University of Rajasthan
Jaipur

SYLLABUS

B.Sc. Bio-Technology (Annual Scheme)
2015-16, 2016-17, 2017-18
UNIVERSITY OF RAJASTHAN, JAIPUR
B.Sc. Biotechnology Integrated (Annual Scheme)
2015-2018

Concept
Biotechnology is not a single subject as it being project all around. Biotechnology is a term of convenience for an integrated approach using a conglomerate of several disciplines such as botany, zoology, microbiology, biochemistry and chemistry, molecular biology, genetics, plant breeding, pharmacology medicine, information and computer science and others. Biotechnology, is a collection of tools, and is about problem-solving, where expert from different disciplines collaborate to find a solution to an identified problem, such as pest control, nutritional enhancement, an improved drug a vaccine or an antibody, and the like. While there can be a department of biotechnology with expertise in all relevant areas. For bringing thrust to Biotechnology sector in Rajasthan it is imperative that-

1. State of Rajasthan is an attractive destination for the biotechnology Industry.
2. Create and upgrade biotechnology infrastructure.
3. Create a quality infrastructure for research and commercial activities.
4. Promote biotechnology education by devising suitable courses which are focused to meet the demand of biotech Industry in general and development in Rajasthan in particular.

Priority areas of Biotechnology declared in the Biotech Policy of Government of Rajasthan are:
1. Plant biotechnology,
2. Medical biotechnology,
3. Biodiversity and prospecting,
4. Animal Biotechnology,
5. Bioprocessing, and

State government has taken care of every measure for promoting academia and industry in the state. The University on its part is proposing integrated course in B.Sc. Biotechnology Integrated M.Sc. Biotechnology Integrated or 5 Years M.Sc. Biotechnology integrated course with option
of taking a B.Sc. Biotechnology Integrated after three years or counting to obtain M.Sc. Biotechnology Integrated.

Prerequisites of laboratory-

Some basic minimum equipment required to run the course shall include as follows:

1. Well-equipped library facility with Internet connectivity.
2. Glassware, chemicals and reagents necessary to run the course.
3. Minimum equipment required:
   a. Laminar Flow Hoods/clean benches.
   b. Microscopes compound (8 no)
   c. Centrifuges - one high speed, one microfuge
   d. UV-visible spectrophotometer
   e. Colorimeter
   f. pH meter
   g. BOD incubator
   h. Micro- and regular balance
   i. Autoclave
   j. Glass distillation apparatus
   k. Computers
   l. Cold cabinet/ cold room.
   m. Refrigerator and Deep freeze
   n. DNA/RNA, protein electrophoresis apparatus.
   o. Culture racks with light arrangements
   p. Shakers
   q. Incubators

Prerequisites of admission to the course:
1. Candidates who have passed 12th standard examination under 10+2 system of Rajasthan State Higher Secondary Board, CBSE or any equivalent examination of any recognized Board with physics, Chemistry & Biology or Physics, Chemistry & mathematics in one and the same attempt with not less than 50% marks together.

2. Candidates who have appeared for and are expecting their result on or before 31st June of the respective final qualifying examinations are also eligible to apply.

3. The admission could be through entrance test or open merit.

General

The B.Sc. - M.Sc. Integrated biotechnology shall be a 5 year course. However the candidate will have the possibility of obtaining degree of B.Sc. Integrated Biotechnology after completion of three year course or alternatively to continue for the M.Sc. Biotechnology Integrated proposed here.

Admission to the M.Sc. Biotechnology Integrated can be for a 5 years integrated course at once level of entry, where facilities and faculty shall exist for conducting such course. Admission for B.Sc. Biotechnology Integrated could be done separately where graduate level facilities are available and M.Sc. Biotechnology should only be run at the Institution fully equipped to the course.

Admission to M.Sc. Biotechnology Integrated shall be restricted to B.Sc. Biotechnology Integrated student. University may decide suitable admission process. Procedure for filling such seats by competitive examination or through merit could be decided. List of Practicals to be carried out is appended and these require some basic equipments which must be present in the institution, starting the course. It is imperative that that only such institutions which can run the practical prescribed should have the affiliation to open these courses.

Details of the equipment are appended which are essential to run course successfully and it is intended that due consideration is given while granting affiliation to run course of Integrated biotechnology or one continuous course of M.Sc. Biotechnology Integrated that such facilities exists in the institution(Appendix I). The University shall appoint head examiner for each practical proposed here, who will formulate a skeleton question paper as well as possible exercises to be given in the examination. There can be 50 percent choice of exercises to be given in each question but it will be compulsory to conduct the practical examination on the basis of question paper sent by the university. If the compliance of the University question paper and exercises proposed is not done, the matter shall be reported in the COC/BOS and Academic council and University may initiate appropriate action against such institutions who did not give prescribed exercise set by the head examiner appointed for setting the question paper for the practical. This is being proposed in order to maintain adequate level of study and examination in professional courses.
The number of papers and maximum marks for each paper together with the minimum marks required for a pass are shown against each subject separately. It will be necessary for a candidate to pass in theory part as well as practical part of a subject/paper, wherever prescribed. Separately, classification of successful shall be as follows:

**First Division** 60% of the aggregate marks prescribed at (a) Part First Examination excluding those obtained in the **Second division** 48% compulsory subject, (b) part Second Examination (c) Part Third Examination taken together.

All the rest will be declared to have passed the examination if they obtain a minimum pass marks in each subject viz. 36%. No division shall be awarded at the First and the Second Year Examination

**B.Sc. Biotechnology Integrated Programme:**

(B.Sc.: Bachelor of science/master of Science.)

**Level:** Biotechnology Undergraduate Course / Biotechnology two years or 4 semesters for postgraduate/ 5 years for complete course or 10 Semester

**Aims & Content:**

Candidates will be trained in the basic part biotechnology and in the skills of self-education, critical evaluation, problem recognition and problem solving in science. There is an emphasis on integrating theory with extensive practical training.

Candidates will have:

1. Excellent skills in the science of medical biotechnology.
2. Generic skills including teamwork, oral and written presentation.
3. An awareness of the social, economic and ethical aspects of biotechnology management.

**Objectives:**

- Understand modern biotechnology - practices and approaches with an emphasis in technology application in pharmaceutical, medical, industrial, environmental and agricultural areas.

- Become familiar with public policy, biosafety, and intellectual property rights issues related to biotechnology applications nationally and globally.

- Gain experience with standard molecular tools and approaches utilized: manipulate genes, gene products and organisms.

