

# BIJU PATNIK UNIVERSITY OF TECHNOLOGY, ORISSA

## Environmental Engineering

| 5 <sup>th</sup> Semester           |  |       |           |  | 6 <sup>th</sup> Semester           |  |       |           |  |
|------------------------------------|--|-------|-----------|--|------------------------------------|--|-------|-----------|--|
| Code                               | Theory<br>Subjects   | L-T-P | Credit    |  | Code                               | Theory<br>Subjects                                   | L-T-P | Credit    |  |
| HSSM3301                           | Principles of Management<br>OR                               | 3-0-0 | 3         |  | HSSM3302                           | Optimization in Engineering<br>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<br>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<br>Microbiology & Toxicology | 0-0-3 | 2         |  | PCEV7303                           | Environmental Monitoring Lab-V<br>Air Monitoring Lab | 0-0-3 | 2         |  |
| PCEV7302                           | Environmental Monitoring Lab-III<br>Environmental Chemistry  | 0-0-3 | 2         |  | PCEV7304                           | Design & Drawing of Environmental<br>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.

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