3. Finding out Reduced levels of various spots of a grid layout using Dumpy level.
4. Finding out Reduced levels of various spots of a grid layout using Theodolite.
5. Exposure in handling of a total station.
6. Exposure in handling of Global Positioning System (GPS)
7. Finding of Plastic Index (PI) value of a given soil sample.
8. Finding of specific size & uniformity Co-efficient of a bulk sand sample required for filter media.
9. Finding out the Concrete cube strength through Universal Testing Machines.
10. Finding out tensile strength of a reinforce steel sample.

### **Books**

1. Surveying Vol-1- B.C. Punmia
2. Strength of Materials – Ramamrutham.S
3. Soil Mechanics- B.C. Punmia

# BSCM1210 Mathematics – IV

## Module-I

(20 hours)

### Numerical methods:

Approximation and round of errors, Truncation error and Taylor's series

Roots of equation: The bisection method, the false-position method, fixed point iteration, the Newton-Raphson method, Muller's method

Linear algebraic equation: LU decomposition, the matrix inverse, Gauss-Seidel method

Interpolation: Newton divided difference interpolation, Lagrange Interpolation, Newton's forward and backward interpolation.

Numerical integration: The trapezoidal rule, The Simpson's rules, Gauss quadrature

Ordinary differential equation: Euler's method, Improvement of Euler's method, Runge-Kutta methods

## Module-II

(10 Hours)

### Probability:

Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson and Hypergeometric distributions, Normal distribution, Distribution of several random variables.

## Module-III

(10 Hours)

### Mathematical Statistics:

Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Chi square test for goodness of fit , Regression Analysis, Fitting Straight Lines, Correlation analysis.

### Text books:

1. S. C. Chapra and R. P. Canale, "Numerical methods for Engineers", Fifth Edition, McGraw Hill Education  
Reading Chapters : 2, 3(3.1, 3.2), 4(4.2, 4.3), 5(5.1, 5.2, 5.3), 6(6.4), 9(9.1, 9.2), 10(10.2), 13(13.1,13.2,13.5), 16(16.1, 16.2), 17(17.3), 20(20.1, 20.2, 20.3)
2. E. Kreyszig," Advanced Engineering Mathematics:, Eighth Edition, Wiley India  
Reading Chapters: 22, 23( except 23.5 and 23.8)

### Reference books:

1. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", Seventh Edition, Thomson/CENGAGE Learning India Pvt. Ltd
2. P. V.O'Neil, "Advanced Engineering Mathematics", CENGAGE Learning, New Delhi

# BSCP1206 **Physics II**

## **Module-I**

This unit covers the basic principles and applications of different types of accelerators and their important applications.

Need for nuclear accelerators.

D.C. Accelerators: Cockcroft-Walton, Van de Graff, Tandem accelerators.

R.F. Accelerators: Linear accelerators, cyclotrons, electron accelerator, betatron.

Application of nuclear accelerators - Production of radio isotopes, Radiation processing of materials, medical applications.

This unit covers the basic principle, properties of nanoparticles.

## **Nanoparticles.**

Properties, Classification & characterization of nanoparticles, fabrication of nanoparticles, Structure of carbon nanotubes, types of carbon nanotubes, Properties of (Electrical, thermal) carbon nanotubes, Quantum Dots.

## **Module-II**

Study of crystal structure by diffractions methods, Bragg's condition for crystal diffraction, Laue's Condition, Miller indices, Reciprocal lattice, Geometrical Structure factor, Atomic form factor.

Energy bands in solids: Kronig-Penney model, allowed bands and forbidden gaps, elemental and compound semiconductors.

Superconductivity: Superconductors and their properties, Meisner's effect, Type-I and Type-II superconductors, thermodynamic properties of superconductors, London equation, Application of superconductors

## **Module-III**

Defects in crystal:-Schottky and Frenkel defects, color centres, dislocation.

Laser: - Principle of lasing, Properties of laser, Ruby laser, He-Ne laser, semiconductor laser(construction and working). Application of laser.

LED: Principle, construction of operation and application, Introduction to fiber optics, basic characteristics of optical fibers, optical fibre communication system.

## **Books Recommended**

### **Text books**

- (1) Concepts in Engineering Physics, Md.N.Khan
- (2) Physics-II, B.B.Swain, P.K.Jena.

### **Reference Books**

- (3).Principles of Nanotechnology, Phani Kumar
- (4) Physics-II, Randhir Singh, Shakti Mohanty,
- (5) Physics-II, A.Serway,W.Jewett
- (6) Solid state Physics, W.Ashcroft, N.David Mermin,
- (7) Introduction to Solid State Physics, C.Kittel,
- (8) Solid State Physics, Dan Wei

# BECS2208 **Database Management System**

## **Module I :** (10 hours)

Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages. Data models - Entity Relationship(ER), Mapping ER Model to Relational Model, Network .Relational and Object Oriented Data Models, Integrity Constraints and Data Manipulation Operations.

## **Module II :** (12 hours)

Relation Query Languages, Relational Algebra and Relational Calculus, SQL.

Relational Database Design: Domain and Data dependency, Armstrong's Axioms, Normal Forms, Dependency Preservation, Lossless design.

Query Processing Strategy.

## **Module III:** (10 hours)

Transaction processing: Recovery and Concurrency Control. Locking and Timestamp based Schedulers.

Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques

### Text Books:

1. Database System Concepts by Sudarshan, Korth (McGraw-Hill Education )
2. Fundamentals of Database System By Elmasari & Navathe- Pearson Education

### References Books:

- (1) An introduction to Database System – Bipin Desai, Galgotia Publications
- (2) Database System: concept, Design & Application by S.K.Singh (Pearson Education)
- (3) Database management system by leon &leon (Vikas publishing House).
- (4) Fundamentals of Database Management System – Gillenson, Wiley India
- (5) Database Modeling and Design: Logical Design by Toby J. Teorey, Sam S. Lightstone, and Tom Nadeau, "", 4<sup>th</sup> Edition, 2005, Elsevier India Publications, New Delhi

# PCEV4202 **Industrial Technology**

## **UNIT 1**

**Classification of industries:** (a)small, medium, large(b)organic, Inorganic(c)highly polluting, moderately polluting, non polluting. **Process Flow Sheets:** Significance, symbols, informations, block flow diagram,flow diagram.

**Materials of construction:** Steel,Alloys, Refractory, Coating, Plastics, Glass lining, FRP,

**Electrochemicals:** Alkalies, Electro plating, Electrorefying

**Process conditions:** Effect of temperature, pressure, concentration, flow rate, catalysts etc.

## **UNIT 2**

**Material balance:** Conservation of mass, Chemical stoichiometry, mass transfer through phase change, material balance across unit; Overall material balance.

## **UNIT 3**

**Study of heavy chemicals:** Chlorine, HCl, Soda Ash, Sulfuric Acid, Phosphoric Acid.

Fertilizers and its types (N, P, K):

- 1) Nitrogenous fertilizers
- 2) Phosphatic fertilizers
- 3) K fertilizers

Brief overview about the management of industrial solid, liquid and gaseous wastes

**Processes:** Pulp and paper, steel, alumina and aluminum.

### **Textbooks**

1. Outlines of Chemical Technology- C.E.Dryden.
2. Chemical process principles part-1:-Houghen, O; Watson KIM and Ragatz, R.A

### **Reference Books**

1. A textbook of Chemical technology- S.d.Shukla and G.N. Pandey
2. Chemical process industries- R.N.Shreve.
3. Publication of Fertilizer Association of India, New Delhi
4. Industrial Chemistry- Faith, Keyes and Clark
5. Handbook of Industrial chemistry- Riegel

# PCEV4203 **Environmental Chemistry**

## **UNIT 1**

Atmospheric chemistry:

- (a) Basic components: - Pollutants, contaminants, receptors, sink, pathways of pollutants.
- (b) Major regions of atmosphere, particles, ions and radicals in atmosphere, Thermochemical and photochemical reaction in atmosphere, smog, NO<sub>x</sub>, SO<sub>2</sub>, hydrocarbons, suspended particulate matter, chemistry of action of pollutant and effects.

## **UNIT 2**

Aquatic chemistry:

(a) Aquatic environment, water pollutants, colloidal dispersion in water, traces elements in water.

(b) Water quality parameters, pH, conductance, dissolved oxygen, B.O.D and C.O.D of waste water.

(c) Sanitary significance of sulphate, phosphate, nitrate fluoride and cyanide and their effects.

## **UNIT 3**

Soil chemistry-Inorganic and organic components of soil, nitrogen pathway in soil, Fertilizers.

Toxic chemicals in the environment: pesticides, arsenic, cadmium, lead, mercury, carbon monoxide, PAN, MIC, Radioactive wastes

Microbial metabolism of heavy metals, pesticides etc.

