Dr. B. R. AMBEDKAR UNIVERSITY, SRIKAKULAM

General Regulations relating to

POST GRAUDATE AND PROFESSIONAL COURSES
Syllabus under Credit Based Semester System

(with effect from 2009-2010)

1. Candidates seeking admission for the Masters/Professional Degree Courses shall be required to have passed the qualifying examination prescribed for the course of any University recognized by Dr. B.R. Ambedkar University, Srikakulam as equivalent there to

2. The course and scope shall be as defined in the Scheme of Instruction and syllabus prescribed.

3. The course consists of 2/4/6 semesters, @ two semesters/year, unless otherwise specified.

4. The candidates shall be required to take an examination at the end of each semester of the study as detailed in the Scheme of Examination. Each semester theory paper carries a maximum of 100 marks, of which 85 marks shall be for semester-end theory examination of the paper of three hours duration and 15 marks shall be for internal assessment

4. (a) Internal Assessment for 15 Marks: Two mid-term exams, one conventional (descriptive) and the second – 'on-line' with multiple choice questions for each theory paper shall be conducted. The average of these two mid-term exams shall be taken as marks obtained for the paper under internal assessment. If any candidate appears for only one mid-term exam, the average mark, dividing by two shall be awarded. If any candidate fails to appear for both the mid term exams of a paper, only marks obtained in the theory paper shall be taken into consideration for declaring the result. Each mid-term exam shall be conducted only once.

4. (b) Candidates shall be declared to have passed each theory paper if he/she obtains not less than E Grade ie., an aggregate of 40 % of the total marks inclusive of semester-end and internal assessment marks in each paper.

5. A candidate appearing for the whole examination shall be declared to have passed the examination if he/she obtains a Semester Grade Point (SGP) of 5.0 and a CGPA of 5.0 to be declared to have passed the Course.

6. Not withstanding anything contained in the regulations, in the case of Project Report/Dissertation/ Practical/Field Work/Viva-voce etc., candidates shall obtain not less than D grade, i.e., 50% of marks to be declared to have passed the examination.

7. ATTENDANCE: Candidates shall put in attendance of not less than 75% of attendance, out of the total number of working periods in each semester. Only such candidates shall be allowed to appear for the semester-end examination.

7. (a) A candidate with attendance between 74.99% and 66.66% shall be allowed to appear for the semester-end examination and continue the next semester only on medical and other valid grounds, after paying the required condonation fee.

7. (b) In case of candidates who continuously absent for 10 days without prior permission on valid grounds, his/her name shall automatically be removed from the rolls.

7 (c) If a candidate represents the University at games, sports or other officially organized extra-curricular activities, it will be deemed that he/she has attended the college on the days/periods

8 Candidates who put in a minimum of 50% attendance shall also be permitted to continue for the next semester. However, such candidates have to re-study the semester course only after completion of the course period for which they are admitted. The candidate shall have to meet the course fees and other expenditure.

9 Candidates who have completed a semester course and have fulfilled the necessary attendance requirement shall be permitted to continue the next semester course irrespective of whether they have appeared or not at the semester-end examination, at their own cost.

Such candidates may be permitted to appear for the particular semester-end examination only in the following academic year; they should reregister/ reapply for the Semester examination.

The above procedure shall be followed for all the semesters

10. Candidates who appear and pass the examination in all the papers of each and every semester at first appearance only are eligible for the award of Medals/Prizes/Rank Certificates

11. BETTERMENT: Candidates declared to have passed the whole examination may reappear for the same examination to improve their SGPA, with the existing regulations without further attendance, paying examination and other fees. Such reappearance shall be permitted only with in 3 consecutive years from the date of first passing the final examination. Candidates who wish to appear thereafter should take the whole examination under the regulations then in vogue.

12. The semester-end examination shall be based on the question paper set by an external paper-setter and there shall be double valuation for post-Graduate courses. The concerned Department has to submit a panel of paper-setters and examiners approved by the BOS and the Vice-chancellor nominates the paper-setters and examiners from the panel.

13. In order to be eligible to be appointed as an internal examiner for the semester-end examination, a teacher shall have to put in at least three years of service. Relaxation of service can be exempted by the Vice-Chancellor in specific cases.

14. If the disparity between the marks awarded in the semester-end examination by internal and external examiners is 25% or less, the average marks shall be taken as the mark obtained in the

paper. If the disparity happens to be more, the paper shall be referred to another examiner for third valuation. In cases of third valuation, of the marks obtained either in the first or second valuation marks, whichever is nearest to the third valuation marks are added for arriving at the average marks.

15. Candidates can seek revaluation of the scripts of the theory papers by paying the prescribed fee as per the rules and regulations in vogue.

16. The Project Report/Dissertation/ Practical/Field Work/Viva-voce etc shall have double valuation by internal and external examiners.

17. A Committee comprising of the HOD, one internal teacher by nomination on rotation and one external member, shall conduct viva-voce examination. The department has to submit the panel, and the Vice-chancellor nominates viva-voce Committee.

18. Grades and Grade Point Details (with effect from 2009-10 admitted batches)

S. No	Range of Marks	Grade	Grade Points
1.	> 85 %	**O**	10.0
2.	75 % – 84 %	**A**	9.0
3.	67 % - 74 %	**B**	8.0
4.	58 % - 66 %	**C**	7.0
5.	50 % - 57 %	**D**	6.0
6.	40 % - 49 %	**E**	5.0
7.	< 39 %	**F (Fail)**	0.0
8.	Incomplete: (*Shall be upgraded from E to O Grade on subsequent appearance of the same semester. The corresponding Grade Points will be awarded)*	**I**	

19. Calculation of **SGPA** (Semester Grade Point Average) **& CGPA (**Cumulative Grade Point Average):

For example, if a student gets the grades in one semester A,A,B,B,B,D in six subjects having credits 2(S1), 4(S2), 4(S3), 4(S4), 4(S5), 2(S6), respectively. The SGPA is calculated as follows:

$$\textbf{SGPA} = \frac{\{9(A)x2(S1)+9(A)x4(S2)+8(B)x4(S3)+8(B)x4(S4)+8(B)x4(S5)+6(D)x2(S6)\}}{\{2(S1)+4(S2)+4(S3)+4(S4)+4(S5)+2(S6)\}} = \frac{162}{20} = 8.10$$

i. A student securing 'F' grade thereby securing 0.0 grade points has to appear and secure at least 'E' grade at the subsequent examination(s) in that subject.

