VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY, BALLARI-583 105

Distribution of Courses/Papers in Undergraduate Programme I to VI Semester

Name of the Degree Program: **BSc (Hons.)**
Discipline Core: **Biotechnology**
Starting year of implementation: **2021-22**

Program Outcomes (POs):

By the end of the program the students will be able to:

1. Understand concepts of Biotechnology and demonstrate interdisciplinary skills acquired in cell biology, genetics, biochemistry, microbiology, and molecular biology.
2. Demonstrate the Laboratory skills in cell biology, basic and applied microbiology with an emphasis on technological aspects.
3. Competent to apply the knowledge and skills gained in the fields of Plant biotechnology, animal biotechnology and microbial technology in pharma, food, agriculture, beverages, herbal and nutraceutical industries.
4. Critically analyse the environmental issues and apply the biotechnology knowledge gained for conserving the environment and resolving the problems.
5. Demonstrate comprehensive innovations and skills in the fields of biomolecules, cell and organelles, molecular biology, bioprocess engineering and genetic engineering of plants, microbes, and animals with respect to applications for human welfare.
6. Apply knowledge and skills of immunology, bioinformatics, computational modelling of proteins, drug design and simulations to test the models and aid in drug discovery.
7. Critically analyse, interpret data, and apply tools of bioinformatics and multi omics in various sectors of biotechnology including health and Food.
8. Demonstrate communication skills, scientific writing, data collection and interpretation abilities in all the fields of biotechnology.
9. Participate in professional skills such as, handling microbes, animals and plants and demonstrate the ability to identify ethical issues related to recombinant DNA

technology, genetic engineering, animals handling, intellectual property rights, biosafety, and biohazards.

10. Explore the biotechnological practices and demonstrating innovative thinking in addressing the current day and future challenges with respect to food, health, and environment.
11. Understand the application of molecular biology techniques and principles in forensic and clinical biotechnology.
12. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises or CROs.

I SEMESTER

DSC1: Cell Biology and Genetics **Total Contact Hrs 56 Hrs**

IA: 40 **SEE: 60**

(4 CREDITS)

Unit – 1: Cell as a Basic unit of Living Systems and Cellular Organelles 12Hrs

Concept, Development and Scope of Biotechnology. Historical perspectives. Discovery of cell, the cell Theory, Ultra structure of a eukaryotic cell- (Both plant and animal cells), Surface Architecture: Structural organization and functions of plasma membrane and cell wall of eukaryotes.

Cellular Organelles: Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).

Unit- 2. Chromosomes and Cell Division 11Hrs

General Introduction, Discovery, Morphology and structural organization – Centromere, Secondary constriction, Telomere, Chromonema, Euchromatin and Heterochromatin, Chemical composition and Karyotype. Single-stranded and multi-stranded hypothesis, folded-fibre and nucleosome models. Special type of chromosomes: Salivary gland and Lampbrush chromosmes.

Cell Division: Cell cycle, phases cell division. Mitosis and meiosis, regulation of cell cycles cell cycle checkpoints, and enzymes involved in regulation, Significance of cell cycle, mitosis and meiosis interphase nucleus, achromatic apparatus, synaptonemal complex Cell Cycle and regulation, mitosis and meiosis. Cell Senescence and programmed cell death.

Unit-3. Genetics 11Hrs

History of genetics: Introduction and brief history of genetics. Mendelian theory: Laws of inheritance- dominance, segregation, incomplete dominance, codominance with an example. Law of independent assortment, test cross, back cross. Deviations to Mendelian inheritance, complementary, supplementary and interaction of genes (13:3 ratio), epistasis.

Maternal Inheritance: Plastid inheritance in Mirabilis, Petite characters in yeast and Kappa particles in paramecium, Sex-linked inheritance, Chromosome theory of inheritance.

Gene interaction: Supplementary factors: comb pattern in fowls, Complementary genes-Flower colour in sweet peas, Multiple factors–Skin colour in human beings, Epistasis–Plumage colour in poultry, Multiple allelism: Blood groups in Human beings.

Unit-4. Linkage and Crossing Over **11Hrs**

Introduction, Coupling and repulsion hypothesis, Linkage in maize and Drosophila, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize.

Mutations: Types of mutations, Spontaneous and induced, Mutagens: Physical and chemical, Mutation at the molecular level, Mutations in plants, animals and microbes for economic benefit of man.

Unit-5. Chromosomal variations and Human genetics **11Hrs**

Chromosomal variations: A general account of structural and numerical aberrations, chromosomal evolution of wheat and cotton.

Sex Determination in Plants and animals: Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types.

Human Genetics: Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).

Course Outcome (COs):

At the end of the course the student should be able to:

CO 1: Would be able to comprehend the structure of a cell with its organelles.

