

<b>INSTITUTE</b>	<b>FACULTY OF PHARMACY</b>
<b>PROGRAM</b>	<b>BACHELOR OF PHARMACY</b>
<b>SEMESTER</b>	<b>5</b>
<b>COURSE TITLE</b>	<b>PHARMACEUTICAL BIOTECHNOLOGY</b>
<b>COURSE CODE</b>	<b>13PH0505</b>
<b>COURSE CREDITS</b>	<b>4</b>

**Objective:**

- 1 Biotechnology has a long promise to revolutionize the biological sciences and technology.
  - Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting.
  - Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs.
  - Biotechnology has already produced transgenic crops and animals and the future promises lot more.
  - It is basically a research-based subject.
- 2 Biotechnology has a long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises lot more. It is basically a research-based subject.

**Course Outcomes:** After completion of this course, student will be able to:

- 1 Understanding the importance of Immobilized enzymes in Pharmaceutical Industries
- 2 Genetic engineering applications in relation to production of pharmaceuticals.
- 3 Importance of Monoclonal antibodies in Industries.
- 4 Appreciate the use of microorganisms in fermentation technology.

**Pre-requisite of course:** Biotechnology has a long promise to revolutionize the biological sciences and technology. Scientific application of biotechnology in the field of genetic engineering, medicine and fermentation technology makes the subject interesting. Biotechnology is leading to new biological revolutions in diagnosis, prevention and cure of diseases, new and cheaper pharmaceutical drugs. Biotechnology has already produced transgenic crops and animals and the future promises lot more. It is basically a research-based subject.

**Teaching and Examination Scheme**

<b>Theory Hours</b>	<b>Tutorial Hours</b>	<b>Practical Hours</b>	<b>ESE</b>	<b>IA</b>	<b>CSE</b>	<b>Viva</b>	<b>Term Work</b>
3	1	0	75	15	10	0	0

<b>Contents : Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Unit-1: Introduction to Biotechnology</b> a) Brief introduction to Biotechnology with reference to Pharmaceutical Sciences. b) Enzyme Biotechnology- Methods of enzyme immobilization and applications. c) Biosensors- Working and applications of biosensors in Pharmaceutical Industries. d) Brief introduction to Protein Engineering. e) Use of microbes in industry. Production of Enzymes- General consideration Amylase, Catalase, Peroxidase, Lipase, Protease, Penicillinase. f) Basic principles of genetic engineering.	10
2	<b>Unit-2: Cloning</b> a) Study of cloning vectors, restriction endonucleases and DNA ligase. b) Recombinant DNA technology. Application of genetic engineering in medicine. c) Application of rDNA technology and genetic engineering in the production of: i) Interferon, ii) Vaccines: hepatitis-B, iii) Hormones-Insulin. d) Brief introduction to PCR.	10
3	<b>Unit-3: Immunity</b> Types of immunity- humoral immunity, cellular immunity: a) Structure of Immunoglobulins. b) Structure and Function of MHC. c) Hypersensitivity reactions, Immune stimulation and Immune suppressions. d) General method of the preparation of bacterial vaccines, toxoids, viral vaccine, antitoxins, serum-immune blood derivatives and other products relative to immunity. e) Storage conditions and stability of official vaccines. f) Hybridoma technology- Production, Purification and Applications. g) Blood products and Plasma Substitutes.	10
4	<b>Unit-4: Immune blotting techniques</b> a) Immuno blotting techniques- ELISA, Western blotting, Southern blotting. b) Genetic organization of Eukaryotes and Prokaryotes. c) Microbial genetics including transformation, transduction, conjugation, plasmids and transposons. d) Introduction to Microbial biotransformation and applications. e) Mutation: Types of mutation/mutants.	8
5	<b>Unit-5: Fermentation</b> a) Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. b) Large scale production fermenter design and its various controls. c) Study of the production of - penicillins, citric acid, Vitamin B12, Glutamic acid, Griseofulvin. d) Blood Products: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes.	7
<b>Total Hours</b>		<b>45</b>

### Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	<b>Tutorial</b> Workshop 1, Workshop 2, Workshop 3, Workshop 4, Workshop 5, Workshop 6, Workshop 7, Workshop 8, Workshop 9, Workshop 10, Workshop 11, Workshop 12, Workshop 13, Workshop 14, Workshop 15	15
<b>Total Hours</b>		<b>15</b>

### Textbook :

- 1 Molecular Biotechnology, S.B. Primrose, Blackwell Scientific Publication., 1991

### References:

- 1 Molecular Biotechnology: Principles and Applications of Recombinant DNA, Molecular Biotechnology: Principles and Applications of Recombinant DNA, B.R. Glick and J.J. Pasternak: , American Society for Microbiology, 2002
- 2 Kuby Immunology , Kuby Immunology , RA Goldshy et. al., W. H. Freeman, 2006
- 3 Monoclonal Antibodies: Principles and Practic, Monoclonal Antibodies: Principles and Practic, J.W. Goding, Academic Press, 1996
- 4 Molecular Biology and Biotechnology Paperback, Molecular Biology and Biotechnology Paperback, J.M. Walker and E.B. Gingold: , Royal Society of Chemistry., 2000
- 5 Immobilized Enzymes, Immobilized Enzymes, Zaborsky, CRC Press, 1973
- 6 Principles of Fermentation Technology Paperback , Principles of Fermentation Technology Paperback , Stanbury F., P., Whitakar A., and Hall J., S., Aditya books Ltd., 2016

### Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
10.00	20.00	25.00	25.00	10.00	10.00

### Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and the need of students. The teacher in addition to the conventional teaching method by the blackboard may also use any tools such as demonstration, role play, quiz, brainstorming, MOOCs etc.
- 2 The internal evaluation will be done based on continuous evaluation of students in the laboratory and classroom.
- 3 Students will use supplementary resources such as online videos, NPTEL videos, MOOCs/ e-courses, virtual laboratories.