ii. If a student gets the grades in another semester D, A, B, C, A, E, A, in seven subjects having credits 4(S1), 2(S2), 4(S3), 2(S4), 4(S5), 4(S6), 2(S7) respectively,

$$\textbf{SGPA} = \frac{\{6(D)x4(S1)+9(A)x2(S2)+8(B)x4(S3)+7(C)x2(S4)+9(A)x4(S5)+5(E)x4(S6)+9(A)x2(S7)\}}{\{4(S1)+2(S2)+4(S3)+2(S4)+4(S5)+4(S6)+2(S7)\}} = \frac{162}{22} = 7.36$$

$$\textbf{CGPA} = \frac{(9x2+9x4+8x4+8x4+6x2+6x4+9x2+8x4+7x2+9x4+5x4+9x2)}{(20+22)} = \frac{324}{42} = 7.71$$

a) A candidate has to secure a minimum of 5.0 SGPA for a pass in each semester in case of all PG and Professional Courses. Further, a candidate will be permitted to choose any paper(s) to appear for improvement in case the candidate fails to secure the minimum prescribed SGPA/CGPA to enable the candidate to pass at the end of any semester examination.

b) There will be no indication of pass/fail in the marks statement against each individual paper.

c) A candidate will be declared to have passed if a candidate secures 5.0 CGPA for all PG and Professional Courses.

d) The Classification of successful candidates is based on **CGPA** as follows:
   i) **Distinction** –CGPA 8.0 or more;
   ii) **First Class** –CGPA 6.5 or more but less than 8.0
   iii) **Second Class** –CGPA 5.5 or more but less than 6.5
   iv) **Pass** –CGPA 5.0 or more but less than 5.5

e) Improving CGPA for betterment of class will be continued as per the rules in vogue.

f) CGPA will be calculated from II Semester onwards up to the final semester. CGPA multiplied by “10” gives aggregate percentage of marks obtained by a candidate.

Dr. B. R. AMBEDKAR UNIVERSITY, SRIKAKULAM

ANNEXURE – I

Eligibility

Course	*Qualifying Examination for Admission*
M.Sc Biotechnology	B.Sc/B.Sc(Vocational with any two of the following subjects: Biotechnology, Biochemistry, Botany, Zoology, Chemistry Microbiology, Env. Science, Human Genetics,Fisheries, Aquaculture and Mathematics, B.Sc (Vocational) with food Science & Quality Control

ANNEXURE – II

M.Sc. BIOTECHNOLOGY

SCHEME OF INSTRUCTION

First Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction per Week
101	Cell Biology	Compulsory	4
102	Biomolecules	Compulsory	4
103	Microbial Physiology & Genetics	Compulsory	4
104	Analytical Tools and Techniques in Biotechnology	Compulsory	4
105	Lab-I: Cell Biology and Microbiology	Compulsory	12
106	Lab-II: Biochemical Analysis and Techniques	Compulsory	12

Second Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction per Week
201	Enzymology and Metabolism	Compulsory	4
202	Molecular Biology	Compulsory	4
203	Genetic Engineering	Compulsory	4
204	Biology of Immune System	Compulsory	4
205	Lab-III: Molecular Biology & Genetic Engineering	Compulsory	12
206	Lab-IV: Enzymology and Immunology	Compulsory	12

Third Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction per Week
301	Cell Culture Technology and Tissue Engineering	Compulsory	4
302	Plant Biotechnology	Compulsory	4
303	Animal Biotechnology	Compulsory	4
304	Medical and Environmental Biotechnology	Compulsory	4
305	Lab-V: Plant Tissue Culture Techniques	Compulsory	12
306	Lab-VI: Animal Cell Culture and Environmental Biotechnology	Compulsory	12

Fourth Semester:

Course No.	Title of the Paper	Compulsory/Elective	No.of Periods of instruction Per Week
401	Heterologous Expression and Downstream Processing	Compulsory	3
402	Bioinformatics and Biostatistics	Compulsory	3
403	Lab-IV: Industrial Biotechnology and Bioinformatics	Compulsory	6
404	Project work*	Compulsory	
405	Seminar@	Compulsory	
406	Comprehensive Viva-voce	Compulsory	

In each of the semesters each candidate has to present a paper on Biotechnology and related topics, according to the schedule given by the Department for 20 Minutes on Saturday in the SEMINAR conducted by the Department.

***Project Work:** Candidates shall have to do a project work in the field of Biotechnology and related fields in reputed Organizations/ Companies/ Lboratories etc.. for a period of two months at the end of IV Semester. The candidate shall submit the project work dissertation under the supervision of a faculty member.

@Seminar: Each student shalll give seminar on project work dissertation.

During all the four semesters the medium of instruction and writing examination is ENGLISH only.

Annexure - III

Scheme of Examination as per Credit System

First Semester:

Course No.	Title of the Paper	Credit Points	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment
101	Cell Biology	4	100	85	15
102	Bio Molecules	4	100	85	15
103	Microbial Physiology & Genetics	4	100	85	15
104	Analytical tools & Techniques in Bio Technology	4	100	85	15
105	Lab I : Cell Biology & Microbiology	2	50	45	5
106	Lab I I : Bio Chemical Analysis & Techniques	2	50	45	5
	Total	20	500	430	70

Second Semester:

Course No.	Title of the Paper	Credit Points	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment
201	Enzymology & Metabolism	4	100	85	15
202	Molecular Biology	4	100	85	15
203	Genetic Engineering	4	100	85	15
204	Biology & Immune System	4	100	85	15
205	Lab I : Molecular Biology & Genetic Engineering	2	50	45	5
206	Lab II : Enzymology & Immunology	2	50	45	5
	Total	20	500	430	70

Third Semester:

Course No.	Title of the Paper	Credit Points	Max. Marks.	Double Valuation (Internal + External)	Internal Assessment
301	Cell Culture Technology & Tissue Engineering	4	100	85	15
302	Plant Bio Technology	4	100	85	15
303	Animal Biotechnology	4	100	85	15
304	Medical & Environmental Bio Technology	4	100	85	15
305	Lab I : Plant Tissue Culture Techniques	2	50	45	5
306	Lab II : Animal Cell Culture & Environmental Bio Technology	2	50	45	5
	Total	20	500	430	70

Fourth Semester:

Course No.	Title of the Paper	Credit Points	Max. Marks.	uble Valuation (Internal + External)	Internal Assessment
401	Heterologous Expression & Down Stream Processing	4	100	85	15
402	Bio Informatics & Bio Statistics	4	100	85	15
403	Lab: Industrial BioTechnology & Bioinformatics	2	50	45	05
404	Project Work & Dissertation	6	150	150	-
405	Seminar	2	50	50	-
406	Comprehensive Viva - voce	2	50	50*	-
	Total	20	500	465	35

* Single Valuation by Viva-Voce committee

Total Marks :- First, Second, Third & Fourth Semesters put together: 500+500+500+500 = 2000

Total Credits :- First, Second, Third & Fourth Semesters put together: 20+20+20+20 = 80

Dr. B.R. Ambedkar University, Srikakulam

M.Sc BIOTECHNOLOGY

I SEMESTER

101: CELL BIOLOGY

Objectives

To understand the molecular events & regulations of cell cycle
To know the stricter of plasma membrane
To know the morphology & functions of Endoplasmic reticulum
To understand the mechanism of photo photophosphorylation & oxidative phosphorylation.
To understand the process of evaluation

UNIT-I

Structure of typical bacterial, plant and animal cells and functions of cell organelles. Mechanism of cell division. Cell cycle – Molecular events including cell cycle check points and Cdk – cyclin complexes and their role in cell cycle regulation.