## **TEXT BOOKS :**

1. Chemistry for Environmental Engineering- **Sawer and Mccarty-McGraw Hill**
2. Environmental Chemistry – A.K. Dey, Willy Eastern

## **REFERENCE BOOKS :**

1. Text book of Environmental Chemistry – S.S. Dara. – S. Chand & Co
2. Aquatic Chemistry – Stumm and Morgan

## BECS7208 **Database Managements System Lab**

1. Use of SQL syntax: insertion, deletion, join, updation using SQL. (1 class)
2. Programs on join statements and SQL queries including where clause. (1 class)
3. Programs on procedures and functions. (1 class)
4. Programs on database triggers. (1 class)
5. Programs on packages. (1 class)
6. Programs on data recovery using check point technique. (1 class)
7. Concurrency control problem using lock operations. (1 class)
8. Programs on ODBC using either VB or VC++. (1 class)
9. Programs on JDBC. (1 class)
10. Programs on embedded SQL using C / C++ as host language. (1 class)

## PCEV7203 **Environmental Chemistry Lab**

### **Analysis of water and wastewater samples**

1. Colour and turbidity.
2. Determination of solids
3. Alkalinity, acidity  $P_H$ .
4. Determination of chloride and conductivity.
5. Estimation of iron.
6. Estimation of Manganese.
7. Determination of Chromium.
8. Determination of sulphate and phosphate.
9. Determination of fluoride.
10. Determination of Ammonia, Nitrite, Nitrate and total kjeldahl nitrogen.

### **BOOKS:**

1. Standard methods for estimation of water & waste water-APHA, AWWA, WEF-Washington.
2. Examination of water and waste water manual.
3. Manual on water and waste water analysis - NEERI.



# HSSM7203 **Communication & Interpersonal skills for Corporate Readiness Lab.**

**Lab**

**30 hours**

This course will focus on communication in professional (work-related) situations of the kind that BPUT graduates may expect to encounter on entering the professional domain.

Some typical forms of work-related communication, oral or written, are listed below. Practice activities for all four skills can be designed around these or similar situations.

1. Gaining entry into an organization
  - i. Preparing job-applications and CVs
  - ii. Facing an interview
  - iii. Participating in group discussion (as part of the recruitment process)
  
- 2 In-house communication
  - a. Superior/ Senior → subordinate / junior (individual → individual / group)
    - i. Welcoming new entrants to the organization, introducing the workplace culture etc.
    - ii. Briefing subordinates / juniors : explaining duties and responsibilities etc.
    - ii. Motivating subordinates / juniors ('pep talk')
    - iii. Instructing/ directing subordinates/ juniors
    - iv. Expressing / recording appreciation, praising / rewarding a subordinate or junior
    - v Reprimanding / correcting / disciplining a subordinate/junior (for a lapse) ; asking for an explanation etc.
  
  - b. Subordinate / Junior → Superior / Senior
    - i. Responding to the above
    - ii. Reporting problems / difficulties / deficiencies
    - iii. Offering suggestions

# BIJU PATNIK UNIVERSITY OF TECHNOLOGY, ORISSA

## Environmental Engineering

5 <sup>th</sup> Semester					6 <sup>th</sup> Semester				
Code	Theory Subjects	L-T-P	Credit		Code	Theory Subjects	L-T-P	Credit	
HSSM3301	Principles of Management OR	3-0-0	3		HSSM3302	Optimization in Engineering OR	3-0-0	3	
HSSM3302	Optimization in Engineering				HSSM3301	Principles of Management			
PCEV4302	Environmental Biology & Ecology	3-1-0	4		PCEV4305	Water & Waste Water Engineering-I	3-1-0	4	
PCEV4301	Environmental Microbiology & Toxicology	3-1-0	4		PCEV4306	Fundamentals of Air Pollution	3-0-0	3	
PCEV4303	Water Supply & Waste Water Collection Syste	3-0-0	3		PCEV4307	Solid & Biomedical Waste Management	3-1-0	4	
PCEV4304	Water Resources Engineering	3-1-0	4		PCEV4308	Environmental Impact Assesment	3-0-0	3	
	<u>Free Elective-I (Any one)</u>	3-0-0	3			<u>Free Elective-II (Any one)</u>	3-0-0	3	
FEEV6301	Energy Conservation & Environment				FEEV6303	1) Recycle and Reuse Technology			
FEEV6302	Public Health and Sanitation.				FEEV6304	2)Statistical Methods for Environmental Analysis			
<b>Theory Credits</b>			<b>21</b>		<b>Theory Credits</b>			<b>20</b>	
<b>Practical/Sessional</b>					<b>Practical/Sessional</b>				
PCEV7301	Environmental Monitoring Lab-II Microbiology & Toxicology	0-0-3	2		PCEV7303	Environmental Monitoring Lab-IV Air Monitoring Lab	0-0-3	2	
PCEV7302	Environmental Monitoring Lab-III Environmental Chemistry	0-0-3	2		PCEV7304	Design & Drawing of Environmental System Lab	0-0-3	2	
<b>Practical/Sessional Credits</b>			<b>04</b>		<b>Practical/Sessional Credits</b>			<b>04</b>	
<b>TOTAL SEMESTER CREDITS</b>			<b>25</b>		<b>TOTAL SEMESTER CREDITS</b>			<b>24</b>	
<b>TOTAL CUMULATIVE CREDITS</b>					<b>TOTAL CUMULATIVE CREDITS</b>				

## HSSM3301 **PRINCIPLES OF MANAGEMENT** (3-0-0)

### **Module I: Functions of Management**

Concept of Management, Management as an Art or Science, The Process of Management, Managerial Skills, Good Managers are Born, not Made, Management is concerned with Ideas, Things and People, How a Manager Induces Workers to Put in Their Best, Levels and Types of Management, **Evolution of Management Thought:** Managerial Environment, The process of Management-Planning, Organizing, Directing, Staffing, Controlling.

### **Module II: Marketing Function of Management.**

Modern Concept of Marketing, The Functional Classification of Marketing, Functions of a Marketing Management, Marketing Mix, Fundamental Needs of Customers, The Role of Distribution channels in Marketing, Advertising, Marketing, Consumerism and Environmentalism.

### **Module III: Financial Function & HRM Functions.**

Financial Functions, Concept of Financial Management, Project Appraisal, Tools of Financial decisions making, Overview of Working Capital.

**HRM Function of Management:** Human Resource Management, Human Resource Development, Importance of HRM, Overview of Job Analysis, Job Description, Job Specification, Labour Turnover. Manpower Planning, Recruitment, Selection, Induction, Training and Development, Placement, Wage and Salary Administration, Performance Appraisal, Grievance Handling, Welfare Aspects.

### **Reference Books:**

1. *Business Organization & Management, CR Basu, TMH*
2. *Business Organization & Management, Tulsia, Pandey, Pearson*
3. *Marketing Management, Kotler, Keller, Koshi, Jha, Pearson*
4. *Financial Management, I.M. Pandey, Vikas*
5. *Human Resource Management, Aswasthapa, TMH.*
6. *Modern Business Organisation & Management by Sherlekar, Himalaya Publishing House.*

## HSSM3302 **OPTIMIZATION IN ENGINEERING** (3-0-0)

### **Module-I (10 Hours)**

Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.

**Linear programming:** Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming

### **Module -II (10 Hours)**

**Transportation problems:** Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel's approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method

**Assignment problems:** Hungarian method for solution of Assignment problems

**Integer Programming:** Branch and Bound algorithm for solution of integer Programming Problems

**Queuing models:** General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

### **Module -III (10 Hours)**

**Non-linear programming:** Introduction to non-linear programming.

**Unconstrained optimization:** Fibonacci and Golden Section Search method.

**Constrained optimization with equality constraint:** Lagrange multiplier, Projected gradient method

**Constrained optimization with inequality constraint:** Kuhn-Tucker condition, Quadratic programming

Introduction to Genetic Algorithm.

### **Recommended text books**

1. A. Ravindran, D. T. Philips, J. Solberg, " *Operations Research- Principle and Practice*", Second edition, Wiley India Pvt Ltd
2. Kalyanmoy Deb, " *Optimization for Engineering Design*", PHI Learning Pvt Ltd

### **Recommended Reference books:**

1. Stephen G. Nash, A. Sofer, " *Linear and Non-linear Programming*", McGraw Hill
2. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis," *Engineering Optimization*", Second edition, Wiley India Pvt. Ltd
3. H.A.Taha,A.M.Natarajan, P.Balasubramanie, A.Tamilarasi, " *Operations Research*", Eighth Edition, Pearson Education
4. F.S.Hiller, G.J.Lieberman, " *Operations Research*", Eighth Edition, Tata McDraw Hill
5. P.K.Gupta, D.S.Hira, " *Operations Research*", S.Chand and Company Ltd.