- Develop skills in international teamwork and research collaboration.
Skills that a biotechnology integrated student obtain by the time they have finished their undergraduate programme:

- Understanding of the fundamentals of chemistry and biology and the key principles of biochemistry and molecular biology
- Awareness of the major issues at the forefront of the discipline.
- Ability to access primary papers critically.
- Good "quantitative" skills such as the ability to accurately and reproducibly prepare reagents for experiments.
- Ability to dissect a problem into its key features.
- Ability to design experiments and understand the Limitations of the experimental approach.
- Ability to interpret experimental data and identify consistent and inconsistent components.
- Ability to design follow-up experiments.
- Ability to work safely and effectively in a laboratory.
- Awareness of the available resources and how to use them.
- Ability to use computers as information and research tools.
- Ability to collaborate with other researchers.
- Ability to use oral, written and visual presentations to present their work to both a science literate and a science non-literate audience.
- Ability to think in an integrated manner and look at problems from different perspectives.
- Awareness of the ethical issues in the molecular life sciences.
Scheme of Examination

B.Sc. Biotechnology: Scheme of examination

(2015-2016)

1. Each theory paper shall carry 50 marks and will be of 3 hrs duration. Minimum passing marks shall be 17.
2. The theory question paper will be divided into two parts A and B. Part A of question paper shall be compulsory and contain 10 (ten) very short answer type questions of 20 words covering entire syllabus. Each carrying 1 (one) mark, with a total of 10 marks.
3. Part B of question paper will have 4 questions, one question with internal choice from each unit /section. Students are required to attempt four questions in all from Part B, selecting not more than one question from each section. Each question will carry 10 marks, with a total of 40 marks.

Year: I Year

Theory

<table>
<thead>
<tr>
<th>S.No. Code</th>
<th>Subject I</th>
<th>T</th>
<th>L</th>
<th>MM</th>
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<tbody>
<tr>
<td>1. BT-101</td>
<td>Microbiology</td>
<td>2</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>2. BT-102</td>
<td>Cell Biology</td>
<td>2</td>
<td>3</td>
<td>50</td>
</tr>
<tr>
<td>3. BT-103</td>
<td>Biostatistics &amp; Computer Application</td>
<td>2</td>
<td>3</td>
<td>50</td>
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<tr>
<td></td>
<td>Practical based on above subject</td>
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<td>4</td>
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<td><strong>Total</strong></td>
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<tbody>
<tr>
<td>1. BT-201</td>
<td>Developmental Biology</td>
<td>2</td>
<td>3</td>
<td>50</td>
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<tr>
<td>2. BT-202</td>
<td>Immunology</td>
<td>2</td>
<td>3</td>
<td>50</td>
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<tr>
<td>3. BT-203</td>
<td>Bioanalytical techniques and Instrumentation</td>
<td>2</td>
<td>3</td>
<td>50</td>
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<td>Practical based on above subjects</td>
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<td>75</td>
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<th>Exam Hrs.</th>
<th>MM</th>
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<tbody>
<tr>
<td>1</td>
<td>BT-301</td>
<td>Energy Resources &amp; Utilization</td>
<td>2</td>
<td>3</td>
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<tr>
<td>2</td>
<td>BT-302</td>
<td>Biochemistry-I</td>
<td>2</td>
<td>3</td>
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<td>3</td>
<td>BT-303</td>
<td>Plant and Animal Physiology</td>
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<td>3</td>
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#### Year: II Year

### Subject I

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<th>Exam Hrs.</th>
<th>MM</th>
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<tr>
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<td>Molecular Genetics</td>
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<td>2</td>
<td>BT-402</td>
<td>Food and Dairy Technology</td>
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<td>3</td>
<td>BT-403</td>
<td>Bio resources and waste management</td>
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### Subject II

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<td>Biochemistry II</td>
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<td>BT-502</td>
<td>Plant Secondary metabolites</td>
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<td>BT-503</td>
<td>Environmental biotechnology</td>
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### Subject III

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<th>L Hrs.</th>
<th>Exam</th>
<th>MM</th>
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<tr>
<td>1.</td>
<td>601</td>
<td>Industrial Biotechnology</td>
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<td>2.</td>
<td>602</td>
<td>Recombinant DNA Technology</td>
<td>2</td>
<td>3</td>
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<tr>
<td>3.</td>
<td>603</td>
<td>Behavioral Sciences &amp; Basic Communication Skills</td>
<td>2</td>
<td>3</td>
<td>50</td>
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Practical based on above subjects

Industrial training/project work in Institute itself

(If will be assessed by separate examiner)

**Total**

300

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### Year: III Year

2017-18

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### Theory

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<th>S.No.</th>
<th>Code</th>
<th>Subject I</th>
<th>T</th>
<th>L Hrs.</th>
<th>Exam</th>
<th>MM</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>701</td>
<td>Genomics &amp; Proteomics</td>
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<td>2.</td>
<td>702</td>
<td>Plant biotechnology</td>
<td>3</td>
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<tr>
<td>3.</td>
<td>703</td>
<td>Animal biotechnology</td>
<td>3</td>
<td>3</td>
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Practical based on above subjects

**Total**

225

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### Code

Subject II
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<tbody>
<tr>
<td></td>
<td>801</td>
<td>Medical biotechnology</td>
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<tr>
<td></td>
<td>802</td>
<td>Fundamentals of bioinformatics and nanotechnology</td>
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<td>3</td>
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<tr>
<td></td>
<td>803</td>
<td>Bioethics and IPR</td>
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<td></td>
<td></td>
<td>Industrial training/project work in Institute itself*</td>
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<td>(It will be assessed by separate examiner)</td>
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<td>Subject III</td>
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<tr>
<td></td>
<td>805</td>
<td>Critical Reasoning, Scientific writing and presentation</td>
<td>2</td>
<td>50</td>
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<tr>
<td></td>
<td>806</td>
<td>Industrial relations and entrepreneurship</td>
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Student shall study for two and half years and shall work in his own institute / elsewhere in an industry or institution of learning having adequate facilities on intensive training in any one of the branches of biotechnology . He/she will submit a dissertation of about 50 to 100 pages which will be evaluated by a separate external practical examiner.

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<tr>
<td></td>
<td>807</td>
<td>Dissertation will have 200 marks</td>
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</table>

Distributed as below (1) 50 marks viva voce, (2) 150 Dissertation - its content
quality style of presentation.
Remuneration will be Rs. 35 (Thirty five per student) and examiner will not examine more than 20 candidates per batch. only one external examiner will be appointed for each center

Total 300

Total marks for all the three years 2250

BT 101: MICROBIOLOGY

Section-A
General introduction: Microbial diversity and taxonomy. Prokaryotes Types of Microorganisms.
Classification: Haeckel's three kingdom concept, Whitakers five kingdom concept. Bergey’s manual of determinative bacteriology, Basic Concept in Taxonomy Characteristics and structure of microbes:Algae, fungi,mycoplasma, Viruses Protozoans and Helminthes

Section-B
Bacteriology: Morphology and ultra-structure of bacteria-morphological types, Cell Wall-Archaebacteria, gram negative ,gram positive, Structure and function of cilia, chromosome,carboxysomes, plasmids, Bacterial spores, structure, formation and germination. Diversity of bacterial nutrition: Autotrophic,heterotrophic,bacterial genetics plasmids nonconjugative,metabolizable,resistant

Section-C
Gene transfer in bacteria: Conjugation, transformation, transduction.
Growth microbial population: Batch culture of microbes, Simple continuous culture of microbes, growth curve aerobic and anaerobic growth, and effect of environment on microbial growth: temperature,pH, radiation and atmosphere.

Enumeration of microbes: Culture media, total cell count isolation, classification and identification of microbes, bacteria-selective culture techniques, fungi-culture techniques, virus-plaque assays, animal culture, and tissue culture.

