SRI SANKARA ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

ENATHUR, KANCHIPURAM – 631 561
CHOICE BASED CREDIT SYSTEM
DEPARTMENT OF BIOTECHNOLOGY
B.Sc. DEGREE COURSE IN BIOTECHNOLOGY
REGULATIONS

1. ELIGIBILITY FOR ADMISSION:

Candidates for admission to the first year of the Degree of Bachelor of Science courses shall be required to have passed the Higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an Examination accepted as equivalent thereof by the Syndicate of the University of Madras. Provided that candidates for admission into the specific main subject of study shall be Possess such other qualifying conditions as may be prescribed by the University.

2. ELIGIBILITY FOR THE AWARD OF DEGREE:

A candidate shall be eligible for the award of the Degree only if he /she has undergone the prescribed course of study in a College affiliated to the University for a period of not less than three academic years, passed the examinations all the Six-Semesters prescribed earning 140 Credits (in Parts-I, II, III, IV & V).

3. DURATION:

a) Each academic year shall be divided into two semesters. The first academic year shall comprise the first and second semesters, the second academic year the third and fourth semesters and the third academic year the fifth and sixth semester respectively.

b) The odd semesters shall consist of the period from June to November of each year and the even semesters from December to April of each year. There shall be not less than 90 working days for each semester.

4. COURSE OF STUDY:

The main Subject of Study for Bachelor Degree Courses shall consist of the following

PART – I TAMIL / OTHER LANGUAGES

PART – II ENGLISH

PART – III CORE SUBJECTS
ALLIED SUBJECTS
PROJECT/ELECTIVES WITH THREE COURSES

PART – IV

1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6^{th} Standard).

(b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses.

(c) Others who do not come under a + b can choose non-major elective comprising of two courses.

2. SKILL BASED SUBJECTS (ELECTIVE) - (SOFT SKILLS)

3. ENVIRONMENTAL STUDIES

4 VALUE EDUCATION

PART – V EXTENSION ACTIVITIES

5. EXTENTION ACTIVITIES:

A candidate shall be awarded a maximum of 1 Credits for Compulsory Extension Service.

All the Students shall have to enrol for NSS /NCC/ NSO (Sports & Games) Rotract/ Youth Red cross or any other service organizations in the college and shall have to put in Complusory minimum attendance of 40 hours which shall be duly certified by the Principal of the college before 31st March in a year. If a student LACKS 40 HOURS ATTENDANCE in the First year, he/she shall have to compensate the same during the subsequent years.

Students those who complete minimum attendance of 40 hours in One year will get HALF A CREDIT and those who complete the attendance of 80 or more hours in Two Years will ONE CREDIT.

Literacy and population Education Field Work shall be compulsory components in the above extension service activities.

6. SCHEME OF EXAMINATION:

Scheme of Examination shall be given in

Model Scheme

Course Component **Name of the course**	**Inst. Hour**	**Credits**	**Exam Hours**	**Max. Marks**		
				Ext.mark	**Int. mark**	**Total**
PART-I **Language**				**75**	**25**	**100**
PART-II **English**				**75**	**25**	**100**
PART-III **Core subject :**				**75**	**25**	**100**
Core Subject				**75**	**25**	**100**
Allied Subject				**75**	**25**	**100**

PART – IV 1.(a) Those who have not studied Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Tamil comprising of two course (level will be at 6th Standard). (b) Those who have studies Tamil up to XII Std. and taken a Non-Tamil Language under Part-I shall take Advanced Tamil comprising of two courses. (c) Others who do not come under a + b can choose non-major elective comprising of two courses.						
2*Skill based subjects(Elective) – (Soft Skill)						

The following procedure be be followed for Internal Marks:

Theory Papers: Internal Marks 25

INTERNAL MARKS

Tests (2 out of 3) = 10

Attendance = 5

Seminars = 5

Assignments = 5

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25 marks

Break-up Details for Attendance

Below 60% - No marks

60% to 75% - 3 marks

76% to 90 % - 4 marks

91% to 100% - 5 marks

Practical: Internal Marks 40

Attendance	5 marks
Practical Test best 2 out of 3	30 marks
Record	5 marks

Project:

Internal Marks	best 2 out of 3 presentations	20 marks
Viva		20 marks
Project Report		60 marks

7. REQUIREMENTS FOR PROCEEDING TO SUBSEQUENT SEMESTER:

i. Candidates shall register their names for the First Semester Examination after the admission in UG Courses.

ii. Candidates shall be permitted to proceed from the First Semester up to Final Semester irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all the arrear subject of earlier semesters along the current (subsequent) Semester Subjects.

iii. Candidates shall be eligible to go to subsequent semester, only if they earn, sufficient attendance as prescribed therefor by the Syndicate from time to time.

Provided in case of a candidate earning less than 50% of attendance in any one of the Semesters due to any extraordinary circumstances such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorised Medical Attendant (AMA), duly certified by the Principal of the college, shall be permitted to proceed to the next semester and to complete the Course of study. Such Candidates shall have to repeat the missed Semester by rejoining after completion of Final Semester of the course, after paying the fee for the break of study as prescribed by the University from time to time.

8. PASSING MINIMUM:

A candidate shall be declared to have passed:

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 40%(Forty Percentage) of the maximum marks prescribed for the paper for each Paper/Practical/Project and Viva-voce.

c) In the aggregate (External + Internal) the passing minimum shall be of 40% .

d) He/She shall be declared to have passed the whole examination, if he/she passes in all the papers and practicals wherever prescribed / as per the scheme of examinations by earning 140 CREDITS in Parts-I, II, III, IV & V. He/she shall also fulfill the extension activities prescribed earning a minimum of 1 Credit to qualify for the Degree.

9. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

PART- I TAMIL / OTHER LANGUAGES

TAMIL/OTHER LANGUAGES: Successful candidates passing the Examinations for the Language and securing the marks (1) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD Class.

PART – II ENGLISH

ENGLISH: Successful candidates passing the examinations for English and securing the marks (i) 60 percent and above and (ii) 50 percent and above but below 60 percent in the aggregate shall be declared to have passed the examination in the FIRST and SECOND Class, respectively. All other successful candidates shall be declared to have passed the examination in the THIRD class.

PART – III consisting of CORE SUBJECTS, ALLIED SUBJECTS, PROJECT / ELECTIVE with three courses:

Successful candidates passing the examinations for Core Courses together and securing the marks (i) 60 percent and above (ii) 50 percent and above but below 60 percent in the aggregate of the marks prescribed for the Core courses together shall be declared to

have passed the examination in the FIRST and SECOND Class respectively. All other successful candidates shall be declared to have passed the examinations in the Third Class.

PART – IV (consisting of sub items 1 (a), (b) & (c), 2, 3 and 4) as furnished in the Regulations 4 Part-IV supra.

PART – V EXTENTION ACTIVITIES**:**
Successful Candidate earning of 1 credit SHALL NOT BE taken into consideration for Classification/Ranking/ Distinction.

10. RANKING:

Candidates who pass all the examinations prescribed for the course in the FIRST APPEARANCE ITSELF ALONE are eligible for Ranking/ Distinction.

Provided in the case of Candidates who pass all the examinations prescribed for the Course with a break in the First Appearance due to the reasons as furnished in the Regulations. 7 (iii) supra are only eligible for classification.

