Course Structure for BSc Biotechnology

	Paper Semester Code	Paper Title	Hours per week	Total theory hours	Maximum marks	Credits
I	BTY 131	Cytology and Genetics	4	60	100	3
	BTY 151	Cytology and Genetics	2		50	1
II	BTY 231	Microbiology and Biostatistics	4	60	100	3
	BTY 251	Microbiology	2		50	1
III	BTY 331	Molecular-Biology	4	60	100	3
	BTY 351	Molecular-Biology	2		50	1
IV	BTY 431	Genetic Engineering	4	60	100	3
	BTY 451	Genetic Engineering	2		50	1
V	BTY 531	Immunology	3	45	100	2
	BTY 551	Immunology	2		50	1
	BTY 532	Animal cell culture and plant tissue culture	3	45	100	2
	BTY 552	Plant tissue culture	2		50	1
VI	BTY 631	Industrial BT and Environmental BT	3	45	100	2
	BTY 651	Industrial BT and Environmental BT	2		50	1
	BTY 632	Animal Biotechnology and Plant Biotechnology	3	45	100	2
	BTY 652	Internal project	2		50	1

Semester I -Theory
BTY-131– Cytology and Genetics

Total hours -60

Part A- Cytology

Unit-1 Cell as a basic unit of life, Prokaryotic and eukaryotic cell **1 Hour**

Unit – 2. Cellular Organelles **14 Hours**

Endplasmic reticulam, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nuclear (Nuclear envelope with nuclear pore complex, nucleolus, nucleplasm and chromatin). Vacuole, Crytosol and Cytoskeletal structures (Microtubles, Microfilaments and Intermediate filaments) Extracellular matrix

Unit -3. Transport across Cell Membranes and Receptors **09 Hours**

Structure of Plasmamembrane, Passive & Active transport, permeases, sodium potassium pump, Ca2+ ATPase pumps, lysosomal and vacuolar membrane ATP dependent proton pumps; uniport, symport, antiport, transport into prokaryotic cells(porins); Endocytosis and exocytosis; Receptor-mediated endocytosis; Autocrine, paracrine and endocrine models of action; Cytosolic, nuclear and membrane bound receptors, examples of receptors,

Unit -4. Ion Channels and Signal Transduction **07 Hours**

Types of Ion-channels; Ligand-gated and Voltage-gated ion channels; Ion channel defects; Actin, myosin, excitation - contraction coupling, relaxation; Second messengers - cAMP, Inositol phosphates, DAG, cGMP, G proteins, Ca; Protein kinases, serine – threonine kinases, TNF receptor families

Unit -4. Cell Division and Cell Cycle **4 Hours**

Types of cell division (mitosis & meiosis); details of cell cycle, cancer, programmed cell death

PART B : Genetics

Unit – 1. Chromosomes **4 Hours**

Discovery, morphology and structural Organization - centromere, secondary construction, telomere, chromonema, euchromatin and heterochromatin, chemical composition. Ultrastructure: Nucleosome model of chromosome. Special types of chromosomes; Salivary gland and Lampbrush chromosomes Karyotype in man.

Unit 2. Mendelism **2 Hours**

Mendel's work, laws of heredity, Test cross, Incomplete dominance and simple problems

Unit 3. Interaction of Genes **5 Hours**

Supplementary factors; Comb pattern in fowls

Complementary genes; Flower colour in sweet peas

Multiple factors – Skin colouir in human beings

Epistasis: Plumage colour in poultary

Multiple allelism: Blood groups in human beings

Unit 4. Sex Determination in Plants and animals **2 Hours**

Concepts of allosomes and autosomes, XX-XY, XX-XO,ZW-ZZ, ZO-ZZ types

Unit 5. Linkage and Crossing Over **4 Hours**

Coupling and repulsion hypothesis, Linkage in maize and Drosophilea, Mechanism of crossing over and its importance, Chromosome mapping – Linkage map in maize.

Unit 6. Chromosomal Variations and mutations **6 Hours**

A General account of structural and numerical aberrations. Inherited disorders - allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal(Down syndrome and Cri-Du-Chat syndrome) Chromosomal evolution of wheat. Types of mutation: spontaneous and induced, Mutagens: Physical and chemical.

Unit 7. Cytoplasmic Inheritance **2 Hours**

Plastid inheritance in Mirabilis, petite characters in yeast and kappa particles in paramecium.

Reference

Molecular Biology of cell – Bruce Alberts et al, Garland publications

2. Animal Cytology & Evolution – MJD, White Cambridge University Publicatins

3. Molecular Cell Biology – Daniel , Sceintific American Books.

4. Cell Biology – Jack D.Bruke, The William Twilkins Company.

5. Principles of Gene Manipulations – Old & Primrose, Black Well Scientific Publications.

6. Cell Biology – Ambrose & DorouthyM Easty, ELBS Publications.

7. Fundamentals of Cytology – Sharp, Mc Graw Hill Company

8. Cytology – Wilson & Marrision, Reinform Publications

9. Molecular Biology – Smith Faber & Faber Publications
10. Cell Biology & Molecular Biology – EDP Roberties & EMF Roberties, Sauder College.
11. Principles of Genetics – E.J.Gardener, M.J.Simmons and D.P.Snustad -John Wiley & Sons
Publications
12. Molecular Biology- Lodish- Freeman publications
13. Cell Biology-Sadava- Panima publications
14. Genetics- A molecular Approach- Russel –Pearson's publications

