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| **Course code** | **Course name** | **Course Category** | **L-T-P** | **Credits** |
| 22BEXY04 | Fundamentals of Bio-Chemical Engineering | Open free elective | 2-1-0 | 3 |

**FUNDAMENTALS OF BIO-CHEMICAL ENGINEERING**

**Course Learning Objectives:**

1. To enhance skills in the areas of biochemical processes, to provide the fundamental background of biological systems, bio-chemical engineering
2. To make better understanding of food processing and waste treatment
3. To make better understanding of microbial world and their growth.
4. Maintain and improve fermentation technology knowledge
5. To make Better understanding and enhance skill for recovery of product
6. To make expert of enzymes in kinetic analysis of biochemical reaction and also apply the basic concepts of thermodynamics, mass and energy balances, reaction kinetics and reactor design for biochemical processes

**Course Content:**

**Unit -I (9 hours)**

Introduction to biochemical process industries, industrial alcohols, antibiotics, acids, alcoholic beverages, enzymes, vitamins, single cell protein.

**Unit- II (6 hours)**

Food processing and biological waste treatment. Interaction of chemical engineering principles with biological sciences.

**Unit- III (9 hours)**

Life processes, Unit of living system, microbiology, reaction in living systems, biocatalysts, model reactions. Fermentation mechanisms and kinetics : kinetic models of microbial growth and product formation.

**Unit-IV (6 hours)**

Fermenter types; Modeling of batch and continuous fermentor. Bioreactor design, mixing phenomena in bioreactors. Sterilization of media and air, sterilization equipment, batch and continuous sterilize design.

**Unit-V (6 hours)**

Biochemical product recovery and separation. Membrane separation process: reverse osmosis, dialysis, ultrafiltration; Chromatographic methods: adsorption chromatography, gel filtration, affinity chromatography etc.

**Unit-VI (9 hours)**

Electro-kinetic separation: electro-dialysis, electrophoresis. Waste water treatment: activated sludge process, anaerobic digestion, trickling filter.

**Learning Resources**

**Text Book:**

1. JE Bailey and DF Ollis, ‘*Biochemical engineering fundamentals’*, 2nd edition, McGraw Hill, 1986.

**Reference Books:**

1. M. L. Shuler, F. Kargi, ‘*Bioprocess Engineering’*, 2nd Ed., Prentice Hall, 2002
2. Prescott, ‘*Microbiology’* 2nd edition Wm, C. Brown Publishers, 1995.

**Course Outcomes:** At the end of the course, the student will be able to

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| --- | --- |
| CO 1 | The students are expected to understand the basic importance and need for biochemical engineering and also the difference between bioprocesses and chemical processes.  |
| CO 2 | Have good knowledge and skill for food processing  |
| CO 3 | Ability to understood growth pattern and kinetics of microbe. |
| CO 4 | Ability to run fermentor and bioreactor and knowledge for industrial applications.  |
| CO 5 | Well knowledge for biochemical product recovery and separation |
| CO 6 | Acquire the knowledge of enzyme catalyzed reaction and inhibition mechanisms. |

**For Theory Courses Only:**

**Assessment Method**

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| --- | --- | --- | --- |
| **Assessment Tool** | **Monthly tests** | **End Semester Test** | **Total** |
| Weightage (%) | 40% | 60% | 100% |