UNIT-II

Ultra structure of plasmamembrane - Components and membrane asymmetry. Transport processes - active transport, ionophores and ion channels. Exo and endocytosis. Phago and pinocytosis.

UNIT-III

General morphology and functions of endoplasmic reticulum. Signal hypothesis. Ribosomes - eucaryotic and procaryotic. Ribosomal proteins. Role of Golgi in protein secretion. Lysosomes and peroxisomes. Cytoskelatal elements. Cell – cell interaction.

UNIT-IV

Mitochondria - structure, biogenesis and enzymatic compartmentation. Organization of mitochondrial respiratory chain, mechanism of oxidative of phosphorylation. Ultra structure of the chloroplast. Photosynthesis - photophosphorylation. Carbon dioxide fixation in C-3, C-4 and CAM plants. Photorespiration.

UNIT-V

Organic evolution: Origin of life. Species concept, population, dones, races, and subspecies. Mechanisms of speciation. Role of isolating mechanisms. Lamarckism, Darwinism, Neo-Darwinism, synthetic theory of evolution. Micro, macro and mega evolution, sequential and divergent evolution. Natural selection.

BOOKS RECOMMENDED:

1. Molecular Biology of the Cell by B.Alberts et.al (Garland publications incorporation.)

2. Molecular Cell Biology, J. Darnell et. al (Scientific American Books) .

3. Cell Biology by N.O.Thorpe (John wiley & sons).

4. Organic Evolution by Rastogi.

5. Principles of organic evolution by J.L.Stebbins (Prentice Hall).

I SEMESTER

102: BIOMOLECULES

Objectives

- To learn the chemical foundation of Biology
- To learn the classification ,stricter sproperties of carbohydrates & lipids
- To learn the classification & stricter of Amino acids
- To learn the stricter & properties of nucleosids & vitamins
- To study the classification & mechanism of hormones.

UNIT-I

Chemical foundations of Biology – Molucular Stuctre and process in terms of Space, time and energy. Covalent and non covalent (Weak) Bonds, important properties of water . pH, pK, acids, bases, buffers.

UNIT-II

Classification, structure, properties and biological significance of carbohydrates. Monosaccharides, Disaccharides, and Polysaccharides. Biological role of peptidoglycans, glycosamino glycans and Lectins. Lipids - classification, structure and properties of fatty acids, triglycerides, phospholipids, sphingolipids and cholesterol.

UNIT-III

Amino acids - Classification, structure and physico-chemical properties. Chemical synthesis of peptides – solid phase peptide synthesis. Proteins - classification, purification and criteria of homogeneity. Structural organization, sequence determination and characterization of proteins. Conformation of proteins – Ramachandran plots. Denaturation of proteins. Hetero cyclic compounds – Heme and Chlorophylls.

UNIT-IV

Structure and properties of purines, pyrimidines, nucleosides, and nucleotides. Covalent structure of DNA and different forms of DNA - A,B and Z. DNA super coiling. Types of RNA and covalent structure of t-RNA. Classification, structure and physiological roles of Vitamins.

UNIT-V

Hormones- classification and mechanism of action of steroid and protein hormones. Signal transduction cascade by cyclic AMP, Phospho inositate and calcium (Ca^{+}), G-proteins, growth factors and membrane receptor tyrosine kinases. Phytohormones and their physiological roles.

BOOKS RECOMMENDED:

1. Principles of Biochemistry by A.L.Lehninger, 2 Ed. (worth).
2. Biochemistry by L. Stryer 4 Ed. (Freeman-Toppan).
3. Text Book of Biochemistry by West et. al., (Mac Millan).
4. Principles of Biochemistry by Smith et. al., (Mc Graw Hill).
5. Harper's Biochemistry (Langeman).
6. Biochemistry by D.Voet and J.G.Voet (John weily).
7. Biochemistry by U.Satyanarayana (Books & alied (p) Ltd

I SEMESTER

103: MICROBIAL PHYSIOLOGY & GENETICS

Objectives

- To study the process of sterilization
- To study the classification & culture methods of bacteria
- To understand the economic importance of micro organization.
- To study the genetics in prokaryotic gene.
- To study the genetics in Eukaryotes.

UNIT-I

Methods of sterilization, pasteurization and disinfection. Microbes as pathological agents in plant and animals. Biohazards - safety precautions.

UNIT-II

Classification and cultivation of bacteria. Bacterial reproduction and growth curve. Preparation of bacteriological media. Staining techniques. Differences between gram positive and gram negative bacteria. Micro biology of water, milk, air, soil and sewage.Clinically important bacteria.

UNIT-III

Chemical nature and classification of bacteriophages. Parasitic and temperate phages. Plant and animal viruses – multiplication of viruses. General characteristics of T Phage, ϕx174, SV40, TMV. Clinically important viruses, retroviruses, HIV, Hepatitis B Virus and viral infections. General account of algae, molds and yeasts. Economic importance of algae and fungi. Clinically significant protozoans.

UNIT – IV

Microbial genetics: Recombination in prokaryotes, Transformation, conjugation, transduction and sexduction. Mapping of prokaryotic gene. Transposons, retrotransposons and mechanism of transposition. Viral genetics. Biology of plasmids. Extra chromosomal inheritance.

UNIT-V

Genetics of Eukaryotes: Gene & Environment, Genotype and phenotype, Mendel's experiments, Dominance relationships. Multiple alleles, Gene Interaction, Gene mutations, Sex determination, Sex linkage, Linkage and recombination in diploids. Tetrad analysis. Elements of gene mapping, Pedigree analysis.

BOOKS RECOMMENDED:

1. Text book of Microbiology by Pelczar and Reid (Mc Graw Hill).

2. Microbiology by Tortora, Funk & Case.

3. Microbiology by Prescott.

4. Principles of Genetics by Sinnet et.al,., (Mc Graw Hill).

5. Principles of Heridity by Robert Tumarin.

6. Genetics by M.W.Strick Berger (Mac Millan).

7. Cell and Molecular Biology by E,D.P.De Roberties (International edition).

I SEMESTER

104: ANALYTICAL TOOLS AND TECHNIQUES IN BIOTECHNOLOGY

Objectives

- To learn the principle & applications of various microscopes.
- To understand the properties & nature of electromagnetic radiation.
- To learn the separation techniques by means of chromatography
- To learn the principles of electrophoresis
- To understand use of radio isotopes in biology
- To learn the detection & measurements of radio activity.

UNIT-I

Principles and applications of light, phase contrast, fluorescence, scanning and transmission electron microscopi. Flow cytometry.

UNIT-II

Properties of electromagnetic radiations. Principles, instrumentation and applications of UV, visible, infrared, ORD, CD, NMR spectroscopy. Spectrofluorimetry and mass spectrometry, X-ray diffraction.