## PCEV4302 **ENVIRONMENTAL BIOLOGY AND ECOLOGY** (3-1-0)

### **MODULE-I**

Ecology, Definition, Branches and Scope of ecology. Ecological adaptation & concept of limiting factor. Different types of ecosystem in India. Structural and functional attributes of an ecosystem. Biotic and Abiotic components, Food chain, Food web and energy flow. Ecological succession. Biogeochemical cycle.

### **MODULE-II**

Concept of population & population attributes. Concept of carrying capacity and environmental resistance. Development and evolution of ecosystem. Population interaction. Qualitative and quantitative characteristic of a plant community.

### **MODULE-III**

Effects of different types of pollution on aquatic biota, Effect of eutrophication. Concept of stress & strain. Definition and function of Biomonitoring. Biotechnology- Fermentation, Vermiculture and Biofertilizer technology.

### **Text Books:**

1. Fundamentals of Ecology by M.C.Dash & Satya Prakash Dash Tata Mc Graw-Hill Publishing company limited, New Delhi
2. Ecology & Environment by P.B.Sharma – Rastogi Publication.

### **Reference Books :**

- 1 Ecology by N .S. Su bramanyan etal - Narosa publishing House, New Delhi.
2. Biological indicators of fresh water pollution and environmental management, Elsevier, London.
3. Environmental pollution monitoring & control - S.M. Khopkar- New Age, New Delhi.
4. Fundamentals of Ecology by E.P. Odum – W.B. Foundation company

# PCEV4301 **ENVIRONMENTAL MICROBIOLOGY AND TOXICOLOGY** (3-1-0)

## **MODULE-I**

Methods of sterilization, Culture medium, Pure culture method. Classification of microorganism. Composition of microbial cells. Nutrition and growth in microorganisms. Energy generation and utilization, Pathways of metabolism.

## **MODULE-II**

Pathogenic micro organisms, microbial diseases like hepatitis, polio, bacterial dysentery, amoebiasis, typhoid. Microbial decomposition. Fungal diseases, Air borne microbes, Application of microbes in agriculture.

## **MODULE-III**

Toxicology:- Toxic substances and toxicity, environmental toxicants and its classification, Exposure to toxicants. Dose response relationship. Biotransformation of toxicants. Factors affecting toxicity.

Toxicity of metals like mercury, cadmium, arsenic lead, fluorides, toxicity of pesticides, Bio magnification, Antidotes and neutralization of toxicity.

## **TEXT BOOKS**

1. Microbiology – P.D.Sharma – Rastogi publication
2. Concept of Toxicology – Omkar – Shoban Lal Nagin Chand & Co.

## **Reference Books**

1. Microbiology— Chan etel-McGraw Hill-New Delhi

Lehninger Principles of Bio-Chemistry- Nelson & cox

PCEV4303 **WATER SUPPLY AND WASTE WATER COLLECTION SYSTEM** (3-0-0)

**MODULE-I**

**(Raw water collection and Treated water distribution System)**

Introduction and overview of urban and rural water supply system:- Sources selection, Population estimation, Design period, Domestic institution, commercial and industrial needs.

Preliminary Hydraulic design of pressure conduits system (Dead end method and loop network method. Water hammer, it's check in pipes and it's control devices.

Introduction to special and fitting in pipe lines, some examples of different types of valves, elbow, union etc.

**MODULE –II(Waste water collection systems)**

Types of surface and underground drainage system, their merits and demerits.

Types of sewerage- lateral, sub main , Main intercepting and outfall sewers.

Hydraulic design of gravity sewerage system – Sources, rate of domestic sullage and waste water flow, infiltration, ex-filtration, pick factor, pressure sewers.

Appurtenances – Manhole, Street inlet, Inverted siphon, House drainage connection, Sewer junction and transition. Waste water pumping - types of pumps.

**MODULE –III (Storm water collection systems)**

Overview of external storm water collection system – estimation of runoff and design of drains and sewers system. Hydraulic design of gravity storm drainage system. Open drains – Types of drains (Primary, Secondary and Tertiary)

Disposal of sullage water in rural area – septic tanks soak pits. Disposal in natural valley, agricultural and low lying area.

Text Books:-

1. Text book of water supply and waste water Engg. - Hammer etal.
2. Waste Welter Engg. - Metcalf and Eddy - McGraw Hill.

Reference Books:-

1. Design of waste water treatment systems - Quasim.

# PCEV4304 **WATER RESOURCES ENGINEERING** (3-1-0).

## **MODULE-I**

Water resources:- Water Wealth of India, River basins and their potential. Importance of water resources projects in the country. Rain water harvesting, Ground water recharge, Hydrologic cycle, concept of catchments and water budget equation.

Precipitation- Types, measurement, non-recording and recording type of rain gauge. computation of depth of precipitation over an area, Mass curve and consistency of rainfall data.

## **MODULE-II**

Water Losses - Infiltration, factors affecting infiltration, measurement of infiltration. Evaporation - factors affecting evaporation, measurement of evaporation. Evapo-transportation, factors affecting it and estimation, Run off, factors affecting run off, Basin yield, rainfall- run off relationship using regression analysis.

Stream gauging - Measurement of stage and velocity, Area- Velocity method, slope – area method, simple, Stage - discharge curve.

## **MODULE-III**

Hydrograph theory - Components of hydrograph, Separation of base flow, Module hydrograph theory.

Application of Module hydrograph.

Ground water hydrology-scope and importance. Occurrence of ground water. definitions:-aquifers, aquitard, aquifuge, aquiclude, perched aquifer, aquifer parameters . Darcy's law and its validity, steady radial flow into a well in confined and unconfined aquifers, pumping test and recuperation test.

### **Text Books:**

1. Engg. Hydrology:- K.Subramanya:- Tata McGraw Hill
2. Text Book of Hydrology:- Jayarami Reddy P-Laxmi Publication, New Delhi.

### **Reference Books:**

3. Hydrology & water resource Engg:-R.K. Shrama etal.
4. Engg Hydrology. K.M. Murteja.



## FEEV6301 ENERGY CONSERVATION AND ENVIRONMENT (3-0-0)

### MODULE-I

Introduction to Energy Sources: Indian Energy Scenario: Energy Consumption, needs and crisis, energy sources and availability.

Renewable Sources of Energy and Environment: Biomass- introduction energy plantation, biomass conversion technologies (wet and dry process) photosynthesis, agricultural waste derived energy, urban waste derived energy.

Bio- Gas: Generation, factors affecting bio-digestion, advantages of anaerobic digestion, classification of bio-gas plants. Submergence, Ecological Imbalance, Catchments Area Treatment.

Hydropower: Site selection for hydroelectric power plants, classification of hydroelectric power plants, submergence, ecological imbalance, catchments area treatment, advantages and disadvantages of hydroelectric power plants.

### MODULE-II

Non-renewable Energy Sources and Environment: Coal, natural gas-site selection for thermal power plants, fuels for thermal power plants, ash handling systems (brief) Associated Environmental Effects.

Oil : Diesel and electric power plants, essential compounds of diesel – electric plants (types); natural gas - classification and comparison of different gas turbine power plants, Associated Environmental Effects.

Nuclear Energy: Why nuclear power for developing countries, general components of nuclear reactions, different types of reactors, breeding reactors, location of nuclear power plants, disposal of nuclear wastes, Associated Environmental Effects.

### MODULE-III

Alternative sources of renewable energy

Energy form Oceans: ITEC ( 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).

Wind Energy: Introduction, basic principles of wind energy conversion. Site selection considerations. Basic components of wind energy conversion system. Wind energy collectors.

Geo-thermal Energy: Introduction, nature of geothermal fields, geo-thermal source, binary fluid geo-thermal power system.

#### Text Book:

1. Wilber L.C., Handbook of Energy Systems Engineering, Wiley and Sons, 1989.
2. Mathur A.N. and Rathore N.S., Renewable Energy and Environment, Proceedings of the National Solar Energy Technology, Himanshu Publications, Udaipur.

#### Reference Book:

3. Rao and Parulekhar B.B energy Technology - Non-conventional, Renewable and Conventional, 2<sup>nd</sup> Edition, Khanna Publishers, 1977.
4. Saha H., Saha S.K., and Mukherjee M.K., Integrated Renewable Energy for Rural Development, Proceedings of the National Solar Energy Convention. Calcutta, India, Dec. 19-21 (1990).
5. G.D. Rai, Non-conventional Energy Sources, Khanna Publications.
6. Domkundwar, Power Plant Engineering, Khanna Publications.