CO 2: Can distinguish between the structure of prokaryotic and eukaryotic cell.

CO 3: Can explain the organization of genes and chromosomes, chromosome morphology and its aberrations

Cell Biology and Genetics Lab (2 CREDITS)

IA: 25 **SEE: 25**

Total Contact Hrs 56 Hrs

1) Study and maintenance of simple and compound microscope
2) Use of Micrometer and calibration, measurement of onion epidermal cells and yeast
3) Study of divisional stages in mitosis from onion root tips
4) Study of divisional stages in meiosis in grasshopper testes/onion or Rhoeo flower buds.
5) Mounting of polytene chromosomes
6) Buccal smear - Barr bodies
7) Karyotype analysis - Human and Onion, Human – Normal and Abnormal – Down and Turner's syndromes
8) Isolation and staining of Mitochondria
9) Isolation and staining of Chloroplast
10) RBC cell count by Haemocytometer
11) Simple genetic problems based on theory

• Each student is required to submit 5 permanent slides of mitosis & meiosis

Course Outcome (COs):

At the end of the course the student should be able to:

CO 1: would be able to identify and outline the structure of a eukaryotic cell at different magnification, measure the cell length and breadth using micrometry, differentiate stages of Mitosis and meiosis.

CO 2: would be able to identify and distinguish different blood cells, to solve simple genetic problems and analyse Human karyotype and pedigree

Text Books / References

1. Molecular Biology of Cell - Bruce Alberts et al, Garland publications.
2. Animal Cytology and Evolution- MJD, White Cambridge University Publications
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 &Dorothy M Easty, ELBS Publications
7. Fundamentals of Cytology- L. W. Sharp, McGraw Hill Company
8. Cytology-Willson&Marrison, Reinform Publications
9. Molecular Biology- Christopher Smith, Faber & Faber Publications
10. Cell Biology & Molecular Biology – EDP De Robertis& EMF Robertis, Saunder College.
11. Cell Biology- C.B Powar, Himalaya Publications
12. Basic Genetics- Daniel L. Hartl, Jones &Barlett Publishers USA
13. Human Genetics and Medicine lark Edward Arnold P London
14. Genetics – Monroe W Strickberger, Macmillain Publishers, New York
15. Genes V - Benjamin Lewin, Oxford University Press.
16. Genes I - Benjamin Lewin, Wiley Eastern Ltd., Delhi
17. Genes II - Benjamin Lewin, Wiley & Sons Publications

18. Genes III- Benjamin Lewin, Wiley & Sons Publications
19. Principles of Genetics- Sinnott, L.C. Dunn, Dobzhansky, McGraw-Hill.
20. Genetics – Edgar Altenburg Oxford & IBH publications
21. Principles of Genetics – E.J. Gardener, M.J. Simmons and D.P. Snustad, John Wiley & Son Publications
22. Genetics- P.K.Gupta, Rastogi Publication, Meert, India

OEC1: Biotechnology for Human Welfare **Total Contact Hrs: 42Hrs**
IA: 40 **SEE: 60**

(3 CREDITS)

Unit – 1: Industry **10Hrs**

Application of biotechnology in industry: Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase) Protein engineering applications in food, detergent and pharmaceutical industry.

Unit – 2: Environment **8 Hrs**

Application of biotechnology in environmental aspects: Degradation organic pollutants - chlorinated and non-chlorinated compounds; degradation of hydrocarbons and agricultural wastes, PHB –production and its futuristic applications.

Unit – 3: Forensic science **8 Hrs**

Application of biotechnology in forensic science:
Solving crimes of murder and rape; solving claims of paternity and theft by using DNA finger printing techniques.

Unit – 4: Health science **8 Hrs**

Health Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, molecular diagnostics using ELISA, PCR; monoclonal antibodies and their use in cancer; human genome project.

Unit – 5: Food science **8 Hrs**

Quality Factors in Pre-processed Food, Microbial role in food products (Yeast and Bacterial based process and products).

Course Outcome (COs):

At the end of the course the student should be able to:

CO 1: To understand biotechnological application in deriving products from microbes, plant and animal sources as well as the challenges of extracting compounds in a Comprehensive Product Development Plan.

CO 2: To understand the biotechnological in understanding and protecting the environment mainly through the development of biodegradable polymer.

CO 3: To get the basics of forensic science in solving crimes, paternity testing using DNA finger printing technique.

CO 4: To explore the scope and role of Medical Biotechnology in healthcare industry such as multiple uses of antibodies and vaccines.

Text Books / References

1. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology.2nd edition. Panima Publishing Co. New Delhi.
2. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
4. Environmental Biotechnology, Pradipta Kumar Mohapatra
5. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening andJesef Winter
6. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
7. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
8. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
9. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G.Eckert (ED.), CRC Press, Boca Raton (1997).