UNIT-III

Principles and applications of gel-filtration, ion-exchange and affinity chromatography. TLC, GLC and HPLC. Basic principles of sedimentation. Applications of preparative and analytical ultra centrifuges. Principles and applications of lyophilization.

UNIT-IV

General principles of electrophoretic techniques. Poly Acryl amide Gel Electrophoresis. Iso-electric focusing. Isotachophoresis. 2-D Electrophoresis. Capillary electrophoresis. Agarose gel electrophoresis of DNA and RNA. Blotting techniques. DNA fingerprinting.

UNIT-V

Stable and radioactive isotopes. Detection and measurement of radioactivity. Applications of radioisotopes in biological sciences. Autoradiography. Non-isotopic tracer techniques. Principles and range of electrochemical techniques. Operation of pH electrodes. Principles and applications of Ion-selective and gas sensing electrodes. Oxygen electrodes.

BOOKS RECOMMENDED

1. Analytical Biochemistry by David J.Holme (Long man).
2. A Biologists guide to Principles and techniques of practical Biochemistry. Ed.by.B.D.williams (Edward Arnold).
3. Instrumental methods of chemical analysis by G.K.Sharma (Goel).
4. Modern experimental Biochemistry by Rodney Boyer (Pearson Education)
5. Physical Biochemistry by Frefielder (Freeman & Co).
6. Biophysical chemistry principles and techniques by Upadyay, Upadyay and Nath (Himalaya publishing).
7. Instrumental methods of chemical analysis by Chatwal & Anand.

I SEMESTER

105: LAB - I: CELL BIOLOGY AND MICROBIOLOGY

01. Mitosis in onion root tip cells: All phases (Squash method).
02. Meiosis in onion flower buds: All phases including zygotene, diplotene and diakinesis of prophase I (Smear method).
03. Preparation of liquid and solid media for growth of microorganisms.
04. Slants and Stab cultures, Isolation and maintenance of microorganisms by plating, streaking and serial dilution methods.
05. Biochemical characterization of selected microbes.
06. Simple staining and Grams staining.
07. Acid fast and spore staining.
08. Microscopic examination of bacteria, yeast and molds.
09. Growth of a microorganism and growth curve.
10. Analysis of water for portability and determination of MPN.
11. Microbiological examination of milk.
12. Oligodynamic action of heavy metals.
13. Evaluation of disinfectants by phenol coefficient method.
14. Isolation of viruses.
15. Examination of thallus structure and reproductive bodies of algae.
16. Examination of external features and reproductive organs of fungi.
17. Representative species of protozoa.

BOOKS RECOMMENDED:

1. Handbook of Microbiological Media by Atlas R.L.
2. Manual of Clinical Microbiology by Lennettee E.H.
3. Manual of Clinical Microbiology by Murray PR.
4. A Laboratory manual of Microbiology: Microbes in Action.

I SEMESTER

106: LAB-II: BIOCHEMICAL ANALYSIS AND TECHNIQUES

01. Separation of amino acids by paper chromatography.

02. Separation of amino acids/ sugars/ lipids by Thin Layer Chromatography.

03. Ultra violet absorption spectra of nucleic acids and proteins.

04. Determination of molar extinction coefficient of tryptophane / tyrosine.

05. Gel filtration of proteins.

06. Ion exchange chromatography of amino acids.

07. Purification of enzyme by affinity chromatography.

08. Subcellular fractionation by differential centrifugation.

09. Polyacrylamide gel electrophoresis of proteins.

10. Determination of isoelectric point of glycine.

11. Estimation of glycine by formal titration.

12. Estimation of reducing sugars by Benedict's titrimetric method.

13. Estimation of total carbohydrates by anthrone method.

14. Estimation of proteins by Lowry and Bradford methods.

15. Estimation of ascorbic acid.

16. Determination of Iodine value of oils.

17. Estimation of cholesterol.

BOOKS RECOMMENDED:

01. Hawk's physiological chemistry Ed. by Oser (Mc Graw Hill).

02. Biochemical methods By Sadasivam and Manikam (Wiley Eastern limited).

03. An introduction to practical biochemistry by D.T.Plummer (Mc Graw Hill).

04. Laboratory manual in Biochemistry by J.Jayaraman (Wilety Eastern limited).

05. Biochemistry - a laboratory courses by J.M.Beckar (Academic Press).

M.Sc., (Previous) BIOTECHNOLOGY

II SEMESTER

201: ENZYMOLOGY & METABOLISM

Objectives

- To understand the classification & nomenclature of enzymes.
- To understand the factors effecting on enzymatic reaction.
- Understand the mechanism of Enzyme action
- Study the effects by the inborn errors of the metabolism
- Understand the synthesis & degradation process of amino acids & nucleic acids.

UNIT – I

Classification and Nomenclature of Enzymes. Assay of Enzyme Activity- units of enzyme activity. Coenzymes, metalloenzymes, and isoenzymes with examples. Ribozymes and catalytic antibodies.

UNIT-II

Enzymekinetics: Factors affecting the rates of enzyme catalysed reactions. Enzyme – substrate (protein ligand) binding. Michaelis- Menten equation.Methods of Measurement of k_m . Enzyme inhibition – Competitive, non-competitive and uncompetitive. Allosteric enzymes and their properties with examples-Multisubstrate reactions.

UNIT – III

Zymogen activation- Covalent modification- Active site determination. Mechanism of enzyme action of chymotrypsin,Trypsin (serine proteases), carboxy peptidase-A and ribonuclease A. Multienzyme systems.

UNIT – IV

Glycolysis, Glycogenolysis, glycogenesis, gluconeogenesis, HMP shunt path way and their regulation. Tricarboxylic acid (TCA) cycle, Glyoxylate cycle and its significance. Biosynthesis and oxidation of fatty acids- The concept of free energy- Energy rich compounds. Metabolism of cholesterol. Ketone bodies. Biosynthesis of Heme and chlorophylls.

UNIT – V

Protein turnover. General metabolic reactions of amino acids. Urea cycle. Nitrogen fixation. Essential and non-essential amino acids. Biosynthesis and degradation of aromatic and branched chain aminoacids. Inborn errors of amino acid metabolism. Biosynthesis of purine and pyrimidine nucleotides and their regulation. Catabolism of purines and pyrimidines.

BOOKS RECOMMENDED:

1.Principles of Biochemistry by A.L.Lehninger, 2 Ed. (worth).

2.Lehninger Principles of Biochemistry by Nelson, D and Cox, D. Macmillon Pub.

3.Biochemistry by L.Stryer 5 Ed. (Freeman-Toppan).

4.Text Book of Biochemistry by West et. al., (Mac Millan).

5.Principles of Biochemistry by Smith et. al., (Mc Graw Hill).

6.Harper's Biochemistry (Langeman).

7.Biochemistry by D.Voet and J.G.Voet (John wiley).

