ST JOSEPH'S UNIVERSITY, BENGALURU-27.

DEPARTMENT OF BIOTECHNOLOGY

SYLLABUS FOR UNDERGRADUATE PROGRAMME

For Batch 2024-2027

(STATE EDUCATION POLICY)

SUMMARY OF CREDITS IN BIOTECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY
(UG)
(2024-2027)

Semester 1	**Code Number**	**Title**	**No. of Hours of Instructions**	**Number of Hours of teaching per week**	**Numb er of credits**	**Continuous Internal Assessment (CIA) Marks**	**End Semester Marks**	**Total marks**
Theory	BT124	Introduction to Biomolecules and Microorganisms	45	03	03	40	60	100
Practical	BT 1P24	Techniques in Biochemistry and Microbiology	33	03	02	25	25	50
Total Number of credits:			**05**					
Semester2	**Code Number**	**Title**	**No. of Hours of Instructions**	**Number of teaching Hrs /week**	**Number of credits**	**Continuous Internal Assessment (CIA) Marks**	**End Semester Marks**	**Total marks**
Theory	BT224	Fundamentals of Cell Biology and Analytical Techniques	45	03	03	40	60	100
Practical	BT 2P24	Techniques in Cell Biology	33	03	02	25	25	50
Total Number of credits:			**05**					
Semester 3	**Code Number**	**Title**	**No. of Hours of Instructions**	**Number of Hours of teaching per week**	**Numb er of credits**	**Continuous Internal Assessment (CIA) Marks**	**End Semester Marks**	**Total marks**
Theory	BT325	Fundamentals of Genetics and Biostatistics	45	03	03	40	60	100
Practical	BT 3P25	Techniques in Genetics and Biostatistics	33	03	02	25	25	50
Total Number of credits:			**05**					
Semester4	**Code Number**	**Title**	**No. of Hours of Instructions**	**Number of teaching Hrs /week**	**Number of credits**	**Continuous Internal Assessment (CIA) Marks**	**End Semester Marks**	**Total marks**
Theory	BT425	Molecular Biology	45	03	03	40	60	100
Practical	BT 4P25	Molecular Biology	33	03	02	25	25	50
Total Number of credits:			**05**					

BIOTECHNOLOGY UG SYLLABUS-SEP-2024 onwards

Semester	**I**
Paper Code	**BT124**
Paper Title	**Introduction to Biomolecules and Microorganisms**
Number of Teaching Hours per week	**03 hours Theory and 03 hours Practical**
Number of Teaching hours per semester	**45**
Number of Credits	**3 + 2**

Objective of the Paper: This paper has two course subjects. The syllabus covers Biochemistry in both practical and theoretical aspects. It introduces biomolecules that are vital for understanding cell systems and thus providing the foundations of employing them in the industry. This paper also aims to introduce students to basic concepts in Microbiology, with key emphasis on instrumentation and analytical techniques used in microbial laboratories. The course also covers key concepts in antimicrobial agents and assessment of antimicrobial activity, besides providing opportunities for hands-on experiments involving isolation, culturing, control and study of microorganisms.

Content of Course: BT124: Introduction to Biomolecules and Microorganisms	
Biomolecules	**30Hrs**
Unit 1: Introduction	**2 hrs**
Introduction to Biochemical evolution, Prebiotic reactions and molecules, Urey Miller Experiment. Biochemical composition of living organisms, Role of matter in biological systems, Chemical bonds in biological systems.	1 hr 1 hr
Unit 2: Carbohydrates	**4 hrs**
Classification, structure of monosaccharides (trioses-PGA, DHAP, pentoses-Ribose, Deoxy-Ribose and hexoses-Glucose, Galactose, Fructose), Disaccharides-Sucrose, Maltose, Lactose and Polysaccharides-Starch, Glycogen, Occurrence and functions. **Active Learning**: Blood glucose control-Role of insulin and glucagon, Glucose Uptake, Types of GLUT with functions	3 hrs (1 hr)
Unit 3: Proteins	**7 hrs**
Classification and Structure of Amino acids and proteins, Zwitter ion concept, Isoelectric pH, Concept of pKa and Buffers Levels of organization of proteins- Peptide Bond, Primary and secondary structure, Tertiary and quaternary structures, Denaturation. **Active Learning**- Analysis of Stable Structures of Proteins	4 hrs 2 hrs (1 hr)
Unit 4: Enzymes	**6 hrs**