Section-D
Microbial Metabolism: Metabolic pathways and bioenergetics, production of secondary metabolites and their application in industry microbial products.
Food Microbiology: Overall general idea, spoilage & preservation.

Environmental Microbiology: Recycling of biomaterials production of Biogas. Leaching ones by microorganisms, bio fertilizers, bio pesticide, pollution control through use of consortium of microorganisms.

Books:

1. Microbial Physiology, 4th ed. by Albert G. Moor & John W. Foster by Wiley
4. Microbiology by nester
5. General Microbiology by R.Y. Standier
7. General Microbiology by Brock.
8. Food Microbiology by Frazier

Other Books

- Introductory Microbiology: F.C. Ross, Columbus Charles E. Metrill.
- Modern Concept of Microbiology H.D. Kumar and S Kumar Vikas Publishing House, New Delhi.
- Microbiology: K.L. Burdon and R.P. Williams, McMillanworth Publishers

BT102: Cell Biology

Section A

The Cell structural Organization: Development of cell theory, Eukaryotic cells, the nucleus and cell cycle (Mitosis and meiosis). The ultra-structure of the cytoplasm- Cytoskeleton
elements, Endoplasmic reticulum & Golgi complex, membrane organelles, mitochondria, chloroplast, lysosome, Ribosomes, vacuoles and peroxisomes.

Section B

Transport Across Cell Membrane: Molecular organization of cell membrane, passive and active transport, Na-K pump, Ca2+ATPase pumps, Lysosomal and Vacuolar membrane ATP dependent proton pumps, Co-transport into prokaryotic cells, endocytosis and exocytosis, entry of viruses and toxins into cells.

Receptors and models of extra cellular signaling: Cytosolic, nuclear and membrane bound receptors, examples of receptors, autocrine, paracrine and endocrine model of action.

Section C

Signal Transduction: Signal amplification, different model of signal amplifications, cyclic AMP, role of inositol phosphatase messengers, Biosynthesis of inositol triphosphates, cyclic GMP and Glycoproteins in signal transduction, Calcium models of signal amplification, phosphorylation, of protein Kinases.

Section D

Cell Culture: Techniques of propagation of prokaryotic and eukaryotic cells, Cell lines, generation of cell lines, maintenance of stock cells, characterization of cells, immunochemistry, morphological analysis techniques in cell culture, primary cultures, contamination, differentiation, three dimensional cultures.

Books:
1. Cell & Molecular Biology by De Robertis, Lea and Febiger
2. Cell & Molecular Biology by H.Baltimore, WH Freeman

BT-103: Biostatistics & Computer Application

Section A

Statistics as statistical data: various types of data (Raw data, grouped data); Representation of data using frequency distribution diagram (Simple/Multiple/Subdivided bar diagram, Pie diagram), Graphs (Histogram, polygon, curve)

Section B
Measure of central tendency: Mean (Definition & simple problems); Median, Quartiles (Definition, Graphical calculation); Mode (Definition, graphical calculation); Standard deviation; Standard errors, Students-T-Test, ANOVA 1) one way, 2) two way followed by t test (pair wise)

Section C

Introduction to computers: Overview and functions of a computer system Input and output devices; Storage devices: Hard disk, Diskette, Magnetic tape, RAID, ZIP devices, Digital tape, CD-ROM, DVD (capacity and access time)

Main Circuit Board of a PC: Chips, Ports, Expansion; Slots; Memory: Register, buffer, RAM, ROM, PROM, EPROM, EEPROM (comparison); Types of Processing: Batch, Real-Time, Online and Offline.

Section D


Texts/References:
5. The Principles of scientific research, Freedman, P. New York, Pergamon Press.
8. Introduction to Computers Data processing & Networking

BT-201: DEVELOPMENTAL BIOLOGY

Section A

Plant development, plant versus animal development, development of plant embryo, development of seeding; shoot apex organization vegetative and floral apex, root, shoot, leaf and flower development Programmed cell death, ageing and senescence.

Section B

Genes and their role in development, signal transduction in development, cell division cycle,
cytoskeleton, cell adhesion and the extracellular matrix: Unicellular models, sporulation in Bacillus subtilis, mating type switching in yeast aggregation and culmination in Dictyostelium discoideum

Section C

Sex gametes and fertilization, germ line speciation, germ cell migration, gametogenesis, gastrulation in invertebrate and vertebrate, cell, lineage, Axis specification in vertebrates, fate of ectoderm, mesoderm and endoderm.

Section D

Cell differentiation mechanism and factors affecting developmental gradient in Hydra, axial gradients in Drosophila development. Organogenesis in invertebrates and vertebrates.

Books:

BT 202: IMMUNOLOGY

Section - A

Historical Background: Humoral and Cellular components of the immune system. Innate immunity. Skin and mucosal surface, Physiological Barriers, Phagocytic Barriers, Inflammation, Adaptive immunity. Immune Dysfunction and its consequences; Allergy and Asthma,

Cells and Organs of Immune System: Lymphoid cells: Stem cells, B and T Lymphocytes, Natural killer cells, mononuclear phagocytes. Granulocytic cells. Organs. Thymus Bone Marrow, Lymphatic System, Lymph nodes spleen

Section - B

Antigens-Antibody: Antigens Structure, properties, types, Epitopes, Haptens, Antibodies: Structure and function, Antibody mediated functions, Antibody classes and biological Activities, Monoclonal Antibodies

Antigen-Antibody Interaction: Precipitation reaction, Agglutination, Radioimmunoassay: ELISA, Western Blotting. Major Histocompatibility Complex, General Structure and function of MHC, MHC Molecules and genes, Antigen Processing and presentation, T-Cell receptors, T-Cell Maturation and Differentiation, B-Cell Generation, Activation & Differentiation
Section C

**Immune Effector Mechanism:** Cytokinesis (Properties, receptors, antagonists & secretion) the complement system (functions, components, activation regulation and deficiencies). Cell mediated effector responses: Cytotoxic T-Cells, natural killer cells, antibody-dependent cell-mediated cytotoxicity. Inflammation Hypersensitive reaction (Type I, II, III and delayed type (DTH)).

Section D

Immunology in Health & Disease: viral, bacterial and protozoan Vaccines AIDS and other immunodeficiency’s

**Transplantation and Autoimmunity:** Orange specific autoimmune diseases, systemic autoimmune diseases. Graft rejection, evidence and mechanism of graft rejection prevention of graft rejection, immunosuppressive drugs, HLA and diseases, mechanism of immunity to tumor antigens. Autoimmunity in human pathogenic mechanism, experimental models of autoimmune disease, treatment of autoimmune disorders.

Reference Books:

2. Benjamin E and Leskowitz S., Immunology a short course Wiley Liss NY, to 1991
7. Topley and Wilson’s (1995) Text Book on Principles of Bacteriology, virology and

**BT203: BIOANALYTICAL TECHNIQUES & INSTRUMENTATION**

Section A

Solution and Buffers: Preparation of solutions, concept of pH and buffer, types of buffers and their preparation, pH meter.

Cell fractionation techniques, ultra filtration, dialysis and reverse osmosis.