8.Enzoyms by Trevor PalmerThe Horwood publishing colophon Chichester, UK

202: MOLECULAR BIOLOGY

Objectives

- To study the genetic material organization
- To understand the process of DNA Replication
- To understand the process of DNA transcription
- To understand the process of DNA gene regulation
- To understand the process of DNA protein targeting.

UNIT – I

Organization of genetic material - Packing of DNA into chromatin - protein components of chromatin, histones, nucleosome organization. Solenoids loops, domains & scaffolds. polytene chromosomes. Fine structure of the eukaryotic gene. Split genes. Different kinds of genes: overlapping, assembled, polyprotein & nested genes.

UNIT – II

DNA replication – apparatus, enzymes involved and mechanism. Replication at telomeres. DNA damage and repair mechanism. Nuclear genome.C - value paradox. Mitochondrial & plastid genomes and genes.

UNIT – III

Transcription in prokaryotes and eukaryotes.Mechanism of transcription, enzymes and transcription factors, zinc finger, leucine zipper mechanism. Maturation and processing of m-RNA, splicing, 5' end capping & 3' end tailing. RNA editing and transport. RNAi and small RNA's

UNIT – IV

Translation in prokaryotes and eukaryotes: Genetic code - properties of the genetic code, deciphering of the genetic code. Ribosome as a translation factory. t - RNA as an adaptor, its mode of function. Post translational modifications. Leader sequences & protein targeting.

UNIT – V

Regulation of gene expression in prokaryotes - The operon concept, lac & trip operons. Transcriptional control. Post translational control. Regulation in eukaryotes - Control by promoter, enhancer and silencers. Cis-trans elements. Environmental & developmental regulation. DNA methylation & gene expression. Chromatin structure & gene expression.

BOOKS RECOMMENDED:

1. Biochemistry by L.Stryer 5 Ed. (Freeman-Toppan)
2. Genes VIII by B.Lewin (Oxford)
3. Cell and Molecular Biology by E,D.P.De Roberties (International edition)
4. Molecular Biology by David Frefielder.
5. DNA Science by Carolina Publishing Company.
6. Molecular Biology of the Gene by J.D.Watson et. al.,(Benjamin).
7.RNAi – Design and application by Barik (Springer) 2008
8.Small RNA's – Analysis and regulatory functions by Nellen (Springer) 2008.

203: GENETIC ENGINEERING

Objectives

- To learn the isolation procedure of nucleic acids
- To understand the process of cloning
- To learn the character& importance & cloning vectors
- To learn the gene transfer techniques
- To learn the process of PCR & its application.

UNIT-I

Isolation of DNA and RNA from natural sourses. DNA sequencing by chemical and enzymatic methods. Restriction mapping- Nucleic acid blotting – Southern and northern blotting.

UNIT-II

DNA cloning. Enzymes used in genetic engineering : Restriction endonucleases - types, nomenclature and properties. DNA polymerase-I, polynucleotide kinase, DNA ligase, terminal nucleotide transferase, Reverse transcriptase, alkaline phosphatase, S_1 nuclease.

UNIT-III

Salient features of cloning vectors, types of cloning vectors - plasmids, cosmids, phages (lambda and M13 phages), animal (SV40, Baculo) and plant (CMV) viruses, Artificial chromosomes - YACs and MACs. Ligation of foreign DNA to vectors - cohesive and blunt end methods - homopolymer tailing and adaptors. Preparation of gene libraries and c-DNA libraries .

UNIT – IV

Techniques of gene transfer - transformation , transfection, micro injection, electroporation, lipofection and biolistics. Selection of r-DNA clones and their expression. Nucleic acid probes, colony and fluorescent in-situ hybridization.

UNIT – V

Polymerase Chain Reaction and its applications. DNA micro array technology. Applications of genetic engineering in agriculture, animal husbandry, medicine and in industry. Genomics – genome sequencing by shot gun and hierarchical method. Genome annotation – identification of genes, promoters and exon – intron boundries.

BOOKS RECOMMENDED:

1. Recombinant DNA technology by Watson et. al., (Scientific American Books).
2. Genes-VIII by Benjamin Lewin.(Oxford).
3. Principles of Gene Manipulation by Old and Primrose.(Blackwell).
4. DNA Science by Carolina Publishing Company.
5. From genes to clones by Winneker.
6. From genes to genomes concepts and applications of DNA technology by Jeremy W dale and Malcolm von Scrantz, Weil publications
7. Molecular Biotechnology by Glick.
8. Genetic Engineering by Sandhya Mitra.
9. Genomes by T.A. Brown

204: BIOLOGY OF THE IMMUNE SYSTEM

Objectives

- To learn the types of immunity & organs involved in immune system
- To learn about the cells involved in immune system
- To understand the process of MHC
- To understand the diagnostic process of diseases by immunological techniques
- To learn the production of chimeric and monoclonal Ab
- To know about the hypersensitivity
- To learn the process of vaccination and development of vaccine

UNIT-I

Types of immunity – innate, acquired, passive and active. Organisation and structure of lymphoid organs – bone marrow, thymus, spleen and lymphnodes.

UNIT-II

Cells of the immune system – B-Lymphocytes, T-Lymphocytes. T-cell receptor – structure and function. Macrophages. Types of cell mediated immunity and lymphokine activated killer cells. Clonal nature of immune response, Immunological memory. Immuno regulation. Adjuvants and immunological tolerance.

UNIT-III

Nature of antigens and antibodies. Structure and function of antibodies. Isotypes, Allotypes and Idiotypes. Antigen – antibody interactions. The generation of antibody diversity, antigen receptors on B & T lymphocytes. Major Histocompatibility Complex (MHC). Human leucocyte antigens (HLA), MHC restriction and typing. Lymphokines, effector cell mechanisms, genetic control of immune response. Complement system.

UNIT-IV

Immunological techniques - ELISA, RIA, Western Blot, Immunoblot and Immuno fluorescent techniques. FACS. Hybridoma technology - production and applications of monoclonal antibodies. Antibody engineering, chimeric antibodies.

UNIT-V

Hypersensitivity - types of hypersensitivity - immediate and delayed hypersensitivity, autoimmune diseases, transplantation and immunity, immunity to infectious agents. Vaccines and Vaccination, types of vaccines including new generation vaccines. Tumor immunology.

BOOKS RECOMMENDED:

1. Essentials of Immunology by Roit (ELBS).
2. Immunology by Roit et.al (Harper Row).
3. Text book of Immunology by S.T,Barrot (Mosby).
4. Immunology by Kuby.
5. Principles of Microbiology and Immunology by Davis et.al., (Harper).