## FEEV6302 **Public Health and Sanitation** (3-0-0)

### **Module-I**

Water sanitation:- Sanitary consideration for location and construction of wells. Water impurities and biological contamination of water, Water pollution and health, water purification, Drinking water Standards & their significance.

### **Module-II**

Refuse sanitation :- Refuse collection & disposal, quantitative & qualitative characteristics of garbage.

Food sanitation:- Food and Drug act, Food poisoning Balance diet. Food storage and preservation principles of milk sanitation.

### **Module-III**

Industrial hygiene:- Elementary Physiological hygiene, Factors affecting health, Comfort Productivity, Occupational health hazards in industry.

### **Book:-**

1. Food & Nutrition by Gupta.

# SESSIONAL

## PCEV7301 **MICROBIOLOGY & TOXICOLOGY** **ENVIRONMENTAL MONITORING LAB-II** (0-0-3)

1. Introduction-Lab layout, lab apparatus washing, sterilization, sampling procedure collection,- Transportation and handling preparation of culture media.
2. Bacteriological examination of recreational water.
3. Plate count, multiple tube fermentation Techniques (3 and 5 tubes) 0 and membrane filter technique for coliform.
4. Rapid detection methods for coliform.
5. Bacterial cell immobilization and mixed culture tests.
6. Identification of plankton and fungi.
7. Bioassay tests for aquatic organisms demonstration.
8. Fluoride from ground water
9. Pb, Cd, Hg and Cr from waste water samples.
10. Preparation of LC<sub>50</sub>, LC<sub>100</sub>, LD<sub>50</sub> and LD<sub>100</sub>.

### **BOOKS**

1. Standard methods for the examination of water and waste water--AWWA, APHA.
2. Lab. Manual for microbiological studies - Gunashekarana
3. Microbiology lab. Manual by pepper and Bxndecke.

## PCEV7302 **ENVIRONMENTAL MONITORING** **LABORATORY-III.**

### **(ENVIRONMENTAL CHEMISTRY ) - (0-0-3)**

1. Introduction process laboratory equipment and their applications.
2. Determination of Dissolved oxygen.
3. Chlorine demand in water
4. Available chlorine in bleaching powder.
5. Residual chlorine in water.
6. Filtration - Single media and Dual media.
7. Biochemical Oxygen Demand (BOD) from recreational and waste water.
8. Experimental studies on Flocculation and sedimentation process.  
(Jar Test, Column- Test, Pebble Bed Flocculator)
9. Grain size analysis Effective size, uniformity coefficient.
10. Determination of Chemical Oxygen Demand (COD) from waste water.
11. Productivity measurement of any water body.

### **BOOKS**

- 1) Standard methods for examination of water - APHA, AWWA, WPCF- Washington DC.
- 2) Chemistry for environmental engineers- Sawyer - McCarty- McGraw Hill.

## PCEV4305 **WATER AND WASTE WATER ENGINEERING-I** (3-1-0)

### **MODULE-I** (Surface Water Treatment System )

Quality of raw water (turbidity, Suspended solid, odors, colours, organic matters)  
Aeration, Flocculation, Coagulation, Sedimentation, Filtration – Slow sand filter, Gravity and pressure filters, Disinfection – common disinfectants, types of chlorination – Breakpoint chlorination, chlorine demand and safety measures.

### **MODULE-II** (Waste Water Treatment System )

Pretreatment (Screening and Grit removal), Bar Screens, Sedimentation, Suspended and fixed growth systems, Aerobic and Anaerobic system, Activated sludge process, Trickling filters, biological contactors, Biofilters, Secondary sedimentation tanks, Stabilization ponds – Aerobic, facultative, Anaerobic lagoons

### **MODULE-III**

Characterization of sludge - Quantity, Quality and volume, sludge mass balance, Sludge pumping, Thickening, Stabilization, Dewatering, Sludge Drying beds, Disposal of wastes

### **Text Books :**

1. Waste water engineering, by Metcalf & Eddy - McGraw Hill.

### **Reference Books**

2. Design of waste water treatment systems - Quasim.

3. A text book of water supply and waste water engineering - Hammer etal

## PCEV4306 **FUNDAMENTALS OF AIR POLLUTION** (3-0-0)

### **MODULE - I**

Air Pollution: atmospheric structure and composition, scales of air pollution problem-local, urban, regional, continental and global.

Natural and anthropogenic pollutants, emission inventory source classification, primary and secondary pollutants, properties of major air pollutants along with sources and sinks, particulates and gases. Modules of measurements of air pollutant. Simple problems on Module conversion. Photochemical air pollutants, Air pollution due to automobiles. Smoke and its measurement.

Air pollutants effects on human health and welfare, vegetation, animals, materials and structure, Acid rain, Green house effect, Ozone depletion and Heat island effect.

### **MODULE - II**

#### **MEASUREMENT OF AIR POLLUTANTS.**

Measurement of gaseous (CO, HC, NO<sub>x</sub>, SO<sub>2</sub>) and particulate pollutants, sampling devices, sampling train, sampling methods/ techniques, stack sampling techniques. Ambient Air quality standard (CPCB). Air pollution indices- determination of pollution index by different methods.

### **MODULE -III**

**ATMOSPHERIC DISPERSION OF STACK EFFLUENTS:** Plume rise, effective stack height, guide lines for fixing stack height, problems on plume rise' calculations. Gaussian plume model- for point source. Gaussian dispersion coefficients, Pasquill - Gifford atmospheric stability classification.

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 behavior under different atmospheric stability, effect of topography on pollutant dispersion.

Down ground-level concentration computation, maximum ground level concentration. Instantaneous puff. Dispersion model. Estimate for various sampling times and decay of pollutant.

**NOISE POLLUTION:** Sources of noise, effects of noise pollution, Modules & measurement or noise, control of noise pollution, standards. Equations & Application.

#### **Text Books:-**

1. Wark.K., Warner C.F. and Davies W.T., Air Pollution- Its Origin and Control., Harper & Row Publishers, New York, 1998.
2. Boubel R.W., Donald L.F., D.B. Turner & A.C. Stern Fundamentals of Air Pollution, Academic Press, 1994.

#### **Reference Books:-**

1. Sincero A.P. and Sincero G.A., Environmental Engineering- A Design Approach., Prentice of India, 1999.
2. Henery. C. Perkins-Air Pollution McGraw Hill.
3. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero- PHI Pub

# PCEV4307 **SOLID & BIO-MEDICAL WASTE MANAGEMENT** (3-1-0)

## **MODULE-I**

**INTRODUCTION:** Definition, Sources, Composition and Properties of Municipal Solid Waste. Generation, Collection rates, waste handling and separation, storage and processing at the source.

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

## **MODULE-II**

**DISPOSAL:** Landfill, Classifications, Types, Siting Considerations, Generation, movement and control of gases and leachates, layout and preliminary design of landfills.

### **Processing of Solid Waste**

Aerobic, Anaerobic digestion, Composting, Incineration and energy Production.

## **MODULE-III**

Biomedical waste management :- Sources, Hazardous associated with bio-medical wastes, Biosafety, Storage of biomedical wastes, disposal and processing.

## **TEXT BOOKS :-**

1. Environmental Engineering by G. Kiely McGraw Hill

## **Reference Books:-**

1. George Tchobanglous, Hilary Theisen and Samuel A. Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues (1993).TMH.
2. Bhide and Sundaresan (2000), Solid Waste Management in Developing countries, Indian National Scientific Documentation Centre. New Delhi.
3. CPHEEO Manual on Solid Waste Management.
4. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero- PHI Pub
5. A Versiland, Solid Waste Engineering, Thanson Books.

# PCEV4308 **ENVIRONMENTAL IMPACT ASSESSMENT** (3-0-0)

## **MODULE-I**

Introduction to environmental impact analysis. EIA under NEPA (National Environmental Policy Act), Methodologies screening and scoping criteria, Rapid and comprehensive EIA, Environmental health impact assessment. Environmental risk analysis.

## **MODULE-II**

Applications of EIA - Base line collection data, prediction and assessment of impacts of physical, Biological and socioeconomic environment, Generation of environment management plan, post project monitoring. EIA report and EIS review process. Methodologies and evaluation techniques of EIA, their selection for specific projects. Impact identification, Impact prediction, Evaluation and mitigation, monitoring and auditing in EIA process.

## **MODULE-III**

Public participation in decision making. Rehabilitation of degraded landscape, Water bodies, mangroves. Sustainable development concept and strategies, cost benefit analysis, Environmental priorities in India and sustainable development. Case studies of reservoir and irrigation projects, ports, mining areas, coastal and industrial zones.

