

**Syllabus (NEP-2020)- HNBGU**

**Program: B.Sc.**

**Subject: Biotechnology**

**Fifth Semester**

**1. Core Paper:  
(Course code: CBT-5)**

**Cell Biology & Genetics  
No. of Credits: 4**

**UNIT -I (Cr-01)**

Structure of prokaryotic and eukaryotic cell: microbial, plant and animal cells; Cell cycle and its regulations, Mitosis, Meiosis

**UNIT -II (Cr-01)**

Structure and functions of Plasma membrane, Endoplasmic reticulum, Nucleus, Golgi complex, Peroxisomes, Lysosomes, Mitochondria, Cytoskeleton, chloroplast.

**UNIT -III (Cr-01)**

Nature of genetic materials, History of Genetics, Mendelian and non-mendelian laws of inheritance, Cytoplasmic inheritance, Sex-linked inheritance, polygenic inheritance, Linkage & crossing over, Chromosome mapping

**UNIT -IV (Cr-01)**

Chromosome structure; Euchromatin; Heterochromatin; Giant chromosomes, Sex determination and dosage compensation, Mutation; Types and applications, population genetics and Hardy-Weinberg law, Eugenics

**Recommended Books:**

1. Becker's Word of the Cell (2021) 10<sup>th</sup> edition, Pearson Publication
2. Gardner: Principles of Genetics, (2006) Wiley Publications
3. De Robertes & Robertis: Cell & Molecular Biology (1987) Lee & Fabiger Philadelphina
4. Strickberger: Genetics (1996) Prentice Hall
5. Alberts et al: Molecular biology of the cell (4<sup>th</sup> ed.) (1994), Garland Publ. New York.

**2. Practical Based on Core Paper (CBT-5)**

**Cell Biology & Genetics  
Credits-02**

**Suggested Practical's:**

1. Study of permanent slides of mitosis
2. Study of permanent slides of meiosis
3. Onion root tip slide preparation to study stage of mitosis
4. Calculation based exercises related to Mendelian inheritance
5. Blood group determination

**Either in Fifth Semester or in Sixth Semester**

**1. Vocational Course  
(Course code: VC-BT-1a)**

**Basics of Fermentation Technology  
No. of Credits: 2**

Unit – I (Cr- 0.5)

Introduction to the microorganisms and their role in ecosystem. Brief idea about their culturing, maintenance and preservation. Sterilization and disinfection.

Unit– II (Cr- 0.5)

Introduction to fermentation and its types. Microbial production of industrially important food products, alcoholic beverages, enzymes and antibiotics.

Unit– III (Cr- 0.5)

Media formulation for industrial fermentation. Requirements of precursors, inducers, media additives and media optimization.

Unit– IV (Cr- 0.5)

Introduction of bioreactors, their types and applications. Measurement and control of bioprocess parameters. Brief idea about downstream processing.

Suggested Readings:

1. Stanbury, P. F. & Whitaker, A. (2016). Principles of Fermentation Technology, Butterworth-Heinemann
2. Blanch, H. W., & Clark, D. S. (1997). Biochemical Engineering. New York: M. Dekker.
3. El-Mansi, M., & Bryce, C. F. (2007). Fermentation Microbiology and Biotechnology. Boca Raton: CRC/Taylor & Francis.
4. Kuila A, Sharma V, (2018). Principles and Applications of Fermentation Technology, Scrivener Publishing, Wiley

**2. Practical Based on Vocational Course (VC-BT-1a)**

**Basics of Fermentation  
Technology  
Credits-02**

Suggested Practical's:

1. Carbohydrate catabolism by microorganisms (oxidation/ fermentation of glucose)
2. Fermentation of carbohydrates
3. Bacteriological examination of water by multiple-tube fermentation test or multiple tube test
4. Production of industrially important extracellular enzymes from microbial source
5. Demonstration of a bioreactor
6. Preservation of industrial cultures by different methods

**Either in Fifth Semester or in Sixth Semester**

**1. Vocational Course  
(Course code: VC-BT-1b)**

**Basics of Forensic Science  
No. of Credits: 2**

Unit – I (Cr-0.5)

Forensic science scope, concepts, definitions, and historical aspects in India. Basic principles of forensic science, introduction to tools, and techniques used in forensic science.

Unit – II (Cr-0.5)

Branches of forensic science, National and international perspectives of forensic science, organizational setup of forensic science laboratories. The code of ethics and conduct for forensic specialists.

Unit – III (Cr-0.5)

Basics of criminology and criminal justice system, forensic dermatoglyphics, and technological methods in forensic science. Data depiction and report writing.

Unit – IV (Cr-0.5)

Forensic biotechnology, DNA fingerprinting / DNA profiling / DNA testing; history of DNA fingerprinting, ethics, rules and procedures.

