

TUMKUR UNIVERSITY

Course Structure and Curriculum of B.Sc. Biotechnology (I and II Semester)

REVISED CBCS PATTERN

SEMESTER	DSC	Pattern of Teaching/Learning/Evaluation (hours/week)			Credits	Course Name
		L (Lecture)	T (Tutorial)	P (Practical)		
I Semester	DSC A1	4	0	0	4	Cell Biology and Genetics
	DSC A2	0	0	4	2	Practical's Based on Cell Biology and Genetics
II Semester	DSC A3	4	0	0	4	Microbiology
	DSC A4	0	0	4	2	Practical's Based on Microbiology

DSC: Discipline Specific Core


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Curriculum for B.Sc., BIOTECHNOLOGY

Revised CBCS PATTERN

I B.Sc., I SEMESTER

DSC A1: CELL BIOLOGY AND GENETICS

60 Hrs

Unit 1: Cell Structure, Organelles and Their Functions

15 Hrs

- 1.1 Cell as basic unit of living organisms-bacterial, fungal, algal, plant and animal cells. Cell Motility in prokaryotes and eukaryotes.
- 1.2 Ultrastructure of prokaryotic cell, structure and functions of cell wall and cell membrane and plasmids (pUC19 and pBR322), Nucleoid, ribosome, flagella, pili, capsule, endospores and their types.
- 1.3 Ultrastructure of eukaryotic cell – plants, animals, protozoan, fungal and algal, Ultrastructure and functions of cell wall, cell membrane, single and double membrane bound organelles, cilia
- 1.4 Models of plasma membrane.
- 1.5 Structural organization of chromosomes - Ultra structure, types, components of chromosomes (histones and non-histones), and Nucleosome model, folded-fibre model, Special types of chromosomes; Salivary gland and Lamp brush chromosomes,

Unit 2: Cell cycle

15 Hrs

- 2.1 Cell cycle and cell division (mitosis and meiosis)
- 2.2 Bacterial cell division
- 2.3 Fungal and Algal cell division
- 2.4 Cell Senescence and Programmed Cell Death.
- 2.5 Apoptosis

Unit 3: Principles and mechanism of inheritance

15 Hrs

- 3.1 Mendel's experiments- factors contributing to success of Mendel's experiments, Principles of inheritance
- 3.2 Law of segregation- Monohybrid Ratio; Law of independent assortment- dihybrids, trihybrids,
- 3.3 Interaction of genes (Supplementary factors; Comb pattern in fowls), Complementary genes (Flower colour in sweet peas), Epistasis: Plumage colour in poultry
- 3.4 Co-dominance and Incomplete dominance, multiple alleles (Eg: ABO blood groups, Eye color in Drosophila). Sex determination - XX-XY, XX-XO, ZW-ZZ, ZO-ZZ types,

Multi- factorial inheritance (Skin colour in Man), Sex Determination in Plants and animals (Concepts of allosomes and autosomes)

- 3.5 Cytoplasmic Inheritance: Plastid inheritance in *Mirabilis*, petite characters in yeast and kappa particles in paramecium. Mitochondrial inheritance in human and poky in *Neurospora crassa*, X-linked inheritance - Hemophilia, Color blindness, X-inactivation, Y-linked inheritance.

Unit 4: Linkages, Crossing Over, mutation and Human Genetics

15 Hrs

- 4.1 Coupling and repulsion hypothesis, Linkage in maize and *Drosophila*, Mechanism of crossing over and its importance.
- 4.2 Gene mapping and map distance, Chromosome mapping – Linkage map in maize
- 4.3 Mutation – Definition, Types: spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level.
- 4.4 Mutations in plants, animals, and microbes for economic benefit of man, General account of structural and numerical aberrations, detection of mutations (Ame's Test)
- 4.5 Karyotype in man, inherited disorders - Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat syndrome).

DSC A2: Practical's Based on CELL BIOLOGY AND GENETICS :

30 Hrs

1. Microscopic observation of cells: Simple staining –
 - a. Bacteria – (Bacilli/cocci)
 - b. fungi – (*Aspergillus*/*Penicillium*/*Rhizopus*) / plant – (stem/leaf) / animal – Isolation and staining of liver parenchyma cell/Buccal epithelial cell
2. Use of Micrometer and calibration, measurement of epidermal cells
3. Preparation of different stages of Mitosis (onion root tips)
4. Preparation of different stages of Meiosis (onion flower bud)
5. Study of Barr bodies
6. Isolation of chloroplasts/mitochondria
7. Vital staining of mitochondria
8. Blood smear – differential staining
9. Problems on co-dominance, epistasis, two point and three point test cross
10. Karyotype analysis – Man and Onion, Man – Normal and Abnormal – Down and Turner's syndromes, Genetic problems

References:

1. Molecular Biology of cell – Bruce Alberts et al, Garland publications
2. Animal Cytology & Evolution – MJD, White Cambridge University Publications

