

## SYLLABUS

**BSc (Hons) Biotechnology-Semester 1**  
**Title of the Course: DSC-1: Subject code: 21BSC1C1BT1L**  
**Paper: Cell Biology and Genetics**

Number of Theory Credits	Number of lecture hours/ semester	Number of practical credits	Number of practical hours / semesters	
4	56	2	56	

  

Unit No.	Course Content	Hours
Unit I	<p><b>Cell as a Basic unit of Living Systems and Cellular Organelles</b>            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),  <b>Surface Architecture:</b> Structural organization and functions of plasma membrane and cell wall of eukaryotes.  <b>Cellular Organelles:</b> Structure and functions of cell organelles – Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclearenvelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).</p>	14
Unit II	<p><b>Chromosomes and Cell Division</b>            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 Lampbrushchromosomes.  <b>Cell Division:</b> 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.</p>	14
Unit III	<p><b>Genetics:</b>            History of genetics: Introduction and brief history of</p>	14

	<p>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.</p> <p><b>Maternal Inheritance:</b> Plastid inheritance in <i>Mirabilis</i>, Petite characters in yeast and Kappa particles in paramecium, Sex-linked inheritance, Chromosome theory of inheritance.</p> <p><b>Gene interaction:</b> 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.</p>	
Unit IV	<p><b>Unit-4.Linkage and Crossing Over</b> Introduction,Coupling and repulsion hypothesis, Linkage in maize and <i>Drosophila</i>, Mechanism of crossing over and its importance, chromosome mapping-linkage map in maize.</p> <p><b>Mutations:</b> 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.</p> <p><b>Chromosomal variations:</b> A general account of structural and numerical aberrations,chromosomal evolution of wheat and cotton.</p> <p><b>Sex Determination in Plants and animals:</b> Concept of allosomes and autosomes, XX- XY, XX-XO, ZW-ZZ, ZO-ZZ types.</p> <p><b>Human Genetics:</b> Karyotype in man, inherited disorders – Allosomal (Klinefelter syndrome and Turner's syndrome), Autosomal (Down syndrome and Cri-Du-Chat Syndrome).</p>	14

**Semester-I; Course : Practicals**  
**Paper : Cell Biology and Genetics; Paper Code: 21BSC2C2BT1P**

- 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

**Text Books / References**

**Reference:**

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

## OPEN-ELECTIVE SYLLABUS:

### BSc Semester 1 – B.Sc (Hons) Biotechnology

**Title of the Course: Open Elective (OE-1): Biotechnology for Human Welfare**

**Course code: 21BSC1O1BT1**

Courses	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
Theory	03	03	42	2	40	60	100

Unit No.	Course Content	Hours
Unit I	<b>Industry</b> Application of biotechnology in industry: Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase) Protein engineering applications in food , detergent and pharmaceutical industry	14
Unit II	<b>Environment</b> 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	14
Unit III	<b>Forensic science</b> Application of biotechnology in forensic science: Solving crimes of murder and rape; solving claims of paternity and theft by using DNA finger printing techniques <b>Health</b> 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	14

#### Reference:

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. 2<sup>nd</sup> edition, Elsevier Science Ltd.
4. Environmental Biotechnology, Pradipta Kumar Mohapatra
5. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jeseff 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).