Microscopy – Principle and application of Dissecting and compound Microscope, phase contrast, Fluorescence and Electron microscopy (SEM and TEM)

Microtomy – types of microtome, material preparation and fixation – Embedding – block making; Steps involved in sectioning, staining and mounting; Cytophotometry; cryostat.

Section B
Spectroscopy- Basic principles, Instrument Design, Methods & Applications of UV–Visible spectrophotometer

IR & Raman spectroscopy – Basic principle, theory and qualitative interpretation of I.R. spectra, quantitative methods

Fluorescence spectroscopy- Principle, Instrument Design, Methods & Applications

Centrifugation & Ultracentrifugation-Basic principles, Forces involved, RCF Centrifugation, techniques-principal, types and applications.

Flow Cytometer: Introduction to flow cytometer- Fluorochromes and fluorescence

Section C

Chromatography-Basic Concepts of Adsorption & Partition Chromatography, Principle Experimental set-up, Methodology & Applications of all types of Adsorption & Partition Chromatography methods-chromatography using paper, thin layer, gas(GC,GLC), HPLC, Ion Chromatography

Section D

Electrophoresis- Principle, Electrophoretic mobility(EPM) estimation, factors affecting EPM, Instrument design & set-up, Methodology & Applications of Free & Zone (Paper, Cellulose acetate, Agarose& Starch gel, Pulse-field, PAGE, SDS-PAGE, Capillary) Electrophoresis techniques, Principle, Experimental set-up, Methodology & Applications isoelectric focusing, 2D electrophoresis

Tracer techniques: Radioactive isotope – Half life, GM counter, Liquid scintillation counter, Autoradiography

Books recommended:


BT – 301: ENERGY RESOURCES AND UTILIZATION

Section - A

Environmental audit. Carbon sequestration. Carbon credits.

Section - B

Gasiform Coal: Gasification technologies, Steam/Oxygen and Stem /Air Gasification; Hydrogasification and Catalytic gasification Underground Gasification.


Section - C

Conversion Fundamentals: Pyrolysis including vacuum pyrolysis; Gasification, Gas shift and synthesis; Direct Liquefaction; Comparison of synthetic Fuel and bio-fuels.

Conversion: Ethanol production technologies; biochemical conversion; thermal Conversion. Catalysts: Environmental Aspects-Environmental effect and their measure; Air pollution control, water Management.

Section - D


Text/Reference Books:

Probstin R.F and Hill, NY.


BT-302: BIOCHEMISTRY I

Section - A


Introduction to biomolecules: Concept of biomolecules, polymerization, formation of polymers chemical bonds (weak interactions)

Section B

Carbohydrates: Introduction, Definition, properties and biological importance, Classification, chemical reactions, structure of monosaccharide, disaccharides & polysaccharides
Amino acids and protein: Introduction, Definition and properties of amino acids, Structure of 20 amino acid, Classification based on structure, polarity and nutritional requirement of amino acid, chemical reactions. Proteins: Classification, primary secondary tertiary and quaternary structure, protein sequencing, biological function, protein nucleic acid interactions, helix coil transitions, zipper model, protein folding, Ramachandran plot, Bonds involved in protein structure

Section C

Lipids: Introduction, Classification, Fatty acids [Classification, Physical property, Chemical property, Sap value, acid value, iodine number, rancidity] phosphoglycerides (e.g., lecithin), sphingolipids (e.g., Cerbrosides), Steroids (Cholesterol), Bile acids, bile salts, plasma lipoproteins

Nucleic acids: Nucleic acid: Purine & pyrimidine bases, nucleosides & nucleotides, double helical structure of DNA, conformational parameters of nucleic acids & their constituents, nucleic acids geometrics, glycosides bond rotational isomers and those puckering backbone rotational isomers and ribose puckering forces stabilizing ordered forms, base pairing, base stacking, Chargaff’s rule, DNA polymorphism, DNA supercoiling, hyperchromicity, circular DNA, Types & structure of RNA, m RNA, tRNA, rRNA& modified nucleotides, tertiary structure of nucleic acids.

Section D

Enzymes: Nomenclature and classification, co-enzymes and co-factors, reaction and derivation of Michaelis-Menten equation kinetics and allosteric regulation of enzymes, isozymes; mode of catalysis.

Vitamins: Their structure, properties and biological structures.

Suggested readings:

5. Rawn, 1989 Biochemistry

BT-303: Plant & Animal Physiology

Section A

Photosynthesis:
Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; \( \text{CO}_2 \) fixation-C\(_3\), C\(_4\) and CAM pathways.

**Respiration and photosynthesis:** Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photosynthetic pathway.

**Nitrogen metabolism:** Nitrate and ammonium assimilation; amino acid biosynthesis

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

**Sensory photobiology:** Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins; stomatal movement; photoperiodism and biological clocks.

Section B

**Solute transport and photoassimilate translocation:** Uptake, transport and translocation of water, ions, solutes and macromolecules from soil, through cells, across membranes, through xylem and phloem; transpiration; mechanisms of loading and unloading of photoassimilates.

**Secondary metabolites:** Biosynthesis of terpenes, phenols and nitrogenous compounds and their roles.

**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.

Section C

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

**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.

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

**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.

Section D

**Sense organs:** Vision, hearing and tactile response.

**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.

**Thermoregulation:** Comfort zone, body temperature – physical, chemical, neural regulation, acclimatization.

**Stress and adaptation**

**Digestive system:** Digestion, absorption, energy balance, BMR.
Endocrinology and reproduction: Endocrine glands, basic mechanism of hormone action, hormones and diseases; reproductive processes, neuroendocrine regulation.

Books:

     Animal physiology by guyton

B.Sc. Biotechnology Part I

List of practical's based upon above syllabus

1. Study of Laboratory rules and safety regulations
2. Basic techniques of sterilization
3. Types of culture media and their preparations for microbes- Bacteria, Fungi, Algae, Protozoa
4. Isolation of microorganisms from air, water and soil
5. Isolation techniques
   a. Spread plate
   b. Streak plate
   c. Pour plate
   d. Serial dilution
6. Growth Curve
7. Study of mitosis stages by squash preparation of onion root.
9. Study of permanent slides of various plant and animal tissues
10. Exercise based on statistical methods for biologists.
11. Computer – Getting familiar with the hardware, booting & operating
12. Tutorials operating systems: DOS, Windows 98/XP, UNIX etc.
13. File handling: copy, rename, delete, type etc. Directory structure: make, rename, move directory
15. Use of internet – Downloading & Installing software/plugins on Windows 98/XP
16. Study of various plant parts and their mode of development
17. Study of seed and its germination stages till the formation of seedling in monocot and dicot
19. Dissection of flower to study its various parts
20. Permanent slides to study various developmental stages in Drosophila Life Cycle
21. Permanent slides to study various developmental stages in Chick (18 hrs., 21 hrs., 36 hrs., 48 hrs., 72 hrs., 96 hrs.,)
22. Preparation of blood film and microscopic study of stained blood film for identification of cell types.
23. Total Leukocyte counting by Hemocytometer.
25. ELISA technique.
26. pH Meter: Standardization of pH meter, Preparation of Buffers.
27. Verification of Beer-Lambert's law using UV-Vis spectrophotometer.
   a. Change in absorbance with concentration of potassium permanganate.
   b. Absorption maxima-- change in absorbance in potassium permanganate with wavelength.
32. Principles and operations of Incubators and Shakers.
33. Principles and operations of Centrifuge.
34. Industrial visits- In Rajasthan Go sewa sangh and Project report Preparation.
35. Determination of \( \lambda \) (wavelength) maxima of given solution.
36. Qualitative estimation of Carbohydrates, Proteins and Lipids.
37. Determine the vitamin C content in citrus fruit by titration method.
39. Effect of substrate concentration on activity of any enzyme and determination of its Km value.
40. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids.
41. To determine the chlorophyll a/chlorophyll b ratio in C3 and C4 plants.
42. Preparation of the standard curve of protein (BSA) and estimation of the protein content in extracts of plant material by Lowry's or Bradford's method.
43. Determination of RBC in given blood sample.
44. Determination of packed cell volume in given blood sample.
45. Determination of the glucose in urine.
46. Study of permanent slides of Mammalian tissue.
47. Introduction to Microtomy
Second Year