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3. Molecular Cell Biology – Daniel , Scientific 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 & Molecular Biology. E.D.D De Robertis & E.M.F De Robertis, Waverly publication
11. An introduction to Genetic Analysis by Anthony, J.F. J.A. Miller, D.T. Suzuki, R.C. Richard Lewontin, W.M-Gilbert, W.H. Freeman publication
12. Principles of Genetics by E.J.Gardner and D.P. Snusted. John Wiley & Sons, New York
13. The science of Genetics, by A.G. Atherly J.R. Girton, J.F. Mcdonald, Saundern College publication
14. Principles of Genetics by R.H. Tamarin McGrawhill
15. Theory & problems in Genetics by Stansfield, Schaum out line series McGrawhill
16. Molecular Cell Biology Lodish, H., Baltimore, D; fesk, A., Zipursky S.L., Matsudaride, P. and Darnel. American Scientific Books. W.H. Freeman, New York
17. The cell: A molecular approach. Geoffrey M Cooper, Robert E Hausman, ASM press
18. Cell and Molecular Biology, Concepts and Experiments – Gerald Karp, John Wiley & Sons, Inc


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I B.Sc., II SEMESTER

DSC A3: MICROBIOLOGY

60 Hrs

Unit 1: Introduction and Scope of Microbiology

15 Hrs

- 1.1 Definition and history of microbiology, contributions of Antony van Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming.
- 1.2 Importance and scope of Microbiology as a modern Science, Branches of microbiology, five kingdom and three domain classification of microorganisms.
- 1.3 Microscopy: Construction and working principles of different types of microscopes – Compound, Dark field, Phase contrast, Confocal, Fluorescence and Electron Microscope (Scanning and Transmission)
- 1.4 Chromatography: Working principles, types – paper and column chromatography
- 1.5 Centrifugation - Working principles and its types, ultra centrifugation

Unit 2: Techniques in Microbiology

15 Hrs

- 2.1 Sterilization: Principles and Applications of Physical Methods. Autoclave, Hot air oven, laminar airflow, Seitz filter, Sintered glass filter, and membrane filter.
- 2.2 Radiation Methods: UV rays and Gamma rays.
- 2.3 Chemical Methods: Alcohol, Aldehydes, Phenols, Halogens and Gaseous agents.
- 2.4 Isolation of microorganisms, types of streaking, serial dilution, pour, spread plate and exposure plate methods.
- 2.5 Stains and Staining Techniques: Principles of staining, Types of stains – simple stains, structural stains and Differential stains

Unit 3: Prokaryotic and Eukaryotic microorganisms

15 Hrs

- 3.1 Concept of microbial species and strains, classification of bacteria based on – morphology (shape and flagella), nutrition, Chemotaxonomy, genetic method and extreme environment, molecular phylogeny.
- 3.2 Bacterial diseases of man –Mode of infection, multiplication, symptoms, diagnosis, treatment, preventive measures of Tetanus, Tuberculosis, Pneumonia, and Cholera.
- 3.3 Microbial Metabolism: Bacterial Photosynthesis: Photosynthetic apparatus in prokaryotes, Photophosphorylation & Dark reaction. Respiration: EMP, HMP and ED Pathways, Krebs's cycle, Oxidative Phosphorylation.

- 3.4 Salient features, Classification, Reproduction, diseases (Aspergillosis, Malaria) of Protozoa, Fungi and Algae
- 3.5 Economic importance of Protozoa, algae and fungi.

Unit 4: General Account acellular organisms

15 Hrs

- 4.1 Viruses – Structure (RNA and DNA virus) and classification
- 4.2 Plant Viruses –TMV, CaMV, (classification, structure, Mode of infection, multiplication, symptoms, diagnosis, treatment, preventive measures
- 4.3 Animal viruses – Hepatitis B, HIV, Bacteriophages- Lamba, T4 Phage
- 4.4 Viroid - Potato spindle tuber Viroid, Prions- CJD, Kuru, BSE
- 4.5 Economic importance of viruses – in genetic engineering; recombinant technology - vaccine production

DSC A4: Practical's Based on MICROBIOLOGY :

30 Hrs

1. Study of Compound microscope, Autoclave, Incubator, Hot air oven, pH meter, Laminar Air flow, spectrophotometer/colorimeter and centrifuge.
2. Preparation of different types of media (Simple, complex and differential media).
3. Staining Techniques: Simple, Negative staining, Gram staining, Endospore staining, fungal and algal staining
4. Isolation of bacteria and fungi from soil, air, and water – streaking, serial dilution and pourplate methods
5. Counting of microorganisms (bacteria/yeast) – Total Count (Haemocytometer)
6. Antibiotic sensitivity test– Disc diffusion/Well diffusion/MIC method
7. Biochemical tests – Starch hydrolysis, catalase, & gelatin liquefaction test
8. Study of Rhizobium from root nodules of legumes
9. VAM

REFERENCES:

1. Microbiology – Pelezar, 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. Frontiers in Microbial technology – P.S.Bisen, CBS Publishers
9. Biotechnology: International Trends of perspectives A.T.Bull, G.Holl M.D.Lilly Oxford &

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QUESTION PAPER PATTERN

Question Paper Pattern for Theory Examination

Time: 03hrs

Max Marks: 80M


- I. Answer any ten of the following. 10x02=20M
1 To 12
- II. Answer any six of the following. 06x05=30M
1 to 8
- III. Answer any three of the following: 03x10=30M
1 to 4

Question Paper Pattern for Practical Examination

Time: 03hrs

Max Marks: 40M

1. Minor experiment any one. 06M
1 to 4
2. Major experiment any one. 14M
1 to 4
3. Spotters 10M
A, B,C,D,E (02each-01M identification 1M comments = 02x05=10M)
4. Viva-voce 05M
5. Record/Project/Reports 05M


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