Classification – types and functions, enzyme units. Factors affecting Enzyme Action. Cofactors – types, examples (NAD, FAD) with functions. Active site, Role of tertiary structure. Mechanisms of enzyme catalysis-Models: Lock and Key and Induced fit. Concepts of Km and Vmax. Enzyme inhibition – competitive, uncompetitive and Non-competitive	2 hr 2hrs 2hrs
Unit 5: Lipids	**5 hrs**
Classification, functions and biological role of lipids Classification and Structure of fatty acids Properties of phospholipids, sphingolipids, glycolipids, steroids, amphipathic lipids, cholesterol **Active Learning**: Properties of triacylglycerols and test for purity of lipids.	2 hrs 1 hr 1 hr (1 hr)
Unit 6: Nucleic Acid	**6 hrs**
Chemical composition, structures; nucleosides, nucleotides; Watson & Crick model, Types of DNA – A, B and Z Types of RNA (mRNA, tRNA) with structure and functions **Active Learning**: Discussion on the original paper of Watson and Crick	3 hrs 2hr (1 hr)
Introduction to Microorganisms	**15 hrs**
Unit 1: History of Microbiology	**1 Hr**
The past and present of Microbiology, Case study on HIV's evolutionary past	
UNIT 2-Prokaryotic microorganisms and Viruses	**5 Hrs**
Bacteria-Cell wall, Capsule, Flagella, Fimbriae, Pili, Plasmids, Endospore, Reserve food. Virus- General Characteristic, life cycle of bacteriophage -lytic and lysogeny Active Learning- Structure and lifecycle of viruses	2 hr 2 hr (1hr)
UNIT 3-Eukaryotic microorganisms	**2 Hrs**
General characteristics of Algae, Fungi and Protozoa	
Unit 4- Microbial growth and Control	**3 Hrs**
Microbial growth-Growth curve and kinetics Sterilization techniques- Definition of terms, Physical methods- Heat & radiation Chemical Methods- Alcohol, aldehydes, phenols, halogen, sterilizing gases as antimicrobial agents	1 hr 2 hrs
Unit 5- Antimicrobial agents and Microbial resistance	**4 hrs**
Mode of action of antimicrobial agents: Antifungal agents- Amphotericin B and Griseofulvin Antibacterial agents- Plazomicin and Imipenum Mechanism of multi-drug resistance **Active Learning:** Antiviral agents- Amantadine and Acyclovir	2 hrs 1 hr (1 hr)

Practical II: BT 1P24: Techniques in Biochemistry and Microbiology

1. Introduction to molarity, molality and normality, Calculations for solution preparations, Instruments: Handling of pipettes, burettes, colorimeter and spectrophotometer.
2. Estimation of Reducing Sugars by DNS method.
3. Estimation of protein by Biuret method.
4. Enzyme Analysis, Kinetics.

5. Handling and applications of important instruments (biological safety cabinets, autoclave, incubator, hot air oven, light microscope, pH meter) used in the microbiology and Biotechnology laboratory.
6. Preparation of culture media for bacterial and fungal isolations, plate preparations and open air culture.
7. Colony characteristics study of bacteria and fungi from air exposure plate.
8. Bacteria– Gram staining Staining techniques, Fungi – Lacto-phenol cotton blue staining
9. Pure culturing techniques: Plating techniques and maintenance of individual cultures.
10. Biochemical Tests – IMViC, Starch hydrolysis, Catalase test, Gelatin hydrolysis, TSI agar and amylase production.