BT-401: MOLECULAR GENETICS

Section A
Mendelian principles: Dominance, segregation, independent assortment, deviation from Mendelian inheritance. Codominance, incomplete dominance, gene interactions and pleiotropy.
Concept of gene: Allele, multiple alleles, pseudo allele, complementation tests. Genome; Basic structure of prokaryotic and eukaryotic genome and its organization

Section B
Macromolecular structure: Structure, types and function of DNA and RNA. Chromosome structure and nucleosome concept; DNA Repair mechanism.
Replication: Prokaryotic and eukaryotic DNA replication. Enzymes and factors required for replication.

Section C
Transcription: Prokaryotic and eukaryotic transcription. Post transcriptional modification of mRNA, rRNA, and tRNA. Reverse transcription
Translation: Concept of Genetic code and its feature Deciphering of Gene code. Prokaryotic and eukaryotic translation, post translational modification, inhibition of transcription and translation. Polymerase Chain Reaction (PCR) Types & Applications

Section D
Mechanism of genetic recombination: Homologous and Non homologous
Mutation elementary concept; types of mutations; Point mutations (Base pair change, frame shift, deletion, etc.) mutagens.
Regulation of gene expression with 'Lac' operon as model.
Gene cloning

Books:
3. Principles of Genetics by Gardner E.J, Simmons M.J. Siustd DP.

BT - 402 : FOOD AND DAIRY TECHNOLOGY

Section -A

Microbial role in food processes, operation and production new protein foods- mushroom, food yeasts, algal proteins

Fermentation as a method for preparing and preserving foods. Food additives like coloring flavors and vitamins.

Organisms and their use for production of fermented foods and beverages: Picking, alcoholic beverages, cheese, sauerkraut, idli, vinegar.

Section -B

Deoxygenating and DE sugaring by glucose oxidase, beer mashing and chill proofing or cheese making by protease in and various other enzyme catalytic action in food processing. Classification of fruit juice.

Post-harvest technology and process of food preservation.

Section -C


Section -D


Skimming of milk, Cream & Cream characteristics, manufacture of yoghurt and other fermented milk product Ice cream manufacture, Butter making technology, technology of cheese and processing of concentrated milks and dried milk powder. 5. Milk quality control, sanitation in the dairy plant, adulteration of milk, dairy equipment maintenance and waste disposal.

Books
1. Frizer, Food Microbiology, THM Publications.

BT- 403: BIORESOURCE AND WASTE MANAGEMENT

Section - A

1. General: Bio resources: Biomass of food, fuels and chemical

2. Biodiversity and its characterization, use of Global positioning system in bio resource management.


Section - B


5. Solid waste collection, transfer and transport: Collection System equipment and labor requirement, collection routes, options for transfer and transport systems.

Section - C


7. Recovery of resources, conversion products and energy: Material, recovery, energy generation and recovery operation reuse in other industry

Section - D


Text/References:
3. Bhide and Sundershen, Solid waste Management in Developing Counteries
4. Books:

BT 501: BIOCHEMISTRY – II

Section -A

Introduction to metabolism: Anabolism & catabolism, exothermic & endothermic reaction, Oxidation & reduction Reactions, Redox potential

Carbohydrate metabolisms: Glycolysis, Fermentation, Citric acid cycle, Oxidative Phosphorylation & ETC, Gluceneogenesis, Pentose phosphate pathway, Glyoxylate shunt, Glycogen metabolism – glycogenolysis and glycogenesis.

Section -B

Lipid metabolisms: Oxidation of fatty acids, Fatty acid synthesis, Biosynthesis of triacylglycerol’s, Biosynthesis of Membrane phospholipids, Biosynthesis of Cholesterol, Biosynthesis of Steroids, biosynthesis of Ketone bodies.

Section C

Photosynthesis: Structure and organization of Chloroplast, Basic information on 'light' and 'dark' reactions of photosynthesis and differences in photosynthesis process of C3+C4 and CAM plants, photorespiration.

Amino acid metabolisms: Metabolic fate of amino group, Transamination, deamination and racemization, Decarboxylation and oxidative degradation of amino acid, Nitrogen excretion and urea cycle.

Section D

Nucleotide metabolisms: Biosynthesis of purine by De novo and salvage pathway, Biosynthesis of pyrimidine nucleotide by De novo and salvage pathway. Phosphorus and sulphur regulation.
Books:

Biochemistry : Garret and Grasirii Pub. Somders College

BT -502: PLANT SECONDARY METABOLITES

Section -A

Introduction, secondary plant products in nature and their occurrence, type and uses. Basic tools and techniques used in isolation and separation.

Section -B

Production in vitro- optimization selection effect of metabolism on secondary metabolite-production, production under stress factors.

Production of alkaloids, steroids and saponins. Mechanism and control by different factors, detoxification of secondary metabolites.

Section -C


Section -D

Sources and type of antitumor compounds, food additives and insecticides. Products obtained in traditional medicinal systems and their significance in plant biotechnology. Biotechnological approach on production of secondary metabolites e.g. ginkolides from cell cultures of Ginkgo biloba L. Use of immobilized cell systems for the production of industrially important chemicals.


BOOK RECOMMENDED:

BT – 503: ENVIRONMENTAL BIOTECHNOLOGY

Section -A

1. Components of Environment – Hydrosphere, lithosphere, atmosphere


3. Environmental pollution and degradation – Pollution of air, water, land and noise with reference to their causes, nature of pollutions, impact and control strategies.


Section -B

5. Waste water: communal, sewage and industrial effluents: type of wastes, properties and step involved in aerobic and anaerobic treatments

6. Principle and design aspects of various waste treatment methods, with advance bioreactor configuration: activated sludge process, trickling filter, fluidized expanded reactor, up flow anaerobic sludge blanket reactor, contract process, fixed/packed reactor, hybrid reectors, sequential batch reactors.