Semester I- Practicals

BTY-151 – Cytology and Genetics

Total hours: 15hrs

1. Use of Micrometer and calibaration, measurement of onion epidermal cells and yeast.**2 Units**
2. Cell division : Mitotic and meiotic studies in grasshopper testes, onion root tips **4Units**
3. Chromosomes: Mounting of polytene chromosomes **2 Units**
4. Buccal smear – Barr bodies **1 Unit**
5. Karyotype analysis in man– Normal and Abnormal – Down and Turner's syndromes **2 units**
6. Simple genetic problems **1 Unit**
7. Isolation of chloroplasts **1 Unit**
8. Vital staining of mitochondria **1 Unit**
9. Blood smear – differential staining **1 Unit**

Reference

1. Genetics: Laboratory Investigations- Robert L. Hammersmith, Thomas R. Mertens

Semester II- Theory
BTY 231 – Microbiology and Biostatistics

Total hours -60 Hrs
Part A: Microbiology

Unit- 1. Introductory Microbiology **4**

Hours

Definition and history of microbiology, contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Importance and scope of Microbiology as a modern Science .Branches of microbiology. Classification and nomenclature of Microorganisms

Unit- 2. Microbial Techniques **7**
Hours

Microscope – Light, Phase contrast, Fluorescence & Electron: Stains and staining techniques - Gram's, acid fast, capsular, flagellar and endospore staning. Methods of Sterilization; Physical and Chemical control of microorganisms.

Unit -2. Structure of bacteria **5**

Hours

Structure of bacteria –shape, flagella ,endospore and capsule, structure based on staining reaction (Gram positive and Gram negative bacteria), extreme environment.

Unit -3. General Account of Viruses **4**

Hours

Viruses – Structure and classification

Plant Viruses – CaMV, Animal viruses – Hepatitis B Herpes Simplex Virus, Bacteriophages

Unit -4. Eukaryotic microorganisms **6**

Hours

Salient features, classification and reproduction of fungi, mycoplasma and algae

Unit- 5. Physiology and biochemistry of microbes **10**

Hours

Nutrition (Photo-autotrophs, Chemo-autotrophs), Parasitism, Saprophytism, Mutualism and Symbiosis, Commensalisms, endozoic microbes) - Respiration: EMP, HMP and ED Pathways, Bacterial photosynthesis: Photosynthetic apparatus in prokaryotes, Photophosphorylation. Nitrogen metabolism(nitrogen fixation)

Unit -6. Pathogenic Microorganisms **4 Hours**

A. Bacterial diseases of man – Tetanus, Tuberculosis, Pneumonia and Cholera

B. Viral diseases: AIDS (HIV)

C. Parasite: Entamoeba and Malaria.

PART B – BIOSTATISTICS

Unit 1. Importance and application **3 Hours**

Tabulation and classification of data, Frequency distribution and Graphical distribution of data

Unit 2. Measures of central tendencies **4 Hours**

Mean, Median, Mode and their properties

Unit 3. Measures of Dispersion **4 Hours**

Mean deviation, Variance, Standard deviation and coefficient of Variation

Unit 4. Hypothesis testing **3 Hours**

Student T and Chi-square test

Unit 5. Probability and Distribution **3 Hours**

Concepts and problems on probability

Unit : Theoretical distributions **3 hours**

Binomial, Poisson, Normal Distribution and their applications

Reference:

MICROBIOLOGY

1. Microbiology – Pelczar, Chan, Krieg Tata- McGraw Hill Publications.

2. Microbiology – concepts and application by Paul A.Ketchum, Wiley Publications
3. Fundaments of Microbiology- Frobisher, Sauders & toppan publications.
4. Microbiology - Ronald M.Atlas
5. Introductory Biotechnology – R.B. Singh C.B.D. India (1990)
6. Industrial Microbiology – Casidal.E.- Wiley Eastern Ltd.
7. Fundamentals of Bacteriology – Salley
8. Fontiers in Microbial technology – P.S.Bisen, CBS Publishers
9. Biotechnology: International Trends of perspectives A.T.Bull, G.Holl M.D.Lilly Oxford &
TBH publishers.
10. General Microbiology-C.B.Powar, H.F. Daginawala, Himalayan Publishing House
11. Microbiology-Prescott- WCb publications
12. Microbiology -An introduction – Tortora- Wesley publications

BIOSTATISTICS

1. Bliss , C.J.K. (1967) Statistics in biology, Vol. I Mc Graw Hill, New York.
2. Campbell R.C.(1974) Statistics for Biologists, Cambridge Univ. Press, Cambridge.
3. Daniel (1999) Biostatistics (3rd edition) Panima Publications Corporation.
4. Swardlaw, A.C. (1985) Practical statistics for Experimental Biogists, John Wiley and sons,
Inc, NY
5. Khan (1999) Fundamentals of biostatistics Publishing Corporation.

SemesterII- Practicals

BTY-251 – Microbiology

Total hours: 15hrs

1. Safety measures in microbiology laboratory **1 Unit**
2. Cleaning and sterilization of glass ware **1 Unit**
3. Study of instruments: Compound microscope, Autoclave, Hot air oven, pH meter, Laminar airflow and centrifuge **1Unit**
4. Staining Techniques: Simple, Negative staining, Gram staining, Endospore staining and fungal staining. **4 Units**

5. Media preparation: Nutrients agar, MRBA and Nutrient broth **2 Units**

6. Isolation of bacteria and fungi from soil, air, and water – dilution and pourplate methods **2 Units**

7. Estimation of microorganisms – Total Count (Haemocytometer) **1 Unit**

8. Antibiotic sensitivity test **1 Unit**

9. Biochemical tests IMViC test **1 Unit**

10. Study of Rhizobium from root nodules of legumes **1 Unit**

Reference

1. Laboratory Experiments in Microbiology - by Ted R. Johnson, Christine L. Case- Addison- Wesley (2006)

2. Microbiology: A Laboratory Manual - by James G. Cappuccino, Natalie Sherman- Addison-Wesley (2007)