Text Books / References

1. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T. Brown Publishers.
2. Black JG. (2008). Microbiology: Principles and Explorations. 7th edition. Prentice Hall
3. Madigan MT, and Martinko JM. (2014). Brock Biology of Micro-organisms. 14th edition. Parker J. Prentice Hall International, Inc.
4. Pelczar Jr MJ, Chan ECS, and Krieg NR. (2004). Microbiology. 5th edition Tata McGraw Hill.
5. Srivastava S and Srivastava PS. (2003). Understanding Bacteria. Kluwer Academic Publishers, Dordrecht
6. Stanier RY, Ingraham JL, Wheelis ML and Painter PR. (2005). General Microbiology. 5th edition McMillan.
7. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition Pearson Education.
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013). Prescott's Microbiology. 9th edition. McGraw Hill Higher Education.
9. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
10. Microbiology- Concepts and applications by Paul A. Ketchum, Wiley Publications
11. Fundamentals of Microbiology –Frobisher, Saunders & Toppan Publications
12. Introductory Biotechnology-R.B Singh C.B.D. India (1990)
13. Fundamentals of Bacteriology - Salley
14. Frontiers in Microbial technology-P.S. Bison, CBS Publishers.
15. Biotechnology, International Trends of perspectives A. T. Bull, G.
16. General Microbiology –C.B. Powar
17. Principles of Biochemistry by Lehninger
18. Biochemistry by Stryer
19. Brooker, Wiemaier G, Stiling, Principles of Biology

Semester	**II**
Paper Code	**BT224**
Paper Title	**Fundamentals of Cell Biology and Analytical Techniques**
Number of Teaching Hours per week	**03 hours Theory and 03 hours Practical**
Number of Teaching hours per semester	**45**
Number of Credits	**3 + 2**

Objective of the Paper: This paper has been designed to expose students to a broad range of cell biological themes. The topics will be covered in depth, with references to the relevant techniques and disease implications. These will provide the students a firm handle of cell biological principles and the ability to understand and analyze diverse biological phenomenon.

Fundamentals of Cell Biology	30 Hrs
Unit 1: Cell biology basics	**2 hours**
Cell theory, cell size and volume, cellular organization Eukaryotes vs prokaryotes, compartmentalization.	1 hr 1 hr
Unit 2: Cell structure and function	**4 hours**
Introduction to eukaryotic cells, basics of cell organelles Nucleus, ER and Golgi complex, endomembrane system, mitochondria and chloroplast **Active Learning**: Endosymbiotic theory.	1 hr 2 hrs (1 hr)
Unit 3: Plasma membrane and transport	**4 hours**
Structure of the plasma membrane and associated proteins, membrane permeability Active and passive transport, facilitated diffusion and transport proteins, tonicity and osmoregulation	2 hrs 2 hrs
Unit 4: Cellular energetics	**4 hours**
Introduction to metabolism (anabolism and catabolism), ATP and reaction coupling, C3 and C4 cycles, overview of cellular respiration Oxidative phosphorylation and the electron transport chain, fermentation and anaerobic respiration **Active Learning**: Evolution of photosynthesis	2 hrs 1 hr (1 hr)