Section -C


Section -D

9. Environmental monitoring (Bio indications, Biomarkers, Biosensors) Environmental Protection Act

10. Waste disposal and management, legislation of environmental problems, microbiological and biochemical aspects of waste water treatment processes, microbial strain improvement with view to develop scavengers, bioremediation. Environmental laws, national movements on sustainable developments, environmental policies and conservation, IUCN role in environmental protection
References:
2 Metcalf Eddy - Waste water Biotechnology.
5 R.S. Ramalho - Introduction to waste water treatment

BT 601: INDUSTRIAL BIOTECHNOLOGY

Section A

Introduction to bioprocess technology, basic principles of fermentation technology. Range of microbial fermentation processes. Recombinant DNA technology assisted products. Flow chart of typical industrial fermentation process. Concept of value addition shelf life improvement. Low volume high value and High volume low value products.

Bioreactor/Fermenter – types & operation of Bioreactors, Construction, Design & Operation Materials of Constructions, Components of the fermenters & their specifications

Types of Bioprocess: Bio-transformations (enzyme, whole cell), Batch fed batch, cell cycle and continuous fermentation processes. Monad model and constitutive equations used for expressing growth, substrate consumption and product formation, solid state fermentation

Section B

Technology of Microbial cell maintenance – steps to maintain microbial culture in an aseptic & sterile environment (how to inoculate, preserve & maintain), Strain preservation, maintenance and strain improvement by mutation of gene transfer processes

Industrial production of Ethyl alcohol, Acetic Acid (Vinegar), Citric acid, lactic acid, α-amylase, protease penicillin, tetracycline and vitamin B12, With reference to easily available raw materials, Production of herbal drugs. Antibiotics, amino acids, vitamins, ethanol, vaccines (FMD, DTP, New Castle disease), Single cell protein (Methanolic yeast, Spirulina).

Section C

Enzyme technology – nature of enzymes, application of enzymes, limitations of microbial cells used as catalysts in fermentation, multi enzyme reactors, genetic engineering & protein engineering of enzymes, cloning strategy for enzymes technology of enzyme production, use of
immobilized cells and enzymes (Calcium alginate beads, polyacrylamide), industrial applications of immobilized enzymes.

Application of enzymes in Medical/pharmaceutical, and in food industry, Industrial applications of amylases and proteases, Production of amino acids and antibiotics by immobilised enzymes/cells. Use of microbial enzymes in leather, paper and dairy industry.

Biological fuel generation — photosynthesis, sources of biomass, ethanol from biomass, methane from biomass, hydrogen, microbial recovery of petroleum

Section D

Biotechnology in specific medical & industrial applications - Retting of jute, microbial process for immunization (Production of monoclonal antibodies), Deterioration of paper, textiles, painted surfaces and their prevention, Bio-films, microbial biopolymers, bio surfactants, Microbial culture selection with high yield potential.

Fermented Foods: Yoghurt, Buttermilk, Idli, Dosa, Cheese, Tempeh. Plant cell suspension culture for the production of food additives-Saffron and Capsaicin, Microbial polysaccharides and polyesters; production of xanthenes gum and polyhydroxyalkon des (PHA)

Books:

4. (Unit V).
BT 602: RECOMBINANT DNA TECHNOLOGY

Section A

Milestones of recombinant DNA Technology: Introduction and Historical perspective and early experiments.
Recombinant DNA Tools: Enzymes (Restriction enzymes, DNA ligases, DNA Polymerase Reverse Transcriptase, Polynucleotide kinase, End labelling and other enzymes). Cloning hosts (bacteria fungi animal and plant cells).
Gene transfer strategies: DNA mediated gene transfer, vector mediated gene transfer (Plasmid vectors, cosmids, Phagemid, Phage vectors) and Agrobacterium mediated gene transfer.

Section B

Experimental model systems: E. coli, Yeast, Baculovirus and their applications
DNA Libraries: Making of genomic and c-DNA libraries, their screening strategies for recombinant molecules and major application
Transposons: Concept of prokaryotic and eukaryotic transposition

Section C

Transgenic Technology: Production of transgenic Microbes transgenic Animals and transgenic Plant along with their application in Biotechnology
Requirement of recombinant molecules: in health, pharmaceutical, agriculture and industrial sectors in research laboratories, criteria of purity

Section D

Strategies for the production of recombinant molecule: Rationale for the design of vectors for the over expression of recombinant proteins, selection of suitable promoter sequences, ribosome binding sites, transcription terminator, fusion protein tags, purification tags, protease cleavage sites and enzymes plasmid copy number, inducible expression system

In vitro optimization of downstream processing: Over expression conditions, production of inclusion bodies, solubilization insoluble proteins, Purification protocols and upscaling. Determination of purity and activity of over expressed protein
Books:

5. DNA Science by MicklosFreyer
6. Gene cloning and DNA analysis by T.A. Brown
7. Genes V --Benjamin Lewin
10. Molecular Biology of gene by Watson, Baker, Bell, Gann, Levine, Losick
14. Principles of Gene manipulation and Genomics by Primrose and Twyman
19. WinnekeFrom Genes to Clones.

BT 603: Behavioral Science and Basic communication skill

Section A
Behavioral Science : Self Analysis- SWOT Analysis. Self Confidence, Self Esteem
Attitude- Change Management, Perceptions- Ideas and Approach
Motivation- Internal and External Self Talk
Goal Setting- Time Management- Vision & Planning, Problem Solving
Creativity- Out of box Thinking – Lateral Thinking
Interpersonal Skill- Team Work- Networking,
Leadership Skill- Role Models- Leadership Style
Stress Management- Emotional Intelligence- Emotional Quotient

Section B
Conflict Resolution- Approaches- Solution
Presentation Skill- Analytical Thinking, Review
Assertiveness- Stress Management – Quiz
Lateral Thinking (Situational) Team Work, Impromptu (Text Analysis)
Business Plan Presentation- Plan I & Plan II, Chinese Whisper
Self Introduction- GD, Mock Interview, Curriculum Vitae

Section C

Basic Communication Skills-
General Introduction of Communication, The process and importance of Communication, Principle and Benefits of Effective Communication,
Spoken English Communication - Speech Drills, Pronunciation and Accent, Stress and Intonation, Developing Listening Skills, Developing Speaking Skills

Section D

Basic Methods in communication: Developing Reading Skill, Developing Writing Skill, Progression of Thoughts/ Ideas, Structure of Paragraphs, Structure of Essays.