11. TRANSITORY PROVISION:

Candidates who have undergone the course of study prior to the academic year 2015 – 2016 will be permitted to appear for the examinations under those Regulations for a period of TWO years i.e. up to and inclusive of April/May 2018 Examinations. Thereafter, they will permitted to appear for the examination only under the Regulations then in force.

Question Paper Pattern

SECTION – A (30 words)

10 OUT OF 12 - 10 X 2 marks = 20 marks

SECTION – B (200 words)

5 out of 7 - 5 x 5 marks = 25 marks

SECTION – C (500 words)

3 out of 5 - 3x 10 marks = 30 marks

TOTAL = 75 marks

QUESTION PAPER FOR PRACTICALS

The external examiner will prepare a question paper on the spot with the help of the Question Bank supplied by the Controller's office.

SRI SANKARA ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

SYLLABUS FOR B.Sc. DEGREE COURSE IN BIOTECHNOLOGY

CHOICE BASED CREDIT SYSTEM.

FIRST SEMESTER

S. No	**Course component**	**Name of course**	**Inst. hours**	**Credits**	**Theory/ Practical (External : Internal)**	**Max. marks**
1	Part I	Language/ Tamil Paper 1	4	3	75 : 25	100
2	Part II	English Paper 1	4	3	75 : 25	100
3	Part III	**Core**: Paper1: Cell biology	5	4	75 : 25	100
4	Part III	**Core**: Paper 2: Practical 1*	5	4	60 : 40	100
5	Part III	**Allied** :Paper1: Microbiology	6	5	75 : 25	100
6	Part IV	**1.a.** Those who have not studied Tamil upto XII std and taken a non- tamil language under Part – I shall take Tamil comprising of two courses (level will be at 6th std). **b.** Those who have studied Tamil upto XII std and taken a non-Tamil language under Part- I shall take Advanced Tamil comprising of two courses. **c.** Others who do not come under a+b can choose non- major	3	2	75 : 25	100

		elective comprising of two courses.				
7		**2.Skill based subject (Elective):** Soft skill	3	2	75 : 25	100

* practical examination will be conducted at the end of second semester.

SECOND SEMESTER

S. No	**Course component**	**Name of course**	**Inst. hours**	**Credits**	**Theory/ Practical External : Internal**	**Max. marks**
1	Part I	Language/ Tamil Paper 2	4	3	75 : 25	100
2	Part II	English Paper 2	4	3	75 : 25	100
3	Part III	**Core**: Paper3: Molecular Developmental Biology	5	4	75 : 25	100
4	Part III	**Core**: Paper 4: Practical 2*	5	4	60 : 40	100
5	Part III	**Allied** :Paper2: Chemistry	6	5	75 : 25	100
6	Part IV	**1. a.** Those who have not studied Tamil upto XII std and taken a non- tamil language under Part – I shall take Tamil comprising of two courses (level will be at 6^{th} std). **b.** Those who have studied Tamil upto XII std and taken a non-Tamil language under Part- I shall take Advanced Tamil	3	2	75 : 25	100

		comprising of two courses. **c.** Others who do not come under a+b can choose non- major elective comprising of two courses.				
7		**2. Skill based subject (Elective) :** Soft skill	3	2	75 : 25	100

* practical examination will be conducted at the end of second semester.

THIRD SEMESTER

Course components	Subject	Inst Hrs.	Credits	Exam Hrs.	Max. Marks		
					Ext. Marks	Int. Marks	Total
Part-I	Language Paper- III	6	3	3	75	25	100
Part-II	English Paper- III	6	3	3	75	25	100
Part III - Core Courses	Paper-V - Genetics	5	5	3	75	25	100
Practical	Paper- VI Genetics and Biochemistry (Practical)	6	6	3	60	40	100
Allied Subject-II	Paper – I Biochemistry	5	4	3	75	25	100
Part-IV 2. Soft Skill-III			3	3	60	40	100
3. Environmental Studies		2			Examination will be held in IV Semester.		

FOURTH SEMESTER

Course Components	Subject	Inst Hrs.	Credits	Exam Hrs.	Max. Marks		
					Ext. Marks	Int. Marks	Total
Part-I	Language Paper- IV	6	3	3	75	25	100
Part-II	English Paper-IV	6	3	3	75	25	100
Part III Core Courses	Paper-VII - Plant Biotechnology	5	4	3	75	25	100
	Paper-VIII - Plant Biotechnology (Practical)	3	4	3	60	40	100
Allied Subject-II	Paper-II - Biophysics and Biostatistics	6	5	3	75	25	100
Part-IV 2. Soft Skill-IV			3	3	60	40	100
3. Environmental Studies		3	2	3	75	25	100

FIFTH SEMESTER

Course components	Subject	Inst Hrs	Credits	Exam Hrs.	Max. Marks		
					Ext. Marks	Int. Marks	Total
Part-III Core Courses	Paper- IX – Animal and Medical Biotechnology	6	4	3	75	25	100
	Paper- X - Bioinformatics	6	4	3	75	25	100
	Paper-XI - Immunology	5	4	3	75	25	100

Practical	Paper- XII - Animal, Medical Biotechnology and Immunology.	6	4	3	60	40	100
Project (at VI Semester) or Three Electives	Elective –I Pharmaceutical Biotechnology	5	5	3	75	25	100
Part-IV 4. Value Education		2	2				

SIXTH SEMESTER

Course components	***Subject***	**Inst Hrs.**	**Credits**	**Exam Hrs.**	**Max. Marks**		
					Ext. Marks	**Int. Marks**	**Total**
Part-III Core Courses	Paper- XIII - Genetic Engineering.	6	4	3	75	25	100
	Paper- XIV - Bioprocess Technology	6	4	3	75	25	100
Practical	Paper-XV - Genetic Engineering and Bioprocess (Practical).	6	5	3	60	40	100
Project or Electives							
	Project / Elective-II Microbial Biotechnology	5	5	3	75	25	100
	Project / Elective-III Environmental Biotechnology	5	5	3	75	25	100
Part-V - Extension Activities		2	1				

SEMESTER - I

Title of the paper	Paper 1 - Cell Biology		
Category : **Part III Core**	Year & Semester First year, Sem 1	Credits 4	
Pre- requisites	Knowledge of biology at Higher Secondary level		
Objectives of the course	To introduce the student to various biological activities occurring at cellular level		

UNIT- I

Organisation of living organisms – Unicellular to higher organisms – organs – tissues – cells.

UNIT II

Cell: The dynamic cell- the molecules of life- the architecture and types of cells- differentiation of cells into tissues.

UNIT- III

Biomembranes, transport across cell membranes- subcellular organization of eukaryotic cells- microscopy and cell architecture.

UNIT- IV

Genetic code and the synthesis of macromolecules: structure of nucleic acids- nucleic acid synthesis- DNA replication- repair- recombination- protein secretion and sorting, folding, modification, and degradation of proteins.

UNIT – V

Molecular structure of genes and chromosomes: Regulation of transcription in bacteria and eukaryotic cell. RNA processing and post-transcriptional control- cell. RNA processing and post-transcriptional control- Regulation of gene expression. Hormones, viruses and gene expression; Nuclear-Cytoplasmic interaction.

UNIT – VI

Molecular aspects of cell division and cell cycle- cellular energetics- cell motility- cell-to-cell signaling-hormones and receptors.