205 LAB III: MOLECULAR BIOLOGY AND GENETIC ENGINEERING

01. Isolation of RNA from yeast.

02. Estimation of RNA using orcinol reagent and by UV spectrophotometry.

03. Isolation of DNA from microbial, plant and animal sources.

04. Estimation of DNA using diphenylamine reagent and by UV spectrophotometry.

05. Enzyme induction in E.Coli.

06. Isolation of plasmid DNA.

07. Digestion of plasmid DNA with restriction endonucleases.

08. Separation of DNA fragments by Agarose gel electrophoresis.

09. Elution of DNA from agarose gels.

10. Ligation of DNA fragments.

11. Bacterial transformation and identification of transformants.

12. Cloning of green fluorescent protein.

13. Gene expression in bacteria.

14. Amplification of DNA by PCR.

15. Southern blotting technique.

16. RFLP and RAPD mapping.

BOOKS RECOMMENDED:

01. Biotechnology: A laboratory course by Becker J.M.

02. Molecular Cloning : A laboratory manual Vols. 1-3, Sambrook, J.

03. Lab manual in Biochemistry by J.Jayaraman (Wiley Eastern Limited).

04. Biochemistry – A lab course by J.M.Becker (Academic Press).

206: LAB : IV- ENZYMOLOGY AND IMMUNOLOGY

01. Assay of amylase from Saliva.
02. Assay of trypsin.
03. Assay of acid-phosphatase from potato.
04. Assay of Lipase from serum.
05. Assay of Catalase from liver.
06. Time course of enzyme activity
07. Effect of pH and determination of optimum pH.
08. Effect of temperature on enzyme activity and calculation of energy of activation.
09. Effect of substrate concentration on enzyme activity and determination of Km.
10. Effect of metal ions on enzyme activity.
11. Purification of an enzyme.
12. Determination of A, B, O and Rh blood groups in human beings.
13. Handling of mice and rats, techniques of immunization and bleeding.
14. Dissection and identification of thymus, spleen and lymph nodes.
15. Ouchterloney double diffusion.
16. Radial immunodiffusion.
17. Quantitative precipitin assay.
18. Immunoelectrophoresis.
19. Latex agglutination test.
20. Enzyme Linked Immunosorbent Assay (ELISA).
21. Western blotting.
22. Diagnostic test for typhoid fever by Widal test.
23. VDRL test for syphilis.
24. Pregnancy tests.

BOOKS RECOMMENDED:

01.Hawk's physiological chemistry Ed. by Oser (Mc Graw Hill).

02.Biochemical methods By Sadasivam and Manikam (Wiley Eastern limited).

03.An introduction to practical biochemistry by D.T.Plummer (Mc Graw Hill).

04.Laboratory manual in Biochemistry by J.Jayaraman (Wilety Eastern limited).

05.Biochemistry - a laboratory courses by J.M.Beckar (Academic Press).

06.Immunology methods manual - The comprehensive source book by Lefkovits. I.

07.Manual of clinical laboratory immunology by Rose NR.

08.The experimental foundations of modern immunology by Clark W.R.

09.Laboratory Immunology by Bradshaw LJ.

M.Sc., (Final) BIOTECHNOLOGY

III SEMESTER

301 : CELL CULTURE TECHNOLOGY AND TISSUE ENGINEERING

Objectives

- To learn the preparation of plant tissue culture media
- To learn the preparation of Animal tissue culture media
- To understand the production process of artificial organs
- To understand the process of apopotosis
- To learn the types and importance of stem cells
- To understand the process of bone marrow transplantation
- To understand the applications of stemcells in therapy

UNIT-I

Plant tissue culture technology: culture media – composition and preparation. Factors governing in vitro behaviour, Somatic embryogenesis, organogenesis and plant regeneration. Culture types. Micro propagation, Haploids, somaclonal variations, , metabolite production in cultures. Isolation of protoplasts, protoplast fusion and culture. Somatic hybridization.

UNIT-II

Animal cell and tissue culture. Primary culture, balanced salt solutions and simple growth medium. Serum and protein free defined media. Cell lines, primary and established cell line cultures. Basic techniques of mammalian cell culture in vitro. Tissue and organ culture.

Production and use of artificial tissues and organs – Skin, liver and pancreas. Apoptosis – mechanism and significance

UNIT-III

The biology of stem cells – Different types of stem cells – embryonic stem cells, fetal tissue stem cells, adult stem cells; stem cell differentiation, stem cell plasticity – Differentiation versus stem cell renewal. Isolation and propagation of embryonic stem cells; chimeras; generation of knockout mice and knock-in technology.

UNIT-IV

Hematopoietic stem cells and bone marrow transplantation: Cells for hematopoietic reconstitution – Cord blood stem cells; cells for adoptive cellular immunotherapy; bone marrow transplantation - advantages and disadvantages. Allogenic, autologous, syngenic and congenic transplantation.

UNIT-V

Clinical applications of stem cell therapy- neurodegenerative diseases – Parkinson's disease, Alzheimers, spinal cord injury and other brain syndromes. Applications of Cultured Stem cells.

BOOKS RECOMMENDED:

1. Plant tissue culture – Theory and practice by Bhojwani S.S.

2. Plant cell culture – A practical approach by Dixion R.A.

3. Culture of Animal cells by R.I.Freshney. Wiley – Liss.

4. Animal Cell Culture – A Practical approach Ed. by John R.W.Masters (IRL Press).

5. Animal cell culture techniques, Ed. Martin Clynes, Springer.

6. Plant Cell, Tissue and Organ Culture, By Reinert. and YPS Bajaj (Springer – Verlag).

7. Plant tissue and cell culture, by Street, HE (Blackwell).

8. Stem Cells in regenerative medicine by Audet (springer) 2009

9. Cell and tissue engineering by Eibl , Springer (2008)

302: PLANT BIOTECHNOLOGY

Objectives

- To learn the Gene cloning techniques
- To learn about the reporter genes
- To understand the process of herbicide resistant plants
- To understand the process of insect resistant plants
- To understand the process of sliess resistant plants
- To understand the process of disease resistant plants
- To learn the production process of plantibodies and edible vaccines
- To understand the importance and applications of Bio – fertilizer

UNIT-I

Plant Genetic engineering: Gene cloning techniques, Techniques for gene transfer into plants. Mechanism of gene transfer by T_I and R_I plasmids as vectors. Reporter genes, transient gene assays and identification of transgenic plants.

UNIT-II

Reporter genes- Assays for gene transfer in plants Molecular markers and their significance. RFLP, , AFLP and QTL in plants. RAPD for molecular mapping and crop improvement-Clean gene technology

UNIT-III

Agricultural Biotechnology: Engineering of herbicide tolerance in plants, production of disease resistant plants by gene transfer; Development of insect resistant plants. Genetic engineering to improve plant disease resistance. Biotechnological strategies for engineering stress tolerance.

UNIT-IV

Altering protein and oil quality traits in seeds. Chloroplast transformation – advantages in tobacco and potato, plants for expression of bacterial, viral and eukaryotic genes. Edible vaccines and plantibodies. The genetic manipulation of crop yield by enhancement of photosynthesis.

UNIT-V

Algal Biotechnology: Laboratory culture of micro algae. Large scale biomass production. Marine micro algae/sea weeds and their products. Edible sea weeds and their cultivation. Biofertilizers – Blue green algal fertilizers – Azolla, Anabaena, symbiotic association. Sea weed fertilizers. Mycorrhizal biofertilizers, bacterial fertilizers. Biopesticides in agricultural production.