Books Recommended:
Written Communication in English- Sarah Freeman
Phil Lowe and Koge Page: Creativity and problem solving, New Delhi
Organizational Behavior, Davis, K.
Bates, A.P. and Julian, J.: Sociology- Understanding Social Behaviour
Geoff Petty: How to be better at creativity; Kogan Page, New Delhi 1998
Michael Steven: How to be a better problem solver, Kogan Page, New Delhi-1999
Julia T. Wood, interpersonal Communication everyday encounter
B.Sc. Biotechnology Part II
List of Practical

1. Isolation of DNA from human cheek cells
2. Isolation and electrophoretic separation of DNA from prokaryote (bacteria)
3. Assessing the purity & Quantity of extracted DNA spectrophotometrically
4. Determination of absorbance maxima for DNA spectrophotometrically
5. Demonstration and handling of PCR
6. Prepare the mount for polytene and lambrush chromosomes
7. Parameters for quality control analysis of milk
8. Biological characteristics such as Litmus milk test, MBRT test
9. Detection of adulterants, in milk
10. Isolation of protein from milk sample
11. Production of wine from grape juice
12. Educational tour to Dairy/food processing/fermentation industries
15. Study of Industrially important plants (specimens/products) morphology, botany and uses.
16. Study on disposal and treatment of biomedical waste
17. Waste Water Treatment
18. Preparation of standard curve
19. Quantitative estimation of sugar content in plant sample by Anthrone method
20. Quantitative estimation of protein content in plant sample by Lowry method
21. Quantitative estimation of phenolic content in plant sample by Folin-Ciocalteu reagent method given by McDonald
22. Protein profiling by SDS PAGE
23. Isolation of secondary metabolites (aqueous or alcoholic)
24. Qualitative test for:
   a. Alkaloids
   b. Flavanoid
   c. Tanins
   d. Phenols
   e. Saponin
25. Quantitative test for
   a. Alkaloids
   b. Flavanoid
   c. Tanins
   d. Phenols
   e. Saponin
26. To estimate free CO2 in given water sample
27. To determine BOD of given water sample
28. To determine total dissolved solids in water sample
29. MPN determination in water sample

34
30. To determine organic content in soil sample
31. Isolation of microorganisms and Screening of industrially important microorganisms
32. Study of growth, substrate utilization and product formation kinetics in shake flask cultures
33. Cell disruption techniques – Detergent and Enzyme
34. Membrane based filtration – Ultra Filtration and Micro Filtration
35. Centrifugation and Sedimentation
36. Measurements, micropipetting and sterile handling of the reagents
37. Electrophoretic separation of plasmid isolated by alkali lyses method
38. Restriction digestion of DNA (RFLP analysis)
39. Bacterial DNA ligation
40. Molecular characterization by RAPD marker Detection of a specific sequence using PCR
Third Year

BT – 701: GENOMICS AND PROTEOMICS

Section -A

1. Basic structure of prokaryotic and eukaryotic genome.

2. Chromatin model, concept of gene, linkage and crossing over, linkage analysis in Drosophila and Neurospora.

Section -B


4. Multigene families in human genome and repetitive DNA, C-Value paradox and complexity of genome.

Section C


Section D

Protein – protein interactions: Yeast- two hybrid method, GFP Tags, Proteome- wide interaction maps. Understanding of interactions and effects of internal (intracellular) milieu on the activity of the protein and its various complexes and interactions.

Designing genome and proteins: Analysis of nucleic acid / protein sequence and structure data, genome and proteome data using web-based tools.

Applications of mapping: Interrelations of genomics with proteomics. Genomics and proteomics their application to health, agriculture and industry.

Books Recommended


BT-702: PLANT BIOTECHNOLOGY

Section A

1. Historical background; Terminology used in cell & tissue culture; Basic techniques of cell and tissue culture; Surface sterilization; Aseptic tissue transfer. Concept of totipotency (Dedifferentiation, Redifferentiation).


Section B

4. Variability in tissue culture; Soma clonal and other variations (Process, Advantages, Limitation, Screening of soma clonal variants, Verification of soma clones).


6. Production of disease free plants by tissue culture methods (Process, Application, Limitation, and Virus indexing).

Section C

7. Isolation of cells (From plant, From suspension culture, Mechanical method, Enzymatic method) Single cell cultures and cloning (Bergmann cell plating technique, Filter paper raft nurse technique, Micro culture chamber technique, Micro drop method, Feeder layer technique).

8. Protoplast isolation and hybridization: Protoplast isolation and culture, fusion of protoplast (Mechanical, enzymatic, Purification of protoplast, Checking the quality of protoplast); Somatic hybrids (Somatic hybridization- Chemical, Electrical), Fate of somatic hybridization, Verification of hybridity.

Section D
9. Genetic transformation: *Agrobacterium tumefaciens* induced tumor formation and *A. rhizogenes* induced hairy root, features of T1 and RI plasmid, mechanisms of DNA transfer in plants.

10. Genetic engineering: for increasing crop productivity (By manipulation of photosynthesis, Nitrogen fixation, Nutrient uptake efficiency); biotic stress tolerance- (Insects, Fungi, Bacteria, Viruses, Weeds); Abiotic stress (Drought, Flooding, Salt, Temperature); for quality improvement (Protein, Lipids, Carbohydrates, Vitamins, Mineral nutrients).


**Books /Reference:**


**BT – 703: ANIMAL BIOTECHNOLOGY**

**Section A**

Introduction to animal tissue culture: Milestones in Animal tissue Culture, Concepts and Terminologies, Steps in Cell Culture.

Contamination and Aseptic techniques – Sources of Microbial Contamination, Washing & preparation of glassware, packing & sterilization, media sterilization, Filter sterilization, precautions to maintain aseptic conditions.

**Section B**
Laboratory Set up and Media Formulations: Setting up the laboratory, Hazards and safety in the cell culture laboratory, Animal cell culture media, General cell culture media design, Natural media, Synthetic media, Consideration in Media formulation, Nutritional components of media, The Role of serum in cell culture, Choosing a medium for different cell types.

Key techniques in animal cell culture: Culturing and routine Maintenance of the culture, Tissue Disaggregation, Quantification of cells in cell culture, Cloning and selecting cell lines, Physical methods of cell separation.

Section C
Characterization of cell lines: Species verification, Intra-species contamination, Characterization of cell type and stage of differentiation.

Preservation of animal cell lines: Variation and instability in cell line, freezing of cells, Cell viability and Cytotoxicity assay, Cell banks.

Scale Up of animal cell culture: Culture parameters, Scale of anchorage-dependent cells, Suspension culture, Cell culture based vaccines.

Section D
Monoclonal Antibody Production: The limitation of traditional antibody preparation, The basis of hybridoma technology, The details of hybridoma technology, Long term storage of hybridoma cell lines, Contamination, Hybridomas from different species, Human hybridomas, Commercial scale production monoclonal antibodies.

The applications of animal cell culture, Stem cells and applications, Organ Culture and tissue Engineering.

Book

Freshney, R. I., 2000, Culture of Animal Cells: A Manual of Basic Technique, Published by Willey & Liss Publication.


BT – 801: MEDICAL BIOTECHNOLOGY

Section -A
Diseases: Introduction, types: Genetic; Chromosomal aberrations: numerical and structural autoimmune disorders, diseases caused by microbial sources. Mechanism of pathogenicity, pathogenic islands, Molecular basis of diseases. Antimicrobial compounds and their mode of action.


Section -B

- Characteristics of infectious diseases, Herd immunity.

- Disease cycle (Source of disease, reservoir, carriers).

- Transmission of pathogens (Air Borne. contact transmission and vector transmission).

- Bacterial Diseases: Epidemiology, Pathogenicity, Laboratory Diagnosis, Prevention & control of the following diseases: Anthrax, Tuberculosis, Typhoid, Whooping cough, Tetanus, Diphtheria, Leprosy

Section -C

General account of fungal diseases: Mycosis, Subcutaneous and deep.

