CH 785 BIOCHEMICAL ENGINEERING (Elective-II)

Theory : 100 marks	L - T - P
Sessional : 75 marks	3 - 1 - 0

Application of bioprocess in various fields

Chemicals of life : Introduction and basic functions of

- Lipids.
- Sugar & Polysaccharides.
- Nucleotides & RNA & DNA.
- Amino acid & Proteins
- Hybrid bio-chemicals.

Simple enzyme kinetics with one and two substrates

- Michaclis – Menten kinetics.
- Kinetics for reversible reactions.
- Substrate activation & inhibition.
- Multiple substrate on single enzyme.
- Influence on enzyme activity.
- Enzyme deactivation.

Application of enzyme as catalyst.

- Hydrolysis of starch and cellulose by hydrolytic enzyme.
- Medical application.
- Non hydrolytic enzyme.

Immobilized enzyme technology

- Brief overview.

Basic fermentation engineering.

- Media preparation, culture , sterilization
- Manufacture of biochemical products

Transport Phenomena in bio process.

- Gas liquid transfer in cellular system.
- Heat transfer.

Kinetics in cell culture.

- Reaction.
- Kinetics of balance growth.
- Death kinetics.

Bioreactors

- Introduction, Basic features and types

Downstream processing-

- Bio-product recovery and bio-separations

Books:

1. Biochemical Engineering by Bailey, Mcgraw Hills.
2. Bioprocess Engineering-Basic Concepts by M L Shuler and F Kargi, Prentice Hall India
3. Biochemical Engineering by Mukesh Doble, S. Gummadi, Prentice Hall India
4. Biochemical Engineering: Principles and Concepts, S. T. A. Inamdar, Prentice Hall India

CH 783 ENVIRONMENTAL POLLUTION CONTROL ENGINEERING

Theory : 100 marks L - T - P
Sessional : 75 marks 3 – 1 - 0

- Man and Environment, Environmental Legislations.

- Water Pollution :
A (i) Regulations on the discharge of industrial pollutants in water, threshold limits.
(ii) Types of waste water, sources of pollutants, classification of pollutants.
(iii) Site selection, sampling, preservation, water quality parameters and significance, monitoring, determination of BOD and COD.
(iv) Dissolved oxygen balance in water, self purification of a water system (Critical deficit of a runoff).

B. Some fundamental aspects of microbiology as applied to pollution control.

C. Control of Water Pollution :
(i) Basic approach to solve the problem.
(ii) Primary, secondary and tertiary treatment of waste water, clariflocculation, sludge disposal.
(iii) Treatment of phenolic waste water and also water containing N and P.
(iv) Control of heavy metal ions, As, Hg, Cr.

Air Pollution :
(i)Concept of atmosphere, sources of air pollutants, classification and effects, air quality criteria and standard, methods of estimation of air pollutants, monitoring.
(ii) Meteorology and air pollution – lapse rate, plume types, stability, stack design, basic concept of dispersion.
(iii) Fundamental approach to air pollution control.
(iv) Control of particulates.
(v) Control of gaseous pollutants.

Solid Waste Management : Types of solid wastes, sources and composition, methods of waste management – sanitary landfill, composting, incineration, pyrolysis, anaerobic digestion, concepts of recycling.
- Design of lagoons, oxidation pond, activated sludge process units, gravity settler, Rotating Biological Cyclone (RBC) separators, anaerobic digester, and stack for emission control.
- Noise Pollution : Sources of noise, levels permissible, impact of noise pollution, Noise Exposure Index (NEI), control methods of noise pollution.
- Case Studies (Sessional only) : Petroleum Refinery. Petrochemical Complex. Paper Mill. Automobile Pollution.

PRACTICALS :
- Determination of water quality parameters : pH, conductivity, Dissolved Oxygen, BOD and COD.
- Spectrophotometric and Gas Chromatographic analysis of air and water pollutants.
- Analysis of particulates and gaseous pollutants.

BOOKS :
1. G M Masters, Introduction to Environmental Engineering and Science, Prentice Hall India
2. Peavy, Rowe & Tchobanoglous, Environmental Engineering, McGraw-Hill.
3. Mahajan, S.P., Industrial Pollution Control, Tata McGraw-Hill.

CH 786 Factory Training

Sessional: 75

Factory training for a period of 6 (six) weeks is compulsory for all chemical engineering students and 20 marks are allotted for the technical report submitted after completion of the training. There will be a seminar cum viva on the report submitted by the student and 30 marks are assigned for this. The report should be submitted to the HOD, by a date announced by the HOD. Students are to obtain a certificate from the Factory authority regarding their attendance and performance during the training period which is to be submitted along with the report.

CH 781 MASS TRANSFER OPERATION - II

Theory : 100 marks	L – T – P
Sessional: 75 marks	3 – 1 – 0

Extraction:
Solid – liquid: Classification, Rate of solid – liquid extraction, contacting strategy, contacting equipment, Equilibrium, extraction calculation, super critical extraction.

