

BIJU PATNIK UNIVERSITY OF TECHNOLOGY

Environmental Engineering

<u>3rd SEMESTER</u>				<u>4th 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
	Credits (Theory)		19		Credits (Theory)		19
<i>PRACTICALS/SESSIONALS</i>				<i>PRACTICALS/SESSIONALS</i>			
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
	Credits (Practicals/ Sessionals)		6		Credits (Practicals/Sessionals)		6
TOTAL SEMESTER CREDITS			25	TOTAL SEMESTER CREDITS			25

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, "", 4th 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_x, SO₂, 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- **Sawyer 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 th Semester					6 th 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			
Theory Credits			21		Theory Credits			20	
Practical/Sessional					Practical/Sessional				
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	
Practical/Sessional Credits			04		Practical/Sessional Credits			04	
TOTAL SEMESTER CREDITS			25		TOTAL SEMESTER CREDITS			24	
TOTAL CUMULATIVE CREDITS					TOTAL CUMULATIVE CREDITS				

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, 2nd 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 LC₅₀, LC₁₀₀, LD₅₀ and LD₁₀₀.

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_x, SO₂) 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. Biostatistics 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.