Recommended Texts:

1. Cooper, G.M. 2000. The Cell- A molecular approach, II Edn., A.S.M. Press, Washington DC.
2. Lodish, H., Berk, A., Zipursky, S.L., Matusudaria, P., Baltimore, D. and Darnell, J., 2000. Molecular Cell Biology, Media Connected, W.H. Freeman and Company, New York.

Reference Books:

1. Brown, T.A 2001. Gene Cloning & DNA analysis. Blackwell Science, London.
2. Benjamin Lewis, 2000. Genes VII. Oxford University Press, London.

Web Sites:

1. http://www.spc.cc.tx.us/biology/bio_links1.htm

Title of the paper	Paper 2 - Practical – 1		
Category : **Part III Core**	Year & Semester First year, Sem 1	Credits 4	
Pre- requisites	Knowledge of biology at Higher secondary level		
Objectives of the course	To introduce the student to various laboratory exercises pertaining to cell biology and microbiology.		

A. Cell Biology: Microscopy- RBC and WBC counting- Enumeration of WBC- Differential leukocyte Count- Salivary gland preparation from Chironomous larva- Mitosis preparation from onion root tip and meiosis preparation from grasshopper testis- Enumeration of prokaryotic cell- Buccal smear preparation- Cell fractionation (nucleus, mitochondria- Demonstration).

B. Microbiology: Sterilization techniques: Preparation of media, inoculation techniques – Pour plate, spread plate and dilution techniques. Demonstration of microbial contamination on culture plates. Micrometry- Wet preparation: Hay infusion broth, Hanging drop- Simple staining, Differential staining- Capsule staining- Spore staining- Inoculation techniques: Pour plate- spread plate- Dilution techniques. Biochemical tests for identification of bacteria: - Catalase test- Oxidase test- Urease test- IMVIC test- LAO test- Gelatin liquefaction- Starch Degradation- Carbohydrate fermentation- Viable Bacteria; - morphological identification of Fungi.

Title of the paper	Allied 1 - Paper 1- Microbiology		
Category : **Part III Allied**	Year & Semester First year, Sem 1	Credits 5	
Pre- requisites	Knowledge of biology at Higher secondary level		
Objectives of the course	To introduce the student to various aspects of basic microbiology.		

UNIT- I

History and Scope of Microbiology- Anatomy of Prokaryotes and Eukaryotes- Bacteria, Fungi, Algae, Protozoa and Viruses- structure and functions of the cellular components- Growth and nutrition- media and culture.

UNIT- II

Classification of microbes- DNA analysis, Ribosomal RNA analysis- Numerical taxonomy- Molecular taxonomy- methods of microbial identification.

UNIT- III

Environmental Microbiology- role of microorganisms in the productivity of ecosystems- Role of microorganisms in food production; dairy and non-dairy products- fermented foods and alcoholic beverages- production of food (single cell protein), Fuel (ethanol).

UNIT- IV

Medical Microbiology- Pathogenic microbes- Bacterial, Viral, Fungal and Protozoan diseases. Cure, control and prevention- Pharmaceuticals (antibiotics, vaccines etc.), Biofertilizers (BGA), Biopesticides, biopolymers, biosurfactants.

UNIT- V

Industrial use of microbes- fermentation products- bioconversions- products of industrial microbiology- Streptomyces, yeasts (Saccharomyces, Hansenula), Spirulina and Penicillium.

Recommended texts:

1. Pelczar, M.J., Chan, E.C.S., King, N.R., 2001. Microbiology- Concepts and Applications. Tata McGraw – Hill, New Delhi.
2. Ananthanarayan, R. and Paniker, C.K.J. 2000. A text book of Microbiology. 6th edition. Orient Longman Ltd., Hyderabad.
3. Pelzar. 2000. Microbiology. 5th edition. Tata McGraw Hill., New Delhi.
4. Ingraham, J.L., and Ingraham, C.A. 2000. Introduction to microbiology, 2nd edition. Brooks/Cole, Thomson Learning, USA.

Reference books:

1. Kathleen Park Talaro and Talaro, A. 1999. Foundation in Microbiology, 3rd edition, McGraw-Hill, New York.
2. Cappuccino, J.G and Sharman, N. 1999. Microbiology: A Laboratory manual, 4th edition. Addition Wesley Longman Inc., New York.
3. Daniel Lim. 1998. Microbiology, 2nd edition. McGraw-Hill, New York.

Web site:

1. http://science.nhmccd.edu/biol/microbio.html

Non-major elective papers for B.Sc Biotechnology

Semester I

Non-major elective - Microbiology

UNIT- I

History and Scope of Microbiology- Anatomy of Prokaryotes and Eukaryotes- Bacteria, Fungi, Algae, Protozoa and Viruses- structure and functions of the cellular components- Growth and nutrition- media and culture.

UNIT- II

Classification of microbes- DNA analysis, Ribosomal RNA analysis- Numerical taxonomy- Molecular taxonomy- methods of microbial identification.

UNIT- III

Environmental Microbiology- role of microorganisms in the productivity of ecosystems- Role of microorganisms in food production; dairy and non-dairy products- fermented foods and alcoholic beverages- production of food (single cell protein), Fuel (ethanol).

UNIT- IV

Medical Microbiology- Pathogenic microbes- Bacterial, Viral, Fungal and Protozoan diseases. Cure, control and prevention- Pharmaceuticals (antibiotics, vaccines etc.), Biofertilizers (BGA), Biopesticides, biopolymers, biosurfactants.

UNIT- V

Industrial use of microbes- fermentation products- bioconversions- products of industrial microbiology- Streptomyces, yeasts (Saccharomyces, Hansenula), Spirulina and Penicillium.

Recommended texts:

Pelczar, M.J., Chan, E.C.S., King, N.R., 2001. Microbiology- Concepts and Applications. Tata McGraw – Hill, New Delhi.

1. Ananthanarayan, R. and Paniker, C.K.J. 2000. A text book of Microbiology. 6th edition. Orient Longman Ltd., Hyderabad.
2. Pelzar. 2000. Microbiology. 5th edition. Tata McGraw Hill., New Delhi.
3. Ingraham, J.L., and Ingraham, C.A. 2000. Introduction to microbiology, 2nd edition. Brooks/Cole, Thomson Learning, USA.

Reference books:

4. Kathleen Park Talaro and Talaro, A. 1999. Foundation in Microbiology, 3rd edition, McGraw-Hill, New York.
5. Cappuccino, J.G and Sharman, N. 1999. Microbiology: A Laboratory manual, 4th edition. Addition Wesley Longman Inc., New York.
6. Daniel Lim. 1998. Microbiology, 2nd edition. McGraw-Hill, New York.

Web site:

2. http://science.nhmccd.edu/biol/microbio.html

Non-major elective : PLANT PHYSIOLOGY

Unit I. Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO2 fixation-C3, C4 and CAM pathways.

Unit II. **Respiration and photorespiration:** Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory
pathway.

Unit III. Nitrogen metabolism: Nitrate and ammonium assimilation; amino acid biosynthesis.

Unit IV. Plant hormones: Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.

Unit V. Stress physiology: Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic
stress and tolerance to abiotic stress.

Non-major elective: ANIMAL PHYSIOLOGY

Unit I. Blood and circulation: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.

Unit II. Cardiovascular System: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.

Unit III. Respiratory system: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

Unit IV. Nervous system: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone
and posture.