BOOKS RECOMMENDED:

1. Plant Biotechnology by A. Slater, N.W. Scott and M.R. Fowler (Oxford University press).

2. Biotechnology in Agriculture by Swaminathan, M.S (Mc. Milllan India Ltd).

3. Biotechnology and its applications to Agriculture, by Copping LG and P.Rodgers (British Crop Projection).

4. Plant Biotechnology, by Kung, S.and C.J.Arntzen (Butterworths).

III SEMESTER
303: ANIMAL BIOTECHNOLOGY

Objectives

- To know the causes of infertility in humans
- To understand the process of in-vitro fertilisation
- To know the production methods of transgenic animals
- To understand the importance of aquaculture
- To learn the induced breading techniques in fishes

UNIT-I

Infertilities in humans-Types and causes of male and female infertility, sperm collection, Cryopreservation, artificial insemination, Oocyte recovery, superovulation.

UNIT-II

oocyte maturation in vitro, In vitro fertilization in humans and cattle. Embryo culture, embryo transfer in farm animals. Somatic cell nuclear transfer in humans – Legal aspects. Live stock improvement, Immunocontraception - hormonal methods. Biotechnological approaches for the management of pests, mosquitoes and nematodes. Risks and ethical issues

UNIT-III

Production of transgenic animals - mice, sheep and fish. Molecular pharming and animal cloning. Potential applications of transgenic animals – Animal models for diseases and disorders. Transgenic poultry and transgenic insects as bioreactor.

UNIT-IV

The concept of aquatic biotechnology and blue revolution. Economically important aquatic resources from fresh water, brackish water and marine habitats – the finfish, shellfish, lime fish, algae, corals, and holothurians. Bioactive compounds from corals. Fish bioproducts. Pearl culture technology – principles and applications.

UNIT-V

Aquaculture - Fresh water fish culture practices and types. Freshwater prawn culture. Brackish water fish, shrimp and crab culture practices. Fresh water fish hatchery and seed production. Hypophysation and induced breeding techniques. Eyestalk oblation. Techniques involved in transgenic fish production. Post harvest technology. Diagnosis of shrimp & fish diseases caused by bacterial, fungal and viral pathogens using molecular methods.

BOOKS RECOMMENDED:

1. Elements of Biotechnology by PK Gupta (Rastogi & Co).

2. Biotechnology by Kashav. T (Wiley Eastern Ltd).

3. Concepts in Biotechnology by Balasubrahmanian et. al.,(University press).

4. Principles and practices of aquaculture by TVR Pillay.

5. Coastal aquaculture by Santhanam.

6. Fisheries of India by CBL Srivatsava.

7. Molecular Biotechnology by Glick.

304: MEDICAL AND ENVIRONMENTAL BIOTECHNOLOGY

Objectives

- to learn the types of enzyme probes & its importance in diagnosis
- to know the strategics for vaccine development of HIV ,Malaria and TB
- to learn the production methods of health care products through Rdna Technology
- to understand the importance of environment and its conservations
- to know the important of alternative resources, waste management
- to understand the process of bio hazards management

UNIT – I

Enzyme probes - glucose oxidase, lactate oxidase, monoamine oxidase.Use of Enzymes in the diagnosis and treatment of diseases Enzyme based Biosensors.

UNIT – II

DNA probes, PCR amplification and disease diagnosis - Applications in forensic medicine. Genetic diseases and gene therapy. Current strategies for development of vaccines against HIV, Malaria, Tuberculosis.

UNIT-III

Health care products. Products from recombinant DNA Technology - insulin, growth hormone, factor VIII, tissue plasminogen activator, interferons, lymphokines and Hepatitis-B vaccines.

UNIT – IV

Environmental pollution – types, sources and control. Reduction of environmental impact of industrial effluents, chemical herbicides and fertilizers. Removal of oil spills. Environmental monitoring and biomonitoring. Bioremediation - solid and liquid waste treatment. Biomass and energy production from waste. Bioleaching – Microbial recovery of metals and acid mine drainage. Water pollution and its control. Microbiology of waste water treatment.

UNIT-V

Environment and energy: Renewable sources of energy – Biogas, waste materials, energy crops, cellulose. Production of energy and fuel using microorganisms – Biofuels and Biodiesel. Global environmental problems: Ozone depletion, UV-B, Green house effect. Biodiversity-benefits to mankind-conservation; Ecology and sustainable development. Biosafety and environmental issues.

BOOKS RECOMMENDED:

1. Biotechnology by B.D.Singh (Kalyani).

2. Ecology and Environment by PD Sharma.

3. Fundamentals of Ecology, by Odum, EP (Mc Graw Hill)

4. Environmental Biotechnology by Forster, C.F. and Wase D.A.J. (Ellis Horwood).

5. Biotechnological innovations in environmental management by Leach, CK and Van Dam-Mieras, MCE (Butterworth-Herinemann, Oxford (Biotol Series).

6. Molecular Biology and Biotechnology by Meyers, RA, A Comprehensive Desk Reference (VCH Publishers).

7. Biotechnology by U.Satyanarayana (Books & Allied (p) Ltd.

305: LAB - V: PLANT TISSUE CULTURE TECHNIQUES

01. Preparation of media for plant tissue culture (MS and B5).
02. Establishment of callus cultures from carrot cambial tissue.
03. Establishment of cell cultures and plating.
04. Embryo culture of maize/ crotalaria.
05. Organogenesis and regeneration of plants from tobacco explants.
06. Anther culture and production of haploids.
07. Micropropagation using suitable system: Potato/solanum's
08. Enzymatic isolation of protoplast and culture.
09. Polyethylene glycol (PEG) mediated fusion of protoplasts.
10. Agrobacterium culture and transformation.
11. Reporter gene assay (GUS).

BOOKS RECOMMENDED:

01. Plant cell culture – A practical approach by Dixion RA.
02. Plant tissue culture – theory and practice by Bhojwani, S.S.
03. Biotechnology: A laboratory Course by Becker, J.M.

306: LAB-VI: ANIMAL CELL CULTURE AND ENVIRONMENTAL BIOTECHNOLOGY

01. Preparation of animal cell culture media and membrane filtration.

02. Preparation of single cell suspension from spleen and thymus.

03. MTT assay for cell viability and growth.

04. Demonstration of sections of human ovary, testis and aborted human embryos.

05. Estimation of dissolved oxygen and salinity in water samples.

06. Estimation of Chemical Oxygen Demand (COD).

07. Estimation of Biochemical Oxygen Demand (BOD).

08. Determination of suspended solids in industrial effluents.

09. Removal of color of the industrial effluents by biological methods.

10. Reduction of pollution load in effluents by biological methods (laboratory models).

BOOKS RECOMMENDED:

01. Animal cell culture – A practical approach Ed. By John R.W. Masters (IRL Press).

02. Animal cell culture techniques, Ed. Martin clyenes (Springer).

03. Comprehensive Biotechnology. Vol. 4. M.Moo-Young (Ed-in-chief), Pergamon Press, Oxford

04. Environmental Chemistry. A.K.De, Wiley Eastern Ltd, New Delhi.

05. Introduction to Biodeterioration, D.Allsopp and K.J.Seal, ELBS/Edward Arnold.

M.Sc. (Final) BIOTECHNOLOGY

IV SEMESTER

401: HETEROLOGOUS EXPRESSION AND DOWN STREAM PROCESSING

Objectives

- to learn the production of recombinant proteins
- to learn the process of fermentation
- to know the applications of Enzymes in various industries
- to learn the process of immobilization of Enzymes

UNIT-I

Heterologous Expression: Expression vectors and hosts Generally Regarded As Safe (GRAS) organisms. Production of active recombinant proteins of mammalian/eukaryotic origin in prokaryotes. Large scale production of proteins from recombinant microorganisms.