### **Text Books:-**

1. Environmental Impact assessment - Y. Anjaneyulu etal

### **Reference Books:-**

1. Environmental impact analysis - R.K. Jain etal
2. Environmental Engineering by G. Kiely McGraw Hill
3. Environmental Impact assessment - Larry W. Canter- McGraw Hi11.

## Free Elective

### FEEV6303 **RECYCLE AND REUSE TECHNOLOGY** (3-0-0)

#### **MODULE-I**

Waste as a resource - Disposable materials, recycling, collection processing, potential for Reuse.

Waste Analysis--Sampling, composition, categorization, Determination of waste properties, Ash and fires Analysis, Energy content.

#### **MODULE-II**

##### **Recycling System**

Design of recycling systems, collection system, process Train design, and complexity, product design of Recycling, conveyance, Transport safety. Efficiency of operation systems.

Water reuse - Direct and indirect reuse, Ground water recharge, examples of water Reuse, Close. cycle and open cycle Reuse, Recreational Reuse.

#### **MODULE-III**

Energy recovery - Combustion, energy losses, Energy recovery Analysis, Emission control, Residence control, In plant operations, Refuse derived fuel.

Metal recovery-- Ferrous metals- Non-ferrous metal separation,

Reuse of industrial effluent - urban effluent reuse in Arid and semi-Arid zones. uses of sewage in pisci culture, Ground water recharge of sewage effluent.

#### **Text Books:-**

1. Recycling and .Resource recovery engineering - Springer - Springer- Verlag-Berlin.



FEEV6304 **Statistical Methods for Environmental Analysis**  
(3-0-0)

**Module-I**

Data analysis, Sample and Sampling design, Dispersion of data and measurement of dispersion and central tendency in data (mean, median & mode), Natural, binominal and Poisson distributions.

**Module-II**

Test of hypothesis, Type-I & Type-II errors, Significance of data t-test & Chi-square test.

**Module-III**

Association analysis, Correlation and Linear regression analysis, Analysis of variance one and two factor design.

**Text Books:-**

1. Biostatics by Mishra & Mishra
2. Statistical Methods by S. C. Gupta

## **ENVIRONMENTAL MONITORING LAB-IV (AIR MONITORING LAB.) (0-0-3)**

1. Introduction to atmospheric monitoring - particulate sampling - Dust Fall. Pollution suspended particulates and total particulate matters using H.A.S.
2. Estimating sulphur dioxide in Ambient air using High volume air sampler.
3. Estimating Nitrogen dioxide in Ambient air using High Volume of Air sampler.
4. Stack sampling Techniques and Demonstration of stack monitoring.
5. Exercises on Ambient gas monitoring using GASTEC DEVICE Demonstration/ Exercises on Air pollution control Devices - Bag filter, Scrubber, Cyclone and ESP.
6. Exercises on Auto Exhaust analyzer for petrol vehicle.
7. Exercises on smoke density meter for Diesel engines.
8. Exercises on Noise measuring instrument.
9. Exercises on luxmeter (light measuring instrument.)
10. Demonstration- wind monitoring and Analysis of Data for wind rose diagram. Demonstration of Rain Gauge.
11. Humidity measurement

### **Books :-**

1. Air pollution and control- H.C. Perkin.
2. Air pollution theory and control- Stern.

# **DESIGN AND DRAWING OF ENVIRONMENTAL SYSTEMS (0-0-3)**

1. Introduction- Preparation of layout of water supply system for a two storey building.
2. Design and Drawing of canal/ River and Reservoir intake.
3. Drawing of bore well / Infiltration well for Rural areas.
4. Design and Drawing of Cascade Aeration Module.
5. Design and drawing of flocculation and sedimentation Modules (plan and sectional elevation)
6. Design and Drawing of Rapid and Filters (plan and Section)
7. Design and Drawing of Hydraulic profile for water treatment Module.
8. Design and drawing of Defluoridation and softening Modules.

## **Books:-**

1. AWWA, Water Quality treatment, McGraw Hill.
2. Water supply and pollution control Viessman and Hammer. Harper Collins.

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# BIJU PATNIK UNIVERSITY OF TECHNOLOGY, ORISSA

## Environmental Engineering

<u>7<sup>th</sup> SEMESTER</u>				<u>8<sup>th</sup> SEMESTER</u>			
<i>THEORY</i>		<i>Contact Hours</i>		<i>THEORY</i>		<i>Contact</i>	
<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>	<i>Code</i>	<i>Subject</i>	<i>L-T-P</i>	<i>Credits</i>
PCEV4401	Water & Waste Water Engineering-II	3-0-0	3	HSSM3403	Marketing Management	3-0-0	3
	<b>Professional Elective – III (Any One)</b>	3-0-0	3	PCEV4402	Hazardous Waste Management	3-1-0	4
PEEV5401	Instrumental Methods for Environmental Monitoring /						
FEEV6401	Biological Treatment Processes			PCEV4403	Environmental Management (Laws, Policy and Regulation)	3-0-0	3
	<b>Professional Elective – IV (Any One)</b>	3-1-0	4				
PEEV5402	Air & water Pollution Control Engineering.						
FEEV6407	Environmental System Modelling.						
	<b>Free Elective – III (Any One)</b>						
FEEV6402	Occupational Safety & Health	3-0-0	3		<b>Professional Elective – V (Any One)</b>		
FEEV6403	Environmental System Optimization			PEEV5403	Industrial Liquid Waste Management	3-0-0	3
PEEE5401	Soft Computing			PEEI5403	Industrial Instrumentation		
	<b>Free Elective – IV (Any One)</b>				<b>Free Elective – V (Any One)</b>		
FEEV6404	Environmental Geo-Science	3-0-0	3	FEEV6406	Computer Application in Environmental Engineering	3-0-0	3
FEEV6405	Natural Resources and Management			FEEV6408	Industrial Health and Safety Management		
PEEC5403	Biomedical Instrumentation			FEEV6409	Environmental Aspects of Developmental Projects		
	Credits (Theory)		16		Credits (Theory)		16
	PRACTICALS/SESSIONALS				PRACTICALS/SESSIONALS		
	<i>PRACTICALS/SESSIONALS</i>				<i>PRACTICALS/SESSIONALS</i>		
PCEV7401	Environmental Monitoring Lab-VI	0-0-3	2	PCEV7404	Seminar	0-0-3	3
PCEV7402	Project (Stage-I)	0-0-6	3	PCEV7405	Project (Final Stage)	0-0-5	5
PCEV7403	Seminar	0-0-3	2	PCEV7406	Entrepreneurship Project	0-0-2	2
	Credits (Practicals / Sessionals)		7		Credits (Practicals / Sessionals)		10
	TOTAL SEMESTER CREDITS		23		TOTAL SEMESTER CREDITS		26
	TOTAL CUMULATIVE CREDITS		183		TOTAL CUMULATIVE CREDITS		204

## **WATER AND WASTE WATER ENGG-II (3-0-0)**

### **MODULE-I**

Removal of Refractory organics – Adsorption isotherm, Operation and design procedure for activated carbon adsorption column.

Immobilized cells in waste water treatment, Enzymes and microbial cell immobilization, whole-cell immobilization, Immobilized cell reactors.

### **MODULE-II**

Hydraulic design of septic tanks, up-flow anaerobic sludge. Blanket reactor (VASB), up-flow packed bed attached growth reactor. Anaerobic sludge digestion, digestion and stabilization, Gas generation, removal of dissolved inorganic substances – chemical precipitation, Nutrient removal, Iron exchange method, Reverse osmosis, Electro dialysis, membrane filtration

### **MODULE:--III**

Treated waste water disposal on land and its osmotic effects and toxic effects, Tertiary treatment of wastewater ----- disinfection, Reuse of treated waste water as cooling water, Process water in industrial and agricultural sludge disposal.

### **TEXT BOOKS:**

1. Waste Water Engineering – Metclaf & Eddy.
2. Text book of Water Supply & Waste Water Engineering – Hammer Etal.

### **Reference Books :-**

1. Environmental Engineering By Howard S. Peavy, Donald R. Rowe & George Tehobanoglous.
2. Sewage Disposal and Air Pollution Engineering S.K. Gerg.
3. Environmental Engineering – Gerard kiely

# **INSTRUMENTAL METHODS FOR ENVIRONMENTAL MONITORING (3-0-0)**

## **MODULE-I**

Potentiometric titrations, Ion-selective electrodes Electrophoresis, Principle and techniques of adsorption chromatography, paper chromatography and High performance liquid chromatography.

## **MODULE-II**

Basic principles and applications U.V- visible and I.R. spectroscopy.

## **MODULE-III**

Basic principles and applications of atomic absorption spectroscopy (AAS) and Atomic Emission spectroscopy (AES). Flame photometry.