Suggested Readings:

1. Bh MK and Nath S (2002). Role of forensic science in the new millennium, University of Delhi, Delhi
2. James SH and Nordby JJ, Bell S (2015). Forensic science: An introduction to scientific and investigative techniques, 4<sup>th</sup> Edition, CRC Press, Boca Raton.
3. Fisher BAJ and Fisher DJ (2012). Techniques of crime scene investigation, 8th Edition, Routledge-cavendish, Taylor & Francis.
4. Jackson ARW, Brearley D, Mountain H, Jackson JM (2016). Forensic science, 4th Edition, Pearson Education Limited.

**2. Practical Based on Vocational Course (VC-BT-1b)**

**Basics of Forensic Science  
Credits: 02**

Suggested Practical's:

1. To carry out identification and analysis of fingerprints.
2. To carry out basic test of blood samples
3. To take photographs using different filters
4. To identify drug in samples using spectrophotometry assay.

## **Either in Fifth Semester or in Sixth Semester**

### **1. Vocational Course: (Course code: VC-BT-1c)**

**Bioinformatics & Biostatistics  
No. of Credits: 2**

#### Unit – I (Cr-0.5)

Introduction to bioinformatics: Objectives, application and scopes, Information technology in biology, Bioinformatics resources, Internet, Word wide web, Web Browsers.  
Search engine-Entrez, SRS, Web Server-NCBI, EBI.

#### Unit – II (Cr-0.5)

Biological databases-Primary, Secondary database, Sequence alignment and applications: Sequence similarity searching tools –FASTA, BLAST; Multiple sequence alignment and applications.

#### Unit – III (Cr-0.5)

Importance of statistics in biological research. Primary and Secondary data, Methods of data collection and representation.

#### Unit – IV (Cr-0.5)

Mean, Mode, Median, Range, Standard deviation, Standard error

#### Recommended Books: -

1. Lesk A.M. (2019) Introduction to Bioinformatics. Oxford University Press.
2. Des Higgins and Willie Taylor. (2000) Bioinformatics: Sequences, structure and databanks, Oxford University Press
3. Sharma, Munjal, Shankar (2008) A Text Book of Bioinformatics, Rastogi Publication
4. S C Rastogi, N Mendiratta, P. Rastogi. (2008) Bioinformatics Methods and Applications: Genomics Proteomics and Drug Discovery, Prentice Hall of India Private Ltd
5. Khan and Khanum (2018) Fundamentals of Biostatistics, Ukaaz Publications

### **2. Practical Based on Vocational Course (VC-BT-1c) Bioinformatics & Biostatistics Credits: 02**

#### Suggested Practicals:

1. To retrieve nucleotide or protein sequence from the NCBI database
2. Conversion of nucleotide sequence into its corresponding protein sequence utilizing Expsy Translate tool
3. Localization prediction of a protein sequence
4. Statistical calculations

## Sixth Semester

### 1. Core Paper: (Course code: CBT-6)

**Plant Biotechnology**  
**No. of Credits: 4**

#### Unit – I (Cr-01)

Laboratory and materials requirement for plant tissue culture technologies, Aseptic techniques, Plant tissue culture media-composition & preparation, Totipotency; Conservation of plant genetic resources *in vitro*: Techniques, applications and limitations.

#### Unit – II (Cr-01)

Micropropagation: types and its applications, Callus culture, Haploid culture, Meristem culture, suspension culture, Embryo culture, Protoplast culture & protoplast fusion, Somaclonal variation.

#### Unit – III (Cr-01)

*Agrobacterium* mediated gene transfer and other DNA delivery techniques in plants, Transgenic plants and their applications. Biotechnology related to fruit ripening: Flavr-savr tomato.

#### Unit – IV (Cr-01)

Abiotic and biotic stresses in plants and their management, Phytohormones and their signaling, Plant growth promoting bacteria and its applications, Biofertilizers and their uses.

#### Recommended Books: -

1. P.K. Gupta (2010) Elements of Biotechnology, Rastogi and Co. Meerut,
2. T.H. Thomas (1999) Practical Application of Plants Molecular Biology, Edited by R.J. Hanry, Champan and Hall.
3. B.D. Singh (2015) Biotechnology, Kalyani Publishers.
4. Bhojwani SS and Razdan MK: Plant Tissue Culture: Theory and Practice- Elsevier
5. Stewart CN. (2008) Plant Biotechnology and Genetics.. Wiley

### 2. Practical Based on Core Paper (CBT-6)

**Plant Biotechnology**  
**Credits: 02**

#### Suggested Practical's:

1. Study of tissue culture laboratory layout
2. Preparation of MS media
3. Surface sterilization of explant
4. Extraction of plant DNA
5. Electrophoresis and quantification of plant DNA
6. Qualitative and quantitative tests for secondary metabolites