- General Account of viral & protozoan diseases: Pneumonia, mumps, Chickenpox, AIDS and Malaria, Leishmaniasis.

- Brief account of sexually transmitted diseases.

Section -D


Books Recommended:

2. Medical Microbiology, Vol 1; Microbial infection: Mackie and MaCartny, Churchil Livingstone, 1996


**BT - 802 : Fundamentals of Bio information and Nanotechnology**

**Section A**

1. Introduction to Bioinformatics: Nature of Biological data, Bioinformatics and its multidisciplinary approach, Definition of Bioinformatics, History of Bioinformatics, Search engines.

2. Biological databases: Primary, secondary and composite databases. Nucleotide sequence and Protein sequence databases, Structural Databases.

**Section B**

3. Aspects of Bioinformatics: Types of Alignment- Pairwise, Multiple, Global, Local, Heuristic Methods for sequence alignment- FASTA and BLAST. Multiple Sequence alignment

4. Applications of Bioinformatics, Bioinformatics in India (BTIS net).

**Section C**
5 Introduction to Nanotechnology: Nano scale and Richard Feyman’s idea of Nanotechnology, Definition and Historical perspective

6 Characterization and properties of nano-material: Structural characterization, Chemical characterization and Properties: Mechanical, optical, electrical and magnetic

Section D

7 Nano materials and applications: Definition, properties and uses of Carbon nanomaterials, Bucky ball, CNT, Dendrimers, quantum Dots, Nanocomposites, Nanocones, Nanotubes, Nanohorns and Nanowires.

8 Applications of Nanotechnology: Nanotechnology in Environment and energy, Medical nanotechnology and Drug Development, Recent advancements in nanotechnology


List of Books:
1. Text book for Bioinformatics by Shankar and Munjal
2. Bioinformatics by Prakash S lohar
3. Fundamentals and applications of Nanotechnology by MansiKarkare
4. Nanotechnology byEr. RakeshRathi

BT – 803: Bioethics and IPR

Section A

Regulatory Aspects: Direct Non Target effects on beneficial and native organisms, indirect effects, Regulating Recombinant DNA technology, Biohazards

Environmental and Regulatory aspects of using genetically modified plants.

Section BMicroorganisms; monitoring of introduced microorganisms, Ecological impacts of GMM released

Biological Weapons, Risk Assessment. Ethics, Biosafety Regulations in INDIA and international activities.

Section C

Intellectual property rights and protection (IPR & IPP): Forms of IPR (copy Right, Patent, Trade Secrets, Trademark, Other rights). Choice of IPR.
Section D

Patents in Biotechnology: Genes and DNA sequences, Life forms, General Agreement on Tariffs and trade (GATT) Trade related intellectual property rights (TRIPRS); Plant Breeders rights, International conventions, bio piracy, World intellectual property organization:

Text & References:
The Law & Strategy of Biotechnology Patents, Sibley Kenneth,

BT - 805: Critical Reasoning, Scientific Writing and Presentation

Section A

Introduction to Critical Reasoning: Critical Thinking and its benefits, understand the Barriers to critical thinking, learn the feature of arguments, Get acquainted with social influences on critical thinking.

Language of Critical Thinking: to understand the language of critical thinking.

Characteristics of Critical Discourses: Clarity, Accuracy, Precision, Relevance, Depth, Breadth,

Section B

Scientific Writing: Introduction to writing skills, effective Writing Skills, Avoiding Common Error, Paragraph Writing, Note taking, Writing assignments,
Letter Writing: Letter writing, Types of Letter, Types of Letter format
Memo, Agenda and Minutes, Notice and Circulars

Section C


Section D

Presentation and Professional Skills: Presentation, Meetings, Planning and Getting started, Design and Layout of Presentation, Information Packaging, Making the presentation

Text & References:

Michael Steven: How to be a better problem solver, Kogan Page, New Delhi, 1999
Geoff Petty: How to be better at creativity; Kogan Page, New Delhi, 1999
Phil Lowe Koge Page: Creativity and Problem Solving, New Delhi, 1996
Brooks/Cole
Publishing Company.
Business Communication, Raman –Prakash, Oxford
Creative English for Communication, Krishnaswamy N, Macmillan
Textbook of Business Communication, Ramaswami S, Macmillan
Effective Writing, Withrow, Cambridge
Writing Skills, Coe/Rycroft/Erne, Cambridge

BT - 806: INDUSTRIALIZATION AND ENTREPRENEURSHIP

Section -A

Principle of Management - The topic mentioned below are to be covered with respect to Bio industries and Bio products.

Management - meaning and importance, evolution of management thoughts.

Function of management:

i. Planning - meaning and importance, steps in the process of planning, Decision making.

ii. Organizing - process of organizing, types of organizational structures, informal organizations

Section -B


iv. Controlling - Control techniques.

Personnel Management: Manpower planning, source of recruitment, selection and training of staff, job evaluation, merit rating, performance appraisal, wage administration and system of wage payment, incentive, trade unions and industrial relation.

Section -C

Purchases and Stores Management : Concepts of quotations, tenders and comparative statement, inspection and quality control, inventory - Carrying cost and fixed cost of inventers, BEP analysis stores management, functions of storekeeper, methods of inventory - LIFO, FIFO.

Marketing, Management : Concept of selling, marketing, market research, Pricing-methods, penetration and Skimming pricing, Physical distribution methods, advertising and Sales promotion.
Section -D

Export and Import Management: Concept of international trade, duties and antidumping duty, cost involved in exporting a product, pricing of export product. Government assistance for export promotion, export house, export promotion counsel, MODVAT, patent and patent rights.

Management Laws: Concept of Contract act, offer and acceptance, type of Contract, Void Contract, Concept of Guarantee and warranty, introduction of MRTP and FERA.

Work Study: Work Measurement time and motion study, flow process chart, flow diagram, Sio chart, string Chart therbligs.


Reference Books:

1. Management for Business and Industry - C.S. George Jr.

The above syllabus is to be taught keeping in mind the aspect of Commercialization.

Marketing and Management of Biotechnological product. Term work - Minimum five case studies based on the above Syllabus.

BT - 807 : Dissertation Based on Lab and Field Work

Dissertation will have 200 marks distributed as below: (1) 50 marks viva voce (2) 150marks Dissertation
B.Sc. Biotechnology Part III
List of Practical

1. Electrophoretic separation of plasmid DNA.
2. Gene finding tools and genome annotation- Gen Scan, Net Gene, Hmm gene.
3. Comparison of two given genomes- Mummer.
4. Preparation of stock solutions and Murashige & Skoog media
5. Micro-propagation by adventitious buds
6. Culture of anthers to raise haploids
7. Development of virus free plants from meristematic tips
8. Cell culture in bioreactor suspension
9. Basic set up of Animal tissue culture laboratory
10. Preparation of media, sterilization and practices in tissue culture laboratory
11. To Isolate Cells from whole Blood and its primary culture
12. To Study Cryopreservation
13. WIDAL test
14. Acid Fast Bacilli (AFB) staining
15. To perform BLAST
16. To perform FASTA
17. To study Protein Sequence Database
18. Primer Designing