### **Text Books:-**

1. Instrumental methods of Analysis – Merrit and Dean et. al – Van No Strand

### **Reference Books :-**

1. Instrumental methods of Analysis – G.W. Ewing – McGraw Hill.
2. Analytical Chemistry, Theory & Practice by U.N Das, Sultan Chand & Sons, New Delhi
3. Spectrochemical methods of analysis – Ingle and crouch – Prentice Hall.
4. Instrumental methods of chemical analysis – B.K. Sharma
5. Instrumental Methods of Chemical Analysis – G. R. Chatwla and A.K. Anand

# **BIOLOGICAL TREATMENT PROCESSES (3-0-0)**

## **MODULE-I**

Micro organisms and their metabolism, Substrate utilization and their application to biological treatment, biological nutrient removal (Nitrification, Denitrification and phosphorous removal). Production of enzymes by micro organism. Biodegradation of xeno-biotic organic chemicals.

## **MODULE-II**

Aerobic and anaerobic suspended and attached growth systems, Activated sludge treatment process and hydraulic design, Reactor configuration, Process analysis, design and control.

## **MODULE-III**

Trickling filter, Rotating Biological Contactor (RBC), Fluidized Aerobic Bioreactor ( FAB), Fluidized Bed Bio-reactor (FBBR), Restoration of degraded land, Biogas from wastes, Batch and continuous stirred tank reactors.

### **TEXT BOOKS :-**

1. Biology of waste water treatment –N.F. Gray –Oxford Univ. Press.
2. Waste water Engg- Treatment, disposal and reuse –Metcalf and Eddy- McGraw Hill.

### **Reference Books :-**

1. Waste water treatment for pollution control-S.J Arceivala- Tata McGraw Hill.

# **AIR AND WATER POLLUTION CONTROL ENGINEERING (3-1-0)**

## **MODULE-I**

Air pollution control - Nature and characteristics of gaseous and particulate pollutants. Control of gaseous emissions by absorption, adsorption, condensation, chemical transformation and combustion methods. Control of particulate emissions by mechanical collectors, settling chambers, inertial separators, cyclones, fabric filters, bag filters, electrostatic precipitators wet scrubbers. Air pollution control systems for selected industries - fertilizer, cement, paper, refinery and mineral.

## **MODULE-II**

Effluent standards, physical, chemical and biological water quality parameters. Industrial waste water- treatability studies – segregation. Control of pollutants Coagulation, sedimentation, thickening, precipitation, biological oxidation, bio-methanation, adsorption, Ion - exchange membrane separation, Chemical oxidation, sludge disposal method.

## **MODULE-III**

Control of water pollution from distillery, pulp and paper, textile, fertilizer, tanneries, food and pesticide industries.

### **Text Books:**

1. Air pollution control engineering - N.de.Nevers - McGraw Hill.
2. Industrial pollution - W.W. Eckenfelder - McGraw Hill.
3. Environmental Engineering by S. Peavy, Donald R. Rowe Gergge Tchobanoglous-McGraw Hill.

### **Reference Books :**

1. Air Pollution engineering Manual - A.J. Buonicore & W.T. Davies – Van Nostrand
2. Physico-Chcmical processes for water quality Control -W.J. Weber, Job Willy & Sons.
3. Environmental Engineering – Gerard kiely
4. Air Pollution by Henry C. Perkins - McGraw Hill.

# **ENVIRONMENTAL SYSTEM MODELING (3-1-0)**

## **Module -1**

Definition, Classification, examples and models of environmental systems, Purpose of modeling, Problem in modeling.

## **Module – II**

Introduction to air quality models, Air pollution meteorology, Atmospheric turbulence, Gaussian Plume model and modifications. Simulation of special meteorological and topographic conditions. Air Pollution control models.

## **Module – III**

Water quality and water resource management models. Dissolved oxygen and temperature in rivers solid waste generation models.

## **TEXT BOOKS : -**

1. Principles of surface water quality modeling and control – R.V. Thomas and J.A. Muller – Harper int. Edn.

## **Reference Books :-**

1. Fundamentals of air pollution – Richard W. Boubel, Donald L. Fox, D.Bruce Turner, Arthur C. Stera – Academic Press
2. Environmental Pollution – S.M. Khopkar



# OCCUPATIONAL HEALTH AND SAFETY (3-0-0)

## MODULE-I

Occupational Safety and Health Act, Occupational Safety and Health Administration, Right to know Laws

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

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

## MODULE-II

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

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

## MODULE-III

**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.

**Occupational Health:** Health and Safety Considerations, Personal Protective equipments, 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.

## REFERENCES :

1. Colling D,A. Industrial Safety Management and Technology, Prentice Hall, New Delhi.
2. Jella D.E. and Giustina, Safety and Environmental Management, Van Nostrand Reinhold International Thomson Publishing Inc, 1996.
3. Anand Gopal Mukherjee, Environmental Pollution and Health Hazards :Causes and Control, Galgobio Publications Pvt. Ltd.
4. Trevethick R.A., Environmental and Industrial Health Hazards, William Heinemann Medical Books Ltd., London ( 1973).
5. David L. Goetsch, ( 1999), Occupational Safety and Health, 3rd Edition

# **ENVIRONMENTAL SYSTEM OPTIMIZATION ( 3-0-0)**

## **MODULE-I**

Formulation and Analysis of environmental systems, Mathematical modeling and optimization. Optimization and Algorithms.

Methods of Lagrange multipliers, unconstrained and constrained optimization, sequential search Algorithms, Box's Algorithms.

## **MODULE-II**

Linear programming models- Simplex method, Separable and integer programming, Transportation models, Dynamic Programming models, Assignment problems.

## **MODULE-III**

Applications to waste water management systems, water supply and waste water collection system, Agricultural non-point source pollution problem, air pollution control and management systems, solid waste collection.

### **Books:-**

1. Environmental Systems Optimization - D.A. Haith - John- Wiley.
2. Optimization Theory and Application - S.S. Rao - Wiley Eastern.

# SOFT COMPUTING (3-0-0)

## MODULE-I

(12 Lectures)

**Introduction:** Soft Computing Constituents and Conventional Artificial Intelligence, Neuro-Fuzzy and Soft Computing Characteristics.

**Fuzzy Sets:** Introduction, Basic Definitions and Terminology, Set Theoretic Operations, MF Formulation and Parameterization.

**Fuzzy Rules & Fuzzy Reasoning:** Extension Principle and Fuzzy Relations, Fuzzy If-Then Rules, Fuzzy Reasoning.

**Fuzzy Inference Systems:** Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models, Other Considerations.

(BOOK-1:- Chap-1: 1.1 to 1.3, Chap-2: 2.1 to 2.4, Chap-3: 3.2 to 3.4 & Chap-4: 4.2 to 4.5)

## MODULE-II

(14 Lectures)

**Neural Networks:** Neuron Abstraction, Neuron Signal Functions, Mathematical Preliminaries, Neural Networks Defined, Architectures: Feed forward and Feedback, Salient Properties and Application Domains of Neural Networks, Multi-layered Network Architectures, Back-propagation Learning Algorithm, Practical Considerations in Implementing the BP Algorithm, Structure Growing Algorithms, Universal Function Approximation and Neural Networks, Applications of Feed Forward Neural Networks, Reinforcement Learning, Radial Basis Function Networks, Regularization Theory Route to RBFNs, Generalized Radial Basis Function Network, Learning in RBFNs, Associative Learning, Hopfield Network, Content Addressable Memory, Bidirectional Associative Memory, Self Organizing Feature Maps, Applications of the Self Organizing Map.

(BOOK-2:-Chap-3: 3.1 to 3.6, Chap-6: 6.1 to 6.2, 6.5 to 6.6 & 6.8 to 6.10, Chap-8: 8.4 to 8.7,

Chap-10: 10.2 & 10.5 to 10.6 & 10.16 and Chap-12: 12.8 to 12.9)

## MODULE-III

(08 Lectures)

**Regression & Optimization:** System Identification: an Introduction, Least Squares Estimator, Geometric Interpretation of LSE, Recursive Least Squares Estimator.

**Derivative-Free Optimization:** Genetic Algorithms, Simulated Annealing, random Search, Downhill Simplex Search.

**Adaptive Neuro-Fuzzy Inference Systems (ANFIS):** ANFIS Architecture, Hybrid Learning Algorithm.

(BOOK-1:- Chap-5: 5.1, 5.3 to 5.5, Chap-7: 7.2 to 7.5 and Chap-12: 12.2 to 12.3)

## TEXT BOOK:

1. “**Neuro-Fuzzy and Soft Computing**” By J.-S.R.Jang, C.-T.Sun & E. Mizutani, PHI
2. “**Neural Networks: A Classroom Approach**” By Satish Kumar, TMH Education

## Reference Book:

1. “**Neural Networks Fuzzy Logic & Genetic Algorithms; Synthesis & Applications**, S.Rajasekaran & G.A. VijayaLaxmi Pai, Prentice Hall, India, May’2006- LakshmiPai
2. Principle of Soft Computing, S.N. Sivanandan & S.N. Deepa, Wiley India Edition,2010.