Unit 5: Cell communication	**5 hours**
Introduction to cell signaling and general principles Ligands and receptors, GPCR signaling (yeast mating type signaling), feedback and homeostasis Endocrine pathways and long- distance communication, HPA axis.	2 hrs 2 hrs 1 hr
Unit 6: Cell cycle and regulation	**5 hours**
Cell cycle overview, interphase and mitotic phases Cell cycle checkpoints and tumor suppressors Introduction to meiosis, synapsis and crossing-over **Active Learning**: Cell cycle dysregulation in cancer	1 hr 1 hr 2 hr (1 hr)
Unit 7: Cell cytoskeleton and tissue formation	**4 hours**
Filaments and tubules Organization of cytoskeletal elements Cell movement Plant cell wall **Active Learning**: Role of the extracellular matrix in tissue formation.	1 hr 1 hr 1 hr (1 hr)
Unit 8: Cell death	**3 hours**
Definition of life and death, accidental and programmed cell death Apoptosis: brief introduction and physiological importance Cell viability and tests for cell death.	1 hr 1 hr 1 hr
Analytical Techniques	**15 hours**
Unit 9: Basic principles	**2 hours**
Units of measurement, electrolytes and pH, quantitative biological measurements.	2 hrs
Unit 10: Cell disruption and centrifugation	**3 hours**
Methods of cell lysis: physical and chemical, Basic principle of sedimentation, types of centrifugation, preparative versus analytical centrifugation.	1 hr 2 hrs
Unit 11: Microscopy	**3 hours**
Light microscopy, magnification, numerical aperture, resolution Fluorescent proteins and live cell imaging, fluorescence microscopy Electron Microscopy	1 hr 1 hr 1 hr

Unit 12: Chromatography	**3 hours**
Principles of chromatography and performance parameters, adsorption and partition chromatography, size-exclusion chromatography, affinity chromatography **Active Learning**: High-performance liquid chromatography.	2 hrs (1 hr)
Unit 13: Electrophoresis	**2 hours**
Discussion on matrices, agarose electrophoresis, SDS and native PAGE	
Unit 14: Basics of spectroscopy	**2 hours**
Ultraviolet and visible light spectroscopy **Active Learning**: Fluorescence spectroscopy.	1 hr (1 hr)

Practical: BT 2P24: Techniques in Cell Biology

1) Calculation of cell number using a hemocytometer
2) Effect of cell size on diffusion using agarose gel.
3) Sedimentation: isolation of chloroplasts
4) Staining of mitochondria (Janus Green) in cheek cells.
5) Mitosis: Onion root tip
6) Meiosis: Anthers
7) Osmosis: RBC/yeast
8) Chromatography: TLC of amino acids
9) Micrometry
10) Electrophoresis: agarose gel electrophoresis of dyes

Reference text

Molecular Cell Biology, Eighth Edition, 2016, Harvey Lodish; Arnold Berk; Chris A. Kaiser; Monty Krieger; Anthony Bretscher; Hidde Ploegh; Angelika Amon; Kelsey C. Martin

Principles and techniques of Biochemistry and Molecular Biology, Seventh Edition, 2010 Keith Wilson and John Walker.

Semester	**III**
Paper Code	**BT325**
Paper Title	**Fundamentals of Genetics and Biostatistics**
Number of Teaching Hours per week	**03 hours Theory and 03 hours Practical**
Number of Teaching hours per semester	**45 Theory + 33 Practical**
Number of Credits	**3 +2**

Objective of the Paper: This paper has two course subjects. The syllabus covers Genetics and Biostatistics in both practical and theoretical aspects. As part of Genetics, it introduces the fundamental principles of Mendelian Genetics exhaustively. This paper also aims to introduce students to basic concepts in Biostatistics and its applications in the field of biological sciences.

Content of Course: BT325: Fundamentals of Genetics and Biostatistics	
Genetics	**30Hrs**
Unit 1: Mendelian Genetics	**4 hrs**
Mendel's study of heredity-Mendel's experiments, Genotype, phenotype, zygosity, Alleles: dominant and recessive; Principle of segregation, Monohybrid cross, Principles of Independent assortment - Dihybrid cross, Trihybrid ratio, Application of Mendel's Principles-The Punnett square method, the probability method and	1 hr 1 hr 1 hrs