UNIT-II

Principles of microbial growth – Batch fermentation, feed-batch fermentation – continuous fermentation, high density cell cultures – Bioreactors – Large scale fermentation system – tandem Airlift reactors – Single stirred tank reactors.

UNIT-III

Down stream processing: Harvesting microbial cells – Membrane filtration system, high speed semi continuous centrifugation – disrupting microbial cells. Gram scale purification of recombinant proteins – Chromatography systems and analytical methods for large scale purification. Stabilization of the proteins.

UNIT-IV

Processing technology: Microbial metabolites - Organic solvents (Alcohol, Acetone, Butanol), Organic acids (Citric acid, lactic acid), Wines and beers, Antibiotics (penicillin, streptomycin, tetracycline, semi synthetic penicillins), Vitamins (Vitamin B_{12} and Riboflavin), Amino acids (lysine, glutamic acid). Production of single cell proteins.

UNIT-V

Enzyme technology: Sources production, isolation and purification of enzymes for the industrial use. Application of enzymes in pharmaceutical, food processing and other industries. Different techniques of immobilization of enzymes, applications and kinetics of immobilized enzymes. Design and operation of immobilized enzyme systems and bioreactors. Whole cell immobilization. Biosensors - principle and types.

BOOKS RECOMMENDED:

1. Biotechnology – Volumes 1 to 5 by Rehem.
2. Industrial Microbiology by LE Casida Jr.
3. Industrial Microbiology by Presscot and Dunn.
4. Immobilized enzymes by Messing.
5. Biochemical engineering fundamentals by Bailey and Ollis.
6. Biotechnology by BD Singh (Kalyani).

IV SEMESTER

402: BIOINFORMATICS, BIOSTATISTICS AND PATENTING IN BIOTECHNOLOGY

Objectives

- **to learn the fundamentals of computer languages and programming**
- **to learn the fundamentals of bio informatics**
- **to learn the CADD in dry discovery**
- **to learn the tabulation and statistical representation of data**
- **to know the intellectual rights**
- **to understand the importance of patenting & its importance**

UNIT-I

Scope of computers in current biological research. Basic operations, architecture of computer. Introduction of digital computers. Organization, low level and high level languages, binary number system. The soft side of the computer – Different operating systems – Windows, Linux. Introduction of programming in Basic. Introduction to Internet and its applications.

UNIT-II

Introduction to Bioinformatics – Genomics and Proteomics. Bioinformatics – Online tools and offline tools. Biological databases. Types of data bases – Gen bank, Swiss port, EMBL, NCBL, and PDB. Database searching using BLAST and FASTA.

UNIT-III

Multiple sequence alignment and Dynamic programming. Gene and Genome annotation – Tools used. Physical map of genomes. Molecular phylogeny - Concept methods of tree construction. Protein secondary structure prediction. Protein 3D structure prediction. Protein docking. Introduction to homology modeling, Computer Aided Drug Design (CADD) in Drug discovery.

UNIT-IV

Brief description and tabulation of data and its graphical representation. Measures of central tendency and dispersion - mean, median, mode, range, standard deviation, variance. Simple linear regression and correlation. Types of errors and level of significance. Tests of significance – F & t tests, chi-square tests, ANOVA.

UNIT-V

Bio technology processes - Patenting in Bio Technology – intellectual Property Rights (IPR) – Products and process patents – Patenting of living things. Good manufacturing Practices and quality control .

BOOKS RECOMMENDED:

1. Bioinformatics – D.Mount

2. BASIC programming by Balaguru Swamy.

3. Introduction to Bioinformatics by Arthur M.Lesk, Oxford.

4. Biostatistics – Daniel. (Wiley).

5. Statistics by S.C.Gupta.

6. Statistical Methods by G.W.Snedecor & W.G.Cochran.

7. Fundamentals of Biostatistics – Khan & Khanum.

8. Fundamentals of Biostatistics by V.B.Rastogi (Ane Books in India)

403: LAB:VII : INDUSTRIAL BIOTECHNOLOGY AND BIOINFORMATICS

01. Production of protease/amylase by batch fermentation.
02. Immobilization of an enzyme (invertase/lipase/amylase) by gel entrapment.
03. Immobilization of whole cells for enzyme/antibiotic production by gel entrapment.
04. Screening of soil samples for isolation of bacteria, fungi and actinomycetes.
05. Selective isolation of actinomycetes from soil samples.
06. Microbiological assay of an antibiotic including the construction of standard curve.
07. UV survival curve.
08. Production of alcohol by S.cerevisiae and its estimation.
09. Production of streptomycin by fermentation.
10. Production of citric acid by A.niger.
11. Production of red wine from grapes.
12. Production of Glutamic acid by M. glutamicus.
13. Searching Data from NCBI Database.
14. Working on EMBL.
15. Searching structural data from PDB.
16. Genome Map viewer from NCBI.
17. Database search using BLAST.
18. Sequence alignments.
19. Sequence and structure visualization.

BOOKS RECOMMENDED:

01. A manual of Industrial Microbiology and Biotechnology by Demain A.L.
02. Immobilization of enzymes and cells: Methods in Biotechnology vol.1 by Bickerstaff G.F.
03. Principle of fermentation technology by Stanbury.
04. Biotechnology: A laboratory course by Becker J.M.

MODEL QUESTION PAPER

M.A /M.Sc/M.Com/MCA/MLISc/M.Ed/B.Ed(MR)/DEGREE EXAMINATIONS

COURSE IN: _____

SEMESTER_____

PAPER No._____ & TITLE: _____

TIME: 3 Hrs **Max Marks: 85**

SECTION – A

Question No.1 is Compulsory

Answer ALL questions

Each answer shall not exceed one page or 200 words

1. **(5 x 5 = 25)**

A.

B.

C.

D.

E.

SECTION – B

Answer ALL questions

Each answer shall not exceed five page or 1000 words

(5 x 12 = 60)

UNIT-I

2.

Or

3.

UNIT-II

4.

Or

5.

UNIT-III

6.

Or

7.

UNIT-IV

8.

Or

9.

UNIT-V

10.

Or

11.