## **ENVIRONMENTAL GEOSCIENCE ( 3-0-0)**

### **MODULE-I**

Internal structure and composition of Earth, Lithosphere. Types of rocks. Weathering of rocks, soil profile, Soil erosion. Geological site investigation- Dams. Reservoirs, Bridges Tunnels. Silting of reservoirs.

Chemical composition. Mineral resources- Properties, and uses of some important minerals. New areas of exploration of mineral resources. Environmental impact of exploitation, processing and smelting of minerals.

### **MODULE-II**

Water resources:- Hydrological cycle, water bearing properties of rocks and soils, methods of ground water exploration with respect to civil engineering, global water balance, Effects of withdrawal of ground water, recharge of groundwater.

### **MODULE-III**

Natural Hazards –Earthquake-causes and effects ,Measurement of intensity and location of Epicenter. Floods, cyclones. Lands slides-causes and control Metrology.

### **BOOKS**

1. Engineering Geology - B.S. Sathyanarayana Swamy.
2. Principles of Engineering Geology and Geotechniques - Krynine & Judd.
3. Ground water Hydrology - D.K. Todd.
4. Engineering and General Geology - Parbin\_Singh.

## **NATURAL RESOURCES AND MANAGEMENT (3-0-0 )**

### **Module-I**

Concept of natural resources, Renewable and Non-renewable resources, Coal, Bauxite, Iron ore and manganese resources of India in general and Odisha in particular.

### **Module-II**

Forest resources:- Biodiversity resources like fishery resources, forest & wild life resources, management of wild life, Mangrove plantations, Environmental effects of deforestation, Land resources – Classification of land resources. Range land & its management.

### **Module-III**

Fuel Resources:- Coal petroleum, Natural gas, Solar energy resources, Hydrogen as future fuel, Energy from biomass – Biomass as fuel, Biogas plant & generation. Use of biogas.

### **Test Books: -**

1. Environmental chemistry by A.K. Dey. New Age International publisher.

# BIOMEDICAL INSTRUMENTATION

## Module – I (10 Hours)

**Fundamentals of Biomedical Instrumentation:** Sources of Biomedical Signals, Basic Medical Instrumentation System, Intelligent Medical Instrumentation Systems, PC Based Medical Instrumentation Systems, General Constraints & Regulations of Medical Devices

**Biomedical Signals & Electrodes:** Origin of Bioelectric Signals-Repolarization, Depolarization, Resting Potential Recording Electrodes – Ag-AgCl Electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes, Skin Contact Impedance, Motion Artifacts

## Module – II (13 Hours)

**Physiological Transducers:** Introduction to Physiological Transducers, Classification of Transducers, Pressure Transducers, Transducers for Body Temperature Measurement, Biosensors, Smart Sensors

**Biomedical Recording Systems:** Basic Recording Systems, General Considerations for Signal Conditioners, Biomedical Signal Analysis Techniques, Signal Processing Techniques, Writing Systems: Direct Writing Recorders, Inkjet Recorder, Potentiometric Recorders, Digital Recorders

**Biomedical Recorders:** Electrocardiograph (ECG), Phonocardiograph, Electroencephalograph (EEG), Electromyograph (EMG)

## Module – III (14 Hours)

**Patient Monitoring Systems:** System Concepts, Measurement of Heart Rate, Blood Pressure Measurement, Measurement of Respiration Rate

**Blood Flow meters:** Electromagnetic Blood Flow meter, Ultrasonic Blood Flow meter, NMR Blood Flow meter, Laser-Doppler Blood Flow meter

**Patient Safety:** Electric Shock Hazards, Leakage Currents, Safety Codes for Biomedical Equipment

### Text Books:

1. Hand Book of Biomedical Instrumentation-2<sup>nd</sup> Edition by R.S.Khandpur, Tata McGraw Hill 2003 (Chapters 1-6,11,18)
2. Biomedical Instrumentation and Measurements-2<sup>nd</sup> Edition by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, PHI learning Pvt Ltd 2<sup>nd</sup> Edition

### Reference Books:

1. Introduction to Biomedical Equipment Technology-4<sup>th</sup> Edition by Joseph J. Carr, John M. Brown, Pearson Education 2007

## **ENVIRONMENTAL MONITORING LAB-V**

### (Instrumentation Lab)(0-0-3)

1. PH measurement - water, waste water and soil.
2. Conductance measurement.
3. U.V- visible spectral measurements.
4. Chromatographic experiments:-  
Paper chromatography, Thin layer chromatography and column chromatography.
5. Electrophoresis.
6. Colorimetry.
7. Fluorimetry and Phosphometry.
8. Centrifugal Analysis
9. Flame Photometry Analysis
10. Nephelometric Analysis

#### **BOOKS**

1. Instrumental methods of Analysis - G.W. Ewing - McGraw Hill.
2. Instrumental methods of analysis - Merritt and Dean etal - Van No strand.
3. Spectrochemical methods of analysis - Ingle and crouch - Prentice Hall.

## **MARKETING MANAGEMENT (3-0-0)**

**Objective of the Course:** The course aims at introducing the basic concepts of marketing to the undergraduate students in engineering. The learning shall help the students in better designing, manufacturing and selling product/ service packages keeping competitive market, customers and cost in view.

### **Module – I (10 hours)**

Marketing Management: Concept, Process, Functions and relevance in the current context.

Marketing Environment: Elements of micro and macro environment

Competition Analysis: Factors contributing to competition, porter's five forces model, Identifying and analyzing competitors.

Marketing Planning : Exploring Opportunity, Product –market selection, Marketing Planning Process.

Market Research and Information Systems: Research Process, The Internet and World Wide Web based Information collection and processing, Database, Data Warehouses and Data Mining, Global Market Research.

Consumer Behavior: Factors influencing consumer behavior, consumer decision process. Organizational buying behavior.

### **Module II (10 hours)**

Market Segmentation, Targeting and Positioning: Definition, Bases of segmenting consumer and Industrial markets. Target Market strategies: Market Positioning.

Market Demand Forecasting: Key Terms, Forecasting Tools: Short term tools: Moving average and Exponential smoothing methods, Long-term forecasting Tools: Time series analysis, Econometrics methods, Qualitative tools : Buying Intention Survey, Sales Force Opinion and Delphi Techniques.

Product Planning : Product Life Cycle, New Product Development Process, Branding Strategy, Positioning a Brand, Brand Equity, Packaging and Labeling, Product-mix and Product Line, Planned Obsolescence.

### **Module – III (10 hours)**

Pricing Decision: Objectives and Factors influencing pricing, Pricing method and strategies.

Integrated Marketing Communication(IMC)- Concept of IMC, the marketing communication process, Promotion Mix, elements of promotion mix, Direct marketing.

Channels of Distributions: Types of intermediaries, functions of distribution channels, channel levels, Designing Distribution Channels, Physical Distribution, Supply Chain Management (Basic only).

Trends in Marketing: Green Marketing, Customer Relationship Management, E-marketing, Rural Marketing and Service Marketing (concepts only)

### **Books:**

#### **Text Book:**

1. Etzel , Walker ,Stanton and Pandit, *Marketing*, 14/e, Tata McGraw Hill.
2. Saxena, *“Marketing Management”* Tata McGraw Hill, 4/e.

#### **Reference**

1. Grewal, Levy, *‘Marketing’* Tata McGraw Hill, special Indian edition.
2. Karunakaran *“Marketing Management”*, Himalaya Publishing House, 2010/e.
3. Kotler, Keller, Koshy and Jha, *“Marketing Management”*, 13/e, Pearson Education.

# **HAZARDOUS WASTE MANAGEMENT (3-1-0)**

## **MODULE-I**

Types of Hazardous wastes, Exposure and risk assessment, site assessment waste minimization and resource recovery.

Hazardous installations, Hazardous materials, survey of flammable substances, Toxic substances, Highly reactive substances, Radioactive isotopes, Radioactive Pathogens and mutagens, Toxic chemicals.

## **MODULE-II**

Environmental legislation – Characterization and treatment, Chemical, physical and biological treatment, thermal processes, transportation, storage, ground water contamination.

## **MODULE-III**

Disposal techniques - Open dumping, land filling, incineration, composting, potential methods of disposal- utilization, recovery and recycling. Injection well disposal, process selection and facility siting, Site remediation- Feasibility studies and management issues.