the chi-square test; **Active Learning**: Problems.	1 hr
Unit 2: Non Mendelian Inheritance	**6 hrs**
Allelic variation, incomplete dominance and co-dominance; Multiple alleles: ABO blood type alleles in humans, Rh factor alleles in humans; Genotypic interaction- Epistasis (dominant and recessive) , Pleiotropy **Active Learning**: Problems, Extra nuclear inheritance-inheritance of plastid and kappa particles	1 hr 1 hr 1 hr 1 hr 2 hrs
Unit 3: Linkage and Crossing Over	**3 Hrs**
Introduction, detection of linkage, factors affecting recombination frequency, cytological basis of crossing over, crossing over in four strand stage, relation between chiasma and crossing over; Two-point test cross and three-point test cross, Recombination frequency.	1 hr 1 hr 1 hr
Unit 4: Sex Determination, Sex Linkage, Pedigree Analysis	**8 hrs**
Sex determination-Pattern and sex chromosomes, Sex determination in human beings, flowering plants; Dosage compensation-Proof of the Lyon hypothesis, dosage compensation for Drosophila; Sex linkage, Sex linked genes in human beings-Haemophilia; Genes on X and Y chromosomes; Pedigree analysis-Penetrance and expressivity, Inheritance patterns: Autosomal and Sex-linked (dominant, recessive) **Active Learning**: Problems.	2 hrs 1 hr 2hrs 2hr 1 hr
Unit 5: Population Genetics	**3 hrs**
Concept of Gene pool and Allele Frequencies (Gene and genotypic frequencies) The Hardy-Weinberg principle, Application of the Hardy – Weinberg principle and factors affecting H-W equilibrium-Natural selection, Genetic drift; Speciation-Definition of species and mode of speciation (allopatric, sympatric)	1 hr 1 hr 1 hr
Unit 6: Chromosomal Aberrations	**6 hrs**
Numerical chromosomal aberrations– Euploidy, polyploidy- Auto and Allopolyploids; Aneuploidy- Trisomy, monosomy, nullisomy; Examples of aneuploid humans. **Structural chromosomal aberrations**-Deletions and Duplication of chromosome segments; Rearrangement of chromosome structure - inversion, translocation	3 hrs 3hrs
BIOSTATISTICS	15 Hrs
UNIT 1-Introduction	2Hrs
Definition of selected terms Scale of measurements, Methods of collecting data, Presentation of data, statistical tables, Need for reduction of data.	
UNIT 2-Population and Sampling Techniques	2Hrs
Concepts of statistical population and sample, need for sampling studies; Simple procedures of random sampling; Methods of sampling.	2 Hrs
UNIT 3- Measures of Central Tendencies	3 Hrs
Mean, Median, Mode	3 hrs
Unit 4- Measures of Dispersion	3 Hrs

Range, quartile deviation Mean deviation, Variance & Standard deviation, Coefficient of Variance	1Hr 2 Hrs
Unit 5- Probability	2hrs
Basic concepts; Basic theorems of probability addition and multiplication theorems; Conditional probability Introduction to Probability distributions, Binomial, Poisson and Normal Distribution	1 hr 1hrs
Unit 6- Correlation and Regression	3hrs
Correlation concept and applications; Regression concept and applications	

Practical III: BT 3P25: Techniques in Genetics and Biostatistics

1. Fly husbandry I
2. Fly husbandry II
3. Crossing: Monohybrid crosses
4. Isolation of salivary gland chromosomes.
5. Identification of Biomarkers.
6. Barr body identification.
7. Blood typing and probability testing.
8. Karyotyping
9. Data Analysis I.
10. Data Analysis II.
11. DNA fingerprinting

Text Books / References

Genetics:

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.

Biostatistics:

Principles of Biostatistics, Rosner
Biostatistics by Khan and Khanum
Biostatical Analysis, Jerrold H. Peasron

Course Outcomes for BT325

After successful completion of the course, the students will:

CO1	Comprehend Fundamental Genetic Principles
CO2	Analyze Genetic Interactions and Variability
CO3	Apply Genetic Concepts in Population Studies
CO4	Understand