Unit V. Excretory system: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

Non-major elective: BIO-DIVERSITY

Unit I. **Principles and methods of taxonomy:**Concepts of species and hierarchical taxa, biological nomenclature, classical and quantititative methods of taxonomy of plants, animals and microorganisms.

Unit II. Levels of structural organization: Unicellular, colonial and multicellular forms; levels of organization of tissues, organs and systems; comparative anatomy.

Unit III. Outline classification of plants, animals and microorganisms: Important criteria used for classification in each taxon; classification of plants, animals and microorganisms; evolutionary relationships among taxa.

Unit IV. Natural history of Indian subcontinent: Major habitat types of the subcontinent, geographic origins and migrations of species; common Indian mammals, birds; seasonality and phenology of the subcontinent.

Unit V. Organisms of health and agricultural importance: Common parasites and pathogens of humans, domestic animals and crops.

SEMESTER – II

Title of the paper	Molecular Developmental Biology- Paper 3		
Category : **Part III Core**	Year & Semester First year, Sem 2	Credits 4	
Pre- requisites	Knowledge of biology at Higher secondary level and cell biology at Bachelors level.		
Objectives of the course	To introduce the student to various molecular aspects of development of living organisms.		

UNIT- I

Cellular regulation – cell cycle control, cell signaling pathways and differentiation.

UNIT- II

Transcription, expression and regulation in eukaryotic development with slime mould and C. elegans as model systems

UNIT- III

Myogenesis in mammals- growth factors: Mitogens and Oncogenes.

UNIT- IV

Neurogenesis in Drosophila and Mice- Regional specification in Drosophila.

UNIT- V

Embryogenesis- Mammalian homologs in Drosophila ANT-C and BC-X.

Recommended Texts:

1. Gilbert, S. 2000. Developmental Biology. Seventh edition. Sinaver Associates Inc. Publishers, MA. USA.
2. Tait, R.C. 1997. An Introduction to Molecular Biology, Horizon Scientific Press, England.

Reference Books:

1. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. Media Connected. W.H. Freeman and Company, New York.

2. Freifelder, D. 1990. Essentials of molecular biology. Narosa Publishing House, New Delhi.
3. Watson, J.D., and Hopkins, N.H., Roberts, J.W., Steitz, J.A. and Weiner, A.M. 1988, Molecular biology of the gene. 4th edition. Benjamin and Cummings Publishing Company, Inc., California.

Web Site:

1. http://web.wi.mit.edu/sive/pub/generallinks.html

Title of the paper	Practical - 2 – Paper 4		
Category : **Part III Core**	Year & Semester First year, Sem 2	Credits 4	
Pre- requisites	Knowledge of biology & chemistry at Higher Secondary level		
Objectives of the course	To introduce the student to various laboratory exercises in molecular developmental biology and chemistry.		

A – Molecular Developmental Biology: Observation of living gametes (Grasshopper / Frogs). Induction of ovulation and early fertilization in Bull frog - observation of development stages- gastrulation and organogenesis.- Observation of living chick embryos- cleavage and gastrulation- Wound healing- cell aggregation in frog embryos- hormones in amphibian metamorphosis.

B- Chemistry: Volumetric analysis: Acidimetry- Alkalimetry- Permanganametry- Dichlorometry- Iodimetry- Complexemetry- Analysis of Organic compounds with one functional group: aldehyde, ketone, carboxylic acid, aromatic primary and secondary amine, phenol, aromatic ester, alcohol, nitrocompound, carbohydrates.

Title of the paper	Paper 2- Chemistry		
Category : **Part III Allied**	Year & Semester First year, Sem 2	Credits 5	
Pre- requisites	Knowledge of Chemistry at Higher secondary level		
Objectives of the course	To introduce the student to advanced level of Chemistry.		

UNIT- I

Structure of Atoms

Dalton's Atomic theory- Subatomic particles- concepts of atoms and molecules- symbols for elements- electronic configuration of atoms- isotopes- shapes of atomic orbitals-periodical table- periodic classification- periodicity- valency- chemical bond.

UNIT- II

Materials on earth

Properties of gas, liquid, solid, compound, mixtures, solutions, colloids, suspension- Acids, bases and salts- Conductors and non-conductors.

UNIT- III

Changes around us

Slow and fast changes- reversible and irreversible reactions- exothermic and endothermic reactions- condition of chemical reactions- types of chemical reactions- mole concept and stoichiometry in chemical reaction- order of chemical reaction- technique used to determine chemical reactions.

UNIT- IV

Organic chemistry and energy

Organic compounds- classification- functional groups- aromatic, aliphatic, heterocyclic compounds- alkanes in gasoline- fuel from biogas, coal, hydrogen .

UNIT- V

Chemistry in living world

Physical and chemical properties of amino acids and proteins- properties and kinetics of enzymes- thermodynamics.

Recommended texts:

1. Mathews, P. 1996. Advanced chemistry, Cambridge University Press, Low Prize Edition., Oxford.
2. Lee, J.D. 2001. Inorganic Chemistry. Blackwell Science., London.
3. Negi, A.S., and Anand. 2001. A text book of physical chemistry. Taj Press., New Delhi.
4. Sony, P.L. 2000. A text book inorganic Chemistry. Sultan Chand & Sons., New Delhi.

Reference books:

1. Voet, D. and Voet, J.G. 1995. Biochemistry, 2nd edition. John Wiley and Sons, Inc., New York.
2. Lehninger, A.L., Nelson D.L., and Cox, M.M. 1993. Principles of Biochemistry. 2nd edition. CBS Publishers & Distributors, Delhi.
3. Amend, J.R., Mundy, B.P. and Armld, M.T. 1990. General Organic & Biological Chemistry. Saunders College Publishing., London.
4. Greenwood, N.N. and Earnshaw, A. 1989. Chemistry of the Elements. Maxwell Macmillan intl. Ed., London.
5. Cotton, F.A and Wilkinson, G. 1989. Inorganic Chemistry. John Wiley and Sons, Inc., NewYork.
6. Finar, I.L. 1986. Organic Chemistry. Volume 1 & 2, ELBS., London.

Websites:

http://dir.yahoo.com/Science/Chemistry/

http://www.chemistry.mcmaster.ca/faculty/bader/aim/

Semester II

Non-major elective: CHEMISTRY

UNIT I. Structure of Atoms

Dalton's Atomic theory- Subatomic particles- concepts of atoms and molecules- symbols for elements- electronic configuration of atoms- isotopes- shapes of atomic orbitals-periodical table- periodic classification- periodicity- valency- chemical bond.

UNIT II. Materials on earth

Properties of gas, liquid, solid, compound, mixtures, solutions, colloids, suspension- Acids, bases and salts- Conductors and non-conductors.

UNIT III. Changes around us

Slow and fast changes- reversible and irreversible reactions- exothermic and endothermic reactions- condition of chemical reactions- types of chemical reactions- mole concept and stoichiometry in chemical reaction- order of chemical reaction- technique used to determine chemical reactions.

UNIT IV. Organic chemistry and energy

Organic compounds- classification- functional groups- aromatic, aliphatic, heterocyclic compounds- alkanes in gasoline- fuel from biogas, coal, hydrogen .

UNIT V. Chemistry in living world

Physical and chemical properties of amino acids and proteins- properties and kinetics of enzymes- thermodynamics.