### **Text Books :**

1. Environmental Engineering – Kiely – Tata Mc Graw & Hill

### **Reference Books:**

1. Hazardous Waste Management - C.A. Wentz - McGraw Hill
2. Hazardous Waste Management Engineering - E.J. Martin and J.H Johnson- Van Nostrand.



# INDUSTRIAL LIQUID WASTE MANAGEMENT (3-0-0)

## MODULE –I

**Introduction** : Sources of Industrial Wastewaters. Industrial Wastewater Survey.

**Variation in Quantity and Quality of Industrial Wastewater:** Monitoring, Estimation of average characteristics and Loading with problems.

**Toxicity of Industrial Wastewaters to Aquatic Biota:** Testing Methods and Modules, Biomonitoring of Effluents.

## MODULE –II

**Joint Treatment:** Raw Industrial Wastes and Domestic Sewage after Mixing Partly or fully. Selection of Treatment Method.

**Approaches to Minimization of Industrial Wastewater:** Problem by Volume Reduction, Strength Reduction, Equalization, Neutralization and Proportioning. Design Examples.

## MODULE –III

**Treatability Studies for Industrial Wastewaters:** Jar Tests and Bench scale Reactor Studies. Estimation of Process Kinetic Parameters.

**Process Line Diagrams:** Characteristics, Effects and Treatment of Industrial Wastes of - Sugar Industry, Dairy, Distilleries, Pulp & Paper, Pharmaceuticals, Tanneries and rood processing textile, fertilizer and steel Industries. Wastewater reuse and Waste Recovery from Different Industries.

## TEXT BOOKS:-

1. Nemerow N. L., Liquid waste of industry- theories, practice and treatment, Addison Wesle, 1982.
2. Mahajan S.P., Pollution Control in Process industry, TMH Co, 1987.

## Reference Books:-

1. Rao M.N., and Datta A.K., Wastewater Treatment, Oxford and IBM Publishers, 1987.
2. Patton C., Applied Water Technology, Campbell Petroleum Series, 1986.

# INDUSTRIAL INSTRUMENTATION

## **Module 1**

**18 Hours**

**Introduction:** Functional Units, Classification, Performance characteristics, Dynamic Calibration, Errors: An Overview, Statistical Error Analysis, Reliability and Related Topics (Chapter 1 of Text book)

**Instruments for Analysis:** Introduction, Gas Analysers, Liquid Analysers, X-ray Methods, Chromatography (Chapter 8 of Text Book)

## **Module II:**

**10 Hours**

**Telemetry:** Introduction, Pneumatic Means, Electrical Means, Frequency Telemetry, Multiplexing, Modulation, Modulation of Digital Data, Transmission Channels, Briefing of a Telemetry System in Operation, Wireless I/O (Chapter 10 of Text Book)

## **Module III:**

**10 Hours**

**Power Plant Instruments:** Introduction, The Power Plant Scheme, Pressure, Temperature, Flow and Level, Vibration and Expansion, Analysis, Flue Gas Analysis (Chapter 12 of Text Book)

**Hazard and Safety:** Initial consideration, Enclosures, Intrinsic Safety, Prevention of Ignition, Methods of Production, Analysis Evaluation and Construction (Chapter 13 of Text Book)

## **Text Book:**

1. Principles of Industrial Instrumentation, Third Edition, D Patranabis, Tata McGraw Hill Education Private Limited, New Delhi

## **Reference Books:**

1. Process/Industrial Instruments and Controls Handbook, Gregory K. Mc Millian Editor-in-Chief, Douglas M. Considine Late Editor-in-Chief

# **ENVIRONMENTAL MANAGEMENT (LAWS , POLICY AND REGULATIONS) (3-0-0)**

## **MODULE-I**

Water Act, 1974 - Preliminaries and Definitions, constitution of pollution boards, powers and functions of board, prevention and control of water pollution. Power of state Govt. Power to obtain information and take samples or effluents, restriction on new outlets and discharges, refusal or withdrawal or consent by state board, Power to give directions, penalties and procedure.

## **MODULE-II**

Air Act, 1981 and E. P Act, 1986 - Preliminaries, and definitions, Powers and functions of the board, Power to declare air pollution control areas, penalties and procedure, E.P. Act, 1986- Preliminaries, Power of Central Govt. to take measures to protect and improve environment, power to give directions, provisions under prevention, control and abatement of pollution, cognizance of offences, delegation of power.

## **MODULE-III**

Manufacture, storage and import of hazardous chemical rules, 1989., Biomedical. waste disposal act and solid waste: disposal Act, 1999 and 2000. Provisions of Forest Act wild life act.

International laws - UN Frame work convention on climate change, 1992, Vienna convention for protection of ozone layer, 1985, Montreal protocol, 1987, convention on bio-diversity, IUCN, 1948, W.W.F (World Wide Fund for Nature) Movements in India- Chipko, Narmada Bancho Movement etc.

### **Text Books:-**

1. Environmental Law by S.K.Nanda – Central Law publications.
2. Lal's Law Book, Vol- I & II

### **Reference Book:-**

1. Universal's Environmental Laws – Universal Law Publishing Co.Pvt.Ltd.

# **COMPUTER APPLICATIONS IN ENVIRONMENTAL ENGINEERING (3-0-0)**

## **MODULE-I**

Computer Aided Design (CAD)-Engineering design steps, software and analytical tools, requirement of CAD language. Population forecast programme arithmetic increase method, geometric increase method, incremental increase method logistic curve method.

## **MODULE-II**

Water supply treatment programme- Rising main design, pumping Module, service reservoir capacity calculation, Distribution network analysis and design- one to three loops. Water treatment Modules design- plain sedimentation tank, flocculater tank, filters, Mechanical rapid mix Module.

## **MODULE-III**

Sewer design, waste water treatment Modules, screen, Grit chamber, Secondary settling tank, ASP, Trickling filter, Waste stabilization pond, oxidation ditch, sludge digester, sludge drying beds and septic tanks.

Control quality programme on stack effective height calculation. Gaussian plume model for gaseous and particulate dispersion from point source, line source, Gaussian model, Instantaneous puff dispersion model.

# **INDUSTRIAL HEALTH, SAFETY AND MANAGEMENT (3-0-0)**

## **Module –I**

Industrial hazards:- Occupational hazards and pollution, Hazards in open cast and under ground mines, Hazards in storage, Handling and use, Hazards in work place, Hazards due to improper house keeping, Hazards in construction industries.

## **Module-II**

Industrial safety:- Accident, Injury, dangerous occurrence, Unsafe acts, Errorover sight, Mistakes etc. Safety department, Safety department, Structure and function of safety committee staff, leadership styles in safety management communication, Department in motivation, Physiological factors in Industrial safety.

## **Module-III**

Management:- Concept, Definition, Nature and importance, General principle of management, Elements of management functions, Evaluation of management thought and principles.

Books:-

1. Industrial safety – Hand Book II<sup>nd</sup> Ed . Handly, Mc. Graw Hill Book Co. UK
2. Occupational Accident prevention, Judson & Brown, John willy, New york.
3. Protecting personal at Hazards Waste sites – S.P. Levine Martin Butter worthy publishes, London.

# ENVIRONMENTAL ASPECTS OF DEVELOPMENTAL PROJECTS (3-0-0)

## MODULE-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.

**Infrastructure Project:** Highways, Airports, Water Supply and Sanitation, Wastewater Treatment- Salient Details and Environmental Aspects.

**Construction Projects:** Construction activities and their environmental effects, Mitigation Measures

## MODULE –II

**Watershed Development:**

(a) Reservoirs & Dams: Micro-climatic changes, Submergence of land, forest & habitation - social effects. Effects on Flora & Fauna, Pollution accumulation on Sediments, Reservoir Sedimentation.

(b) Irrigation & Agricultural Activities: Water logging, Malaria Cause and Salinity Problems. Mitigative measures for Environmental Protection.

## MODULE –III

**Power Projects:** Hydro thermal and Nuclear projects, Power Transmission lines and Influence on Environment and Mitigation Methods. Industrial Developmental Projects: Process Flow Diagrams and Waste Generation points for Pig Iron Plant, Coke oven, fertilizer, Textile and Food Industry, Plastics and Polymer Industry, Electroplating Industry, Mining Activity. Pollution Control measures, Recycle & Reuse, Cleaner Technologies.

**TEXT BOOKS:**

1. Bindu N. Lohani, Environmental Quality Management (1984) South Asian Publishers Pvt. Ltd
2. Hennery J.G. and Heinke G.W., Environmental Science and Engineering (1996), Prentice Hall.
3. UNEP /UNDP, Environment and Sustainable Development.

**REFERENCE BOOK:**

1. Ashwathanarayana U., (1995), Geoenvironment - An Introduction, Capital Books Pvt. Ltd., New Delhi.

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