Liquid – liquid: Ternary liquid equilibria, solvent selection, single and multi stage and cross current extraction, design calculation for stage wise extraction.

Distillation:
Introduction - Vapour liquid equilibrium, T-x-y diagram, bubble and dew point calculation, concept of volatility, deviation from ideality, minimum and maximum boiling azeotrope mixture, enthalpy – concentration diagram.

Flash vaporisation, steam distillation, batch distillation, continuous multistage fractionation of binary mixture, multi stage batch distillation with reflux, minimum and total reflux. Tray efficiency, Reboiler types.

McCabe Thiele method, Ponchon Savarit method, Distillation in packed column.

Introduction to multi component distillation, azeotropic distillation, extractive distillation

Books recommended:

1. Treybal, R.E.," Mass Transfer operation", McGraw Hill International Edition, 3rd Ed, 1981.
2. McCabe, W.L., Smith, J, and Harriot, P., "Unit operation of Chemical Engineering", McGraw Hill International Edition, 6th Ed, 2001.
3. Geankoplis, C.J., "Transport Process and Unit Operations", Prentice Hall 3rd Ed, India, 1993
4. Dutta, B.K., "Principles of Mass Transfer and Separation Processes", Prentice Hall, India, 2007.
5. Seader, J.D., Henley, J. E., Separation Process Principles" 2nd Ed, Wiley India edition, 2010

CH 784 Polymer Science and Engineering (Elective-1)

Theory : 100 marks
Sessional : 75 marks

L - T - P
3 - 1 - 0

1. Basics
   - Formation
   - Classification
   - Methods of Polymer formation
   - Step Growth, chain growth, Z-N catalyst
2. Molecular weight and moleculer weight distribution
3. Structure of Polymer molecules
   - Based on chemical composition – homo and co-polymer
   - Based on geometrical structure of chain
   - Structural Model-Random Coil, fringed mecellar model, spherulites
4. Physical States and transitions
   - Amorphous and crystalline
   - Transition temperature-glass transition temperature, melting temperature
5. General properties and testing
6. Polymer processing/fabrication
   - Polymer additives
   - Injection molding(plunger and screw type)
   - Compression molding
   - Extrusion – flat, sheet and tubing
   - Pultrusion
   - Blow molding
   - Foams, thermoforming, vacuum forming
   - Spinning, melt, wet and dry
7. Finishing
8. Application, Recycling and Reuse
9. Rheology
   - Viscous flow, models of Newtonian and Non-Newtonian
   - Visco-elasticity – Maxwell Model
10. Introduction to Rubber elasticity
11. Introduction to Nano-composites

In house Demonstrations of Blow moulding & Injection Moulding Machine.

Books:

1. Fried Polymer Science and Technology, 2nd Ed, Prentice Hall India
2. Sinha, Outlines of Polymer Technology, Manufacture of Polymers, Prentice Hall India
3. Fundamentals of Polymers: Raw Materials to finished Products by Narayan Karak, PHL
4. Polymer science by V.R. Gowarikar.

CH 782 PROCESS EQUIPMENT DESIGN

Theory : 100 marks
Sessional : 75 marks

L - T - P
3 - 1 - 0

1. DESIGN OF PIPE FITTINGS AND JOINTS: Design and schematic of simple bolts and screws. Riveted joints. Design & Draw of shafts and couplings.

2. DESIGN OF STORAGE TANK: Design and schematic of storage tank, (vertical and horizontal) supports.

3. DESIGN OF HIGH PRESSURE SYSTEMS: Design of high pressure vessels and reactors.

4. DESIGN OF HEAT TRANSFER EQUIPMENTS: Design and Drawing of Heat Transfer Equipments such as heat exchangers with and without phase change, evaporators.

5. DRAWING OF PHASE SEPARATION EQUIPMENT: Drawing of physical separation equipments such as hydro-cyclones, packed towers, plate columns, electro- static precipitators.

TEXTBOOKS:

1.L. E. Brownell and E.H. Young, "Process Equipment Design - Ves Design", Wiley Eastern Edn. New York, 1968. 2. R. H. Perry, "Chemical Engineers' Handbook", 7th Edn., McGraw Hill , N York, 1998.

2.M. V. Joshi, "Process Equipment Design", 2nd Edn. .Mac Millan Press, N Delhi, 1996.

3. Process Equipment Design-mechanical aspects; B C Bhattachrjee

4.D.Q. Kern, Process Heat Transfer, 2nd Ed., Tata McGraw - Hill, 1997.

REFERENCES:-

1. J. M. Coulson and J. F. Richardson, "Chemical Engineering.", Vol-VI, Pergam Press, New York, 1987.

CH 787 Project-I

Sessional : 150

Under this course each student will be assigned a topic related to Chemical engineering field. The topic shall either be experimental or theoretical (feasibility report/literature survey with some mathematical calculations). The student will work under the supervision of a staff member and submit a report on the assigned project. The student will give a presentation on the project work before a panel of examiners.