Recommended texts:

1. Mathews, P. 1996. Advanced chemistry, Cambridge University Press, Low Prize Edition., Oxford.
2. Lee, J.D. 2001. Inorganic Chemistry. Blackwell Science., London.
3. Negi, A.S., and Anand. 2001. A text book of physical chemistry. Taj Press., New Delhi.
4. Sony, P.L. 2000. A text book inorganic Chemistry. Sultan Chand & Sons., New Delhi.

Reference books:

1. Voet, D. and Voet, J.G. 1995. Biochemistry, 2nd edition. John Wiley and Sons, Inc., New York.
2. Lehninger, A.L., Nelson D.L., and Cox, M.M. 1993. Principles of Biochemistry. 2nd edition. CBS Publishers & Distributors, Delhi.
3. Amend, J.R., Mundy, B.P. and Armld, M.T. 1990. General Organic & Biological Chemistry. Saunders College Publishing., London.
4. Greenwood, N.N. and Earnshaw, A. 1989. Chemistry of the Elements. Maxwell Macmillan intl. Ed., London.
5. Cotton, F.A and Wilkinson, G. 1989. Inorganic Chemistry. John Wiley and Sons, Inc., NewYork.
6. Finar, I.L. 1986. Organic Chemistry. Volume 1 & 2, ELBS., London.

Websites:

http://dir.yahoo.com/Science/Chemistry/

http://www.chemistry.mcmaster.ca/faculty/bader/aim/

Non-major elective: EVOLUTION

Unit I. Emergence of evolutionary thoughts: Lamarck; Darwin–concepts of variation, adaptation, fitness and natural selection.

Unit II. Origin of molecules: Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers.

Unit III. **Origin of cells and unicellular evolution:** Evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes.

Unit IV. Evolutionary history: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary time scale.

Unit V. Human evolution: Stages in primate evolution including human.

Non-major Elective: BEHAVIOURAL BIOLOGY

Unit I. Approaches and methods in study of Behavior.

Unit II. Proximate and ultimate causation; altruism and evolution-group selection, kin selection, reciprocal altruism.

Unit III. Neural basis of learning, memory, cognition.

Unit IV. Sleep and arousal; biological clocks.

Unit V. Development of behavior; social communication; social dominance. Use of space and territoriality.

Non-major elective : BASICS OF ECOLOGY

Unit I. The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Symbiosis. Concept of habitat and niche;

Unit II. Population ecology: Characteristics of a population; population growth curves; population regulation; life history strategies (*r* and *K* selection); concept of metapopulation – demes and dispersal, interdemic extinctions, age structured populations.

Unit III. Community ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones.

Unit IV. Ecological succession: Types; mechanisms; changes involved in succession;
concept of climax.

Unit V. Ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

SEMESTER – III

PAPER V - GENETICS

UNIT I

Classical Genetics – Mendelian laws, monohybrid and dihybrid inheritance. Chromosome structure and organization in prokaryotes and eukaryotes.

UNIT II

Multiple alleles and blood group antigens. Sex chromosomes and sex linked inherited disorders- X linked recessive, dominant inheritance, gender defective phenotypes.

UNIT III

Linkage, Crossing over and genetic mapping of chromosomes.

UNIT IV

Identification of the DNA as the genetic material. Classical experiments of Hershey Chase, Avery McLeod etc. Genetic recombination in bacteria: Conjugation, transduction, and transformation.

UNIT V

Mutagens and Mutation. Principles of variation and selection process of speciation genetic drift, pedigree analysis and Human genome project.

BOOKS FOR STUDY

Lewis, R.2001. Human genetics- concepts and application. 4th edition. McGraw Hill.

Griffiths, Miller, J.H., An introduction to genetic analysis W.H.Freeman. New York.

Winter, P.C., Hickey, G.J. and Fletcher, H.L.2000. Instant notes in genetics.Viva books, Ltd.

Gardener E.J. Simmons M.J.Slustad DP. 1991. Principles of Genetics.

Goodenough U. 1985. Genetics. Hold Saunders international.

PAPER VI - GENETICS AND BIOCHEMISTRY - (PRACTICAL)

Biochemistry Practical

VOLUMETRIC ANALYSIS: Estimation of Glycine by formal titration – Estimation of glucose by Benedict's method – Estimation of ascorbic acid using dichlorophenol indophenol as link solution.

QUALITATIVE AND QUANTITAIVE ANALYSIS:Qualitative analysis of carbohydrates – Glucose, Fructose, Lactose, maltose and sucrose - Qualitative analysis of amino acids: Arginine, cystein, tryptophan and tyrosine.

QUANTITATIVE ANALYSIS:Colorimetric estimation a) protein by Lowry's method, b)DNA using diphenylamine, c) Glucose using orthotoludine method and d)Phosphorous by Fiske – Subba Rao method: Separation of amino acids by Paper chromatography.

Genetics Practical Preparations of culture medium and culture of Drosophila – methods of maintenance – identifications of species and mutants. Identifications of human blood groups – mitotic stages of onion (Alium ceepa) root tip and meiotic stages of cockroach testes – giant chromosomes from Chironomous larvae/ Drosophila salivary glands.

ALLIED SUBJECT II- Paper – I - BIOCHEMISTRY

UNIT I

Structure, chemistry and properties of Carbohydrates; Lipids; and Proteins:

UNIT II

Classification of porphyrins, their structure and properties; structure of metalloporphyrins- haeme and chlorophyll; Vitamins and Hormones.

UNIT III

Principles of Bio-energetic; Metabolism of carbohydrates, fats, proteins, purines, pyrimidines- their biosynthesis & degradation; mechanism of oxidative phosphorylation & its inhibitors, photo phosphorylation.

UNIT IV

Prostaglandins, leukotrienes, thromboxines, interferons and interleukins; antibodies; alkaloids; plant and animal pigments.

UNIT V

Separation methods: Chromatography - electrophoresis and immunoelectrophoresis, high voltage electrophoresis and isoelectric focusing. Isolation methods – centrifugation, ultra – centrifugation, density gradient centrifugation.

BOOKS FOR STUDY

Sathyanarayana. U. 2002. Biochemistry. Books and allied Pvt. Ltd.

Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. 2000.

Harper's Biochemistry, 4th edition. McGraw-Hill.

Stryer, L. 1999. Biochemistry, 4th edition. W.H.Freeman & Company, New York.

Zubey, G.L. 1998. Biochemistry, 4th edition. McGraw-Hill.

Voet, D.and Voet, J.G.1995. Biochemistry, 2nd edition. John Willey and Sons, Inc.

Lehninger, A.L., Nelson, D.L and Cox, M.M.1993. Principles of Biochemistry, 2nd edition. CBS Publishers and Distributors, Delhi.

SEMESTER IV

PAPER VII - PLANT BIOTECHNOLOGY

UNIT I

Plant genome: Organization, structure of representative plant genes and gene families in plants – chloroplast genome organization of mitochondrial genome.

UNIT II

Agrobacterium and crown gall tumors – Mechanism of T-DNA transfer to plants, Ti Plasmid vectors and its utility – Plant viral vectors. Symbiotic nitrogen fixation in Rhizobia.

UNIT III

Seed storage proteins. Regeneration of gene expression in plant transgenic plants and applications – plant vaccine and plant development.

UNIT IV

Plant Hormones – IAA, GA and cytokinins – molecular basis of action – phytochrome – role in photomorphogeneisis – Regulation of gene expression – abscisic acid – and stress – induced promoter switches in the control of gene expression – Ethylene and fruit ripening.

UNIT V

Plant tissue culture – suspension cultured cells – haploid plants – Cloning of hosts – micropropagation – somatic emryogenesis – protoplast isolation and applications.

BOOKS FOR STUDY:

Kojima, Lee, H. and Kun, Y. 2001. Photosynthetic microorganisms in Environmental Biotechnology. Springer – Verlag.

Sudhir, M. 2000. Applied Biotechnology and plant Genetics. Dominant publishers and distributors.

Trivedi, P.C.2000. Applied Biotechnology: Recent Advances. PANIMA Publishing corporation.

Reynolds, P.H.S. (ed). 1999. Inducible gene expression in plants. CABI Publishing, U.K. pp 1-247.

Chrispeels, M. J. and sadava, D.F. 1994. Plants, genes and agriculture. Jhones and Bartlett.

Ignacimuthu. 1996. Applied Plant Biotechnology. Tata McGraw – Hill.

Lycett, G.W. and Grierson, D. (ed). 1990. Genetic Engineering of crop plants.

Grierson and Covey, S.N.1988. Plant Molecular biology. Blackie.

Trigiano, R.N. and Gray, D.J. 1996. Plant tissue culture concepts and laboratory exercise. CRC Press. BocaRatin, New York.

Street, H.E. 1977. Plant tissue culture. Blackwell Scientific Publications oxford, London.

Narayanaswamy S. 1994. Plant cell and tissue culture. Tata McGraw Hill Publishing Company limited, New Delhi.

PAPER VIII - PLANT BIOTECHNOLOGY (PRACTICAL)

Plant Biotechnology

Hands on training in cell and tissue culture and maintenance of culture lines - Callus development and micropropagation of plants – Protoplast manipulation – Agrobacterium technology – Electropropagation – Biolistic transformation – Southern and Northern hybridization.

ALLIED SUBJECT II

PAPER II- BIOPHYSICS AND BIOSTATISTICS

UNIT I

Scope and methods and biophysics – levels of molecular organization – detailed structure of protein molecules at primary, secondary, tertiary and quaternary levels.

UNIT II

Analysis of protein, protein interaction and protein – nucleic acid interaction. Structure and chemical nature of polysaccharides.

UNIT III

Statistics – collection, classification, tabulations of Statistical Data – Diagrammatic representation – graphs – plotted curve – Sampling method and standard errors – random sampling – means – confidence limits – standard errors – variance.

UNIT IV

Measures of central tendency – measures of dispersion – Skew ness, kurtosis, moments – Correlations and regression.

UNIT V

Probablity distributions – Binomial and negative binomial, compound and multinomial distributions – Tests of significance – t tests – F tests – Analysis of variance – Spread sheets – Data entry – Graphics display – word processes.

BOOKS FOR STUDY

1. Creighton, T.E.2002. Protein structure and molecular propertie. W.H. Freeman and Company.
2. Micklos, D.A. and Freyes, G.A. 2002. DNA Science. Cold Spring harbor laboratory Press.
3. Sundar Rao P.S.S., Jesudian G. and Richard J. 1987. An introduction to Bio-Statistics (2nd Ed). Prestographik, Vellore, India.
4. Gupta, S.P. 1997. BiostatisticalMethods, S.Chand and Sons.
5. Elhance, d.n.1972. Fundamentals of Statistics, Kitab Mhal, Allahabad.
6. Sokal, P.R and Rohif, F.R. 1969. Biometry: The Principles and Practice of Statistics, in Biological Research, Freeman and company, San Francisco.
7. Snedecor, George, W.Cochran and William, G. 1967. Statistical Methods, Sixth edition, Oxford and IBH Publishing Co., Oxford

8. Federer W.R 1955. Experimental Design: Theory and Applications, Oxford Publishing Co. Pvt. Ltd., New Delhi.

SEMESTER - V

PAPER IX - ANIMAL AND MEDICAL BIOTECHNOLOGY

UNIT I

Basic principles of Biotechnology – manipulation of reproductive process – Artificial insemination – freezing of semen – Embryo technology – in vitro maturation and fertilization – Pregnancy diagnosis – Assisted reproductive technology – cloning strategies – transgenic animals.

UNIT II

Historical aspects – Medical Biotechnology – Pathogenic microbes – Bacterial, Viral, Fungal and Protozoan disease – diagnosis using modern techniques – probes – Cure, control and prevention.

UNIT III

Health Disease Diagnosis: Hybridoma Technique, Monoclonal antibodies, application of Probes for diagnosis of existing and emerging disease in animal and human disease.

UNIT IV

Vaccines – Production of recombinant vaccines – bacterial, viral or parasitic infections – DNA Vaccines. Synthetic peptide, anti-idiotype, deletion mutant and vaccine vectored vaccine – Prophylaxis.

UNIT V

Genetic engineering of Microorganisms and molecules – Recombinant DNA, DNA/RNA probes – monoclones – diagnosis – Animal cell culture – maintenance and culture of primary, secondary and continuous cell lines – applications.

BOOKS FOR STUDY

Click, B.R. and Pasternark. 2002. Molecular Biotechnology: Principle and applications of recombinant DNA. ASM press.

Ramasamy. P. 2002. Trends in Biotechnology, University of Madras of Publications, Pearl Press.

Kreuzer, H. and Massey, A. 2001. Recombinant DNA and Biotechnology: A guide for teachers, 2nd edition. ASM Press Washington.

Traven. 2001. Biotechnology. Tata McGraw – Hill.

Walker, J.M. and Gingold, E.B. 1999.Molecular biology and Biotechnology, 3rd edition. Panima Publishing Corporation.

Jenkins, N. (ed). 1999 Animal cell Biotechnology: Methods and protocols. Humana press, New Jesey. Pp 1-302.

Ignacimuthu. 1996. Basic Biotechnology. Tata McGraw-Hill.

Puhler, A.V.C.H. 1993. Genetic engineering of Animals. VCH Publishers, Weinbeiim, FRG.

Watson, J.D., Gilman, M., Witknowski, J. and Zoller, M. 1992. Recombinant DNA (2nd ed) Scientific American Books, NY.

Murray, E.T. 1991. Gene transfer and expression protocols – Methods in Molecular biology Vol.7. Humana Press.

Watsen, J.D., Hopkins, N.H., Roberts, J.W. Steitz, J.A. and Weiner, A.M. 1987.Molecular biology of gene. Benjamin/ Cummings 4th Ed. Vol.1&2.

PAPER X - BIOINFORMATICS

UNIT I

Genomic and cDNA sequences: output management from different biological output sources, gene prediction rules and software – Human Genome Project – Mutations, Population studies.

UNIT II

Gene therapy: Analysis of genomic and proteomic information with respect to biological systems – Genome application – Transgenic animals and plants – pathway regulatory networks. Drug design / discovery and identification, synthesis of new drugs; Management of diverse chemical libraries.

UNIT III

Gene expression: Microarrays and recent developments in expression analysis: Genes; Oncogenes – protooncogenes – Classification of Cancer types: Application of Microarrays in Drug toxicity testing, metabolic pathways.

UNIT IV

Sequence analysis (Proteins and Nucleic acids) Sequence alignment methods – Proteomics: Proteins analysis – structural comparisons – 2D gel, Mass spec, protein and antibody arrays.

UNIT V

Protein Database: Comparison of Protein sequences and Database searching – methods for protein structure prediction – conserved patterns in protein sequences and structures – Comparison of protein 3D structures – predicting functions based on DNA and protein sequences.

BOOKS FOR STUDY:

1. Pennington, S.R. and Punn, M.J. 2002.Proteomics: from protein sequence to function. Viva books Pri. Ltd.
2. Maleolm and Goosfship. J. 2001. Genotype to phenotype, 2nd edition. Bios Scientific Publishers Ltd.
3. Misener, S. and Krawetz. S.A. 2000. Bioinformatics: Methods and Protocols. Humana press.
4. Attwood, T.K. and Parry-Smith, D.J.1999. Introduction to Bioinformatics. Pearson Education Asia.
5. Primrose, S.B. 1998. Principle of genome analysis. 2nd edition. Blackwell Science.
6. Durbin, R., Eddy, S., Krogh, A. and Mitchison, G. 1998. Biological sequence analysis. Cambridge University Press.
7. Friedman, C.P. and Wyatt. J.C. 1997. Computers and Machine: Evaluation methods in medicinal information. Springer-verlag, New York.
8. Bishop, M.J. and Rawhings. C.J. 1997. DNA and protein sequence analysis: A practical approach. Oxford University press. New press.
9. Kolodner, R.M. 1997. Computer in Health care: Computerizing large integrated health networks. Springer – Verlag, New York.

PAPER XI - IMMUNOLOGY

UNIT I

Antigen: Isolation, purification and characterization of various antigens and haptens from pathogens and other biological molecules.

UNIT II

Purification of mononuclear cells from peripheral blood: Isolation and Characterization of T cell subsets; B cells and macrophages; Macrophage cultures; Assay for Macrophage activation; Isolation of dendritic cells.

UNIT III

Hybridoma and monoclonal antibody production: Production of antibodies: purification of antibodies, Quantification of Immunoglobulins, Immunodiagosis and Applications of Monoclonal antibodies in biomedical research.

UNIT IV

Assessment of delayed hypersensitivity reactions; In situ and in vivo characterization of cells from tissues; HLA typing.

UNIT V

Biology and assay of cytokines; Vaccine technology including DNA vaccines; Immunotechnology and infectious diseases.

BOOKS FOR STUDY

1. Ramasamy, P and R.E.B.Henna, 2002. Immunity and inflammation. University of Madras Publications Division, M/S. Pearl press, Chennai, India.
2. Parslow, T.G., Stites, D.P. and Terr, A.L. 2001. Medical immunology, 10th edition. McGraw-Hill publishing.
3. Goldsby, R.A., Kindt, T.J. and Osborne, B.A. 2000. Kuby immunology. 4th edition. Freeman and company.
4. Zola, H. 2000. Monoclonal antibodies. Bios Scientific Publishers ltd.
5. Roitt, I. 1996. Immunology. Black well Scientific Publications.
6. Weir, D. M. 1992. Immunological techniques. 3 Volumes. Black well Scientific Publishers.

PAPER XII - ANIMAL, MEDICAL BIOTECHNOLOGY AND IMMUNOLOGY (PRACTICAL)

Animal and Medical Biotechnology

Preparation of tissue culture medium and membrane filtration; preparation of single cell suspension from spleen and thymus; Cell counting and cell viability; Macrophage monolayer from PEC and measurement of phagocytic activity; Trypsinization of monolayer and sub culturing; Cryopreservation and thawing; Measurement of doubling time; Role of serum in cell culture.

Immunology

Blood groups and Rh Typing – Handling of animals and Raising Antibodies – Direct agglutinations – Slide and Tube methods:- Whole cell agglutination – Slide and Tube methods – Whole cell agglutination – Slide and tube methods – Serotyping by slide Agglutination – Indirect Agglutination test: Particle Agglutination – Letex Hbs Ag, ASLO – Passive Haemagglutination – TPH – Precipitation – Single Radial Immuno Diffusion (SRID) – Double Immuno Diffusion – Amboceptor titration (Demonstration) – ELISA (Demonstration) – Skin test for demonstration cutaneous hypersensitivity.

ELECTIVE I - PHARMACEUTICAL BIOTECHNOLOGY

UNIT 1

Pharmaceutical biotechnology an introduction. Microbes in pharmaceutical industry. Formulation of biotech products including biopharmaceutical considerations (Microbiological Considerations). Shelf life of protein based pharmaceuticals. Delivery of proteins - Rate and target site - specific delivery. Site specific delivery of protein drugs.

UNIT 2

Pharmacokinetics and Phermacodynamics - Peptide and protein drugs. Elimination of protein Therapeutics and Distribution of therapeutics, Protein binding of proteins therapeutics, Heterogeneity of protein therapeutics. Chemical modification of protein therapeutics and immunogenicity.

UNIT 3

Protein engineering, Peptide chemistry and Peptidomimetics, catalytic Antibodies, Glycobiology and biosensors. Impact of biotechnology on drug discovery. Gene therapy - ex vivo and in vivo gene therapy. Hematopoietic growth Factors, Chemical description, pharmacology, Pharmaceutical Concerns, clinical and Practice aspects.

UNIT 4

Pharmacology and Formulations- Vaccines, Modern vaccine technologies, pharmaceutical aspects. Monoclonal antibody -Based pharmaceuticals, development of antibody based therapeutics. Formulation of monoclonal antibody- Based therapeutically.

UNIT 5

Biotechnology products in pipeline - Drug development, Protein Pharmaceutical in development. Nucleic acid therapies in development. development of Adhesion molecules, glycoprotein, and carbohydrate based pharmaceuticals and other products of glycobiology.

BOOKS FOR STUDY

1. Daniel Figeys (Ed.) 2005. Industrial proteomics: Applications for Biotechnology and Pharmaceuticals. Wiley and Sons, Incorporated.
2. O. Kayser, R.H. Muller. 2004. Pharmaceutical Biotechnology - Drug Discovery and clinical applications. Wiley - VCH.
3. Heonrich Klefenz. 2002. Industrial Pharmaceutical Biotechnology.
4. Leon Shargel, Andrew B. C. Yu, Susanna Wu-Pong and Yu Andrew B.C.2004. Applied Biopharmaceutics and pharmacokinetics. McGraw- Hill Companies.
5. Sefania Spada, Garywalsh. 2004. Directory of approved biopharmaceutical.
6. Garywalsh. 2003. Biopharmaceutical, biochemistry and biotechnology.
7. Thomas Lengauer (Ed) 2002. Bioinformatics - from Genomes to drugs. Vol.I and II. Wiley - VCH.
8. JOHN F. Corpenter (ed.) Mark C. Manning. 2002. Rational design of stable formulation theory and practice (Pharmaceutical Biotechnology). Plenum, US. Ist edition.
9. D.I.A. Crommelin et al, 2002. Pharmaceutical biology. Amazon prome publications.
10. Werner kalow, UA Meyer and Rachel F Tyndale. 2001.

SEMESTER - VI

PAPER XIII - GENETIC ENGINEERING

UNIT I

Restriction and modification systems in bacteria. Restriction enzymes. Cloning vectors. Core techniques in gene manipulation: Cloning strategies; Construction of gene libraries and Probe.

UNIT II

Recombinant technology: gene cloning – Selection and screening for recombinants – RFLP, DNA finger printing.

UNIT III

DNA sequencing, Polymerase chain reaction; Ligase chain reaction, site directed mutagenesis.

UNIT IV

Expression systems and their applications: Production of protein from cloned genes;

UNIT V

Gene cloning and manipulation in research, medicine and agriculture.

BOOKS FOR STUDY:

1. Thiel. 2002. Biotechnology DNA to Protein: A laboratory Project. Tata McGraw-Hill.
2. Ring, C.J.A. and Blair, E.D.2001. Genetically Engineered viruses. Development and application. Bios Scientific publishers.
3. Davidson, E.H.2001. Genomic regulatory systems: Development and evaluation. Academic press.
4. Kreuzee and Massey, A. 2001. Recombinant DNA & Biotechnology. ASM Press.
5. Mukhopadhyay, S.N.2001.Process Biotechnology fundamentals. Viva books.
6. Jognand, S.N. 2000.Gene Biotechnology. Hemalaya publishers.
7. Walker, M. and Gingold, E.B. 1999. Molecular biology and Biotechnology, 3rd edition. Panama Publishing Corporation.
8. Old, R.W. and Primrose, S.B.1998. Principles of An introduction to Genetic Engineering Blackwell Science.U.K.

9. Brown, T.A. 1995. Gene cloning an introduction. Chapman & Hall. London.

PAPER XIV - BIOPROCESS TECHNOLOGY

UNIT I

Introduction to bioprocess: An overview of traditional and modern applications of biotechnological process, integrated bioprocess and the various (Upstream and down stream) unit operations involved in bioprocesses.

UNIT II

Fermentation processes: General requirements of fermentation processes, main parameters to be monitored and controlled in fermentation processes, aerobic an anaerobic fermentation processes and their application in the biotechnology industry.

UNIT III

Enzymatic bioconversion processes: Kinetics and thermodynamics of enzyme – catalyzed reactions, basic design and configuration of immobilized enzyme enzyme reactors, applications of immobilized enzyme technology. Media design and sterilization for fermentation processes: Medium requirements for fermentation processes and for industrial fermentation.

UNIT IV

Metabolic stoichiometry and energetics: Stoichiometry of cell growth and product fermentation, elemental balances, degrees of reduction of substrate and biomass, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation.

UNIT V

Kinetics of microbial growth and product formation: Phases of cell growth in batch cultures, simple unstructured kinetic models for microbial growth – Growth associated (primary) and non- growth associated (secondary) product formation kinetics – leudeking – Piret models.

BOOKS FOR STUDY

1. Shuler, M.L. and Kargi, F. 2002. Bioprocess engineering – Basic concepts. Prentice Hall of India.

2. Shuler, M.L. and Kargi, F. 1992. Bioprocess engineering, Prentice Hall.
3. Bailey and Ollis, 1986. Biochemical Engineering Fundamentals, McGraw Hill (2nd Ed.).

PAPER XV – GENETIC ENGINEERING AND BIOPROCESS (PRACTICAL)

GENETIC ENGINEERING

Extraction and estimation of intracellular proteins from E. Coli – Lowry's Method – Production of competent cells for transformation – Bacterial transformation – Isolation of genomic DNA – Extraction and estimation of RNA – Restriction Digestion of DNA – Absorption spectra of Nucleic acid – Estimation of DNA by Diphenyl amine method – Melting temperature of DNA, Agarose gel electrophoresis – SDS – PAGE – Agrobacterium mediated gene transfer – Isolation of plasmid DNA – Screening of Recombinants- Southern hybridization (DEMO) – Western Blotting (DEMO) – DNA amplification – PCR (DEMO).

BIOPROCESS

Bioprocess – Fermentor – Part and design, types of fermentor / Bioreactor – Prodection of Biomass and its estimation (dry weight) – Isolation and characterization of microorganisms involved in biodegradation of amylolytic activity by DNS method – Compost making – Production of wine from grapes using bakers yeast – Production of alcohol by S. cerevisae – Isolation of Rhizobial colonies involved in biofertilization – Isolation of lactic acid bacteria.

ELECTIVE II - MICROBIAL BIOTECHNOLOGY

UNIT I

History and scope of microbial biotechnology, microbial diversity and its use, cultivation and preservation of microorganisms in small scale in fermentors, bioreactors, immobilized cells and microbial polysaccharides- Microbial Biomass

UNIT II

Production of microbial enzymes and applications, production of organic solvents-single cell proteins.

UNIT III

Beverages Production of beverages, beer, wine, microbes in banking- production of baker yeast, milk products.

UNIT IV

Biofertilizers and Biopesticides, Biomass from carbohydrates, higher alkanes, methanol, biofertilizers – manufacture, formulation and utilization, biopesticides.

UNIT V

Bioremediation: Microbes in mining, ore leaching, oil recovery, waste water treatment, biodegradation of non cellulose and cellulosic wastes for environmental conservation, protein.

BOOKS AND STUDY:

1. El-mans, E.M.T., and Bryce, C.F.A 2002. Fermentation microbiology and Biotechnology. Taylor and Francis group.
2. Prave, P., Faust, V., Sitting W. and Sukatseh, D.A. (eds.). 1987. Fundamentals of Biotechnology. WCH Weinhein.
3. Moo-Young, M. (ed.) 1985. Comprehensive biotechnology - Volume 2,3 and 4. Pergamon Press.
4. Stanbury, P.F. and Whitaker. A. 1984.Principles of fermentation Technology. Pergamon Press.
5. Coulson, J.M. and Rocjardspm, J.F. 1984. Chemical Engineering. Pregamon press.

ELECTIVE III - ENVIRONMENTAL BIOTECHNOLOGY

UNIT I

Biofilm Kinetics: Soluble microbial products and inert biomass. Reactors: Reactors types – A batch reactor – A continuous- flow stirred- tank reactor with effluent recycle – A plug – flow reactor – A Plug flow reactor with effluent recycles – Reactors with recycle of settled cells.

UNIT II

Linking stoichiometric equations to mass balance equations – Engineering design of reactors – Reactors in series. Reactor configurations – Special factors for the design of anaerobic sludge digesters.

UNIT III

Denitrification: Physiology of denitrifying bacteria – Tertiary denitrification – One – sludge denitrification – Drinking water treatment: Anaerobic treatment by methanogenesis – Uses for methanogenic treatment.

UNIT IV

Detoxification of Hazardous chemicals: Factors causing molecular recalcitrance – Biodegradations of problem environmental contaminants – Bioremediation of problem environmental contaminants – Bioremediation: Engineering strategies for Evaluating bioremediation.

UNIT V

Sewage and waste treatment: Pollution monitoring, control and remediation (petroleum industry, paper industry, chemical industry etc).

BOOKS FOR STUDY:

1. Rittmann, B.E. and McCarty, P.L. 2001. Environmental Biotechnology: Principles and applications. McGraw – Hill, New York.
2. Ahmed, N. Qureshi, F.M. and Khan, O.Y. 2001. Industrial Environmental Biotechnology. Horizon press.
3. Smith, J.E. 1996. Biotechnology, 3rd edition. Cambridge Low price edition. Cambridge University press.
4. Sohal, H.S and Srivastava, A.K. 1994. Environmental and Biotechnology, 1st edition. Ashish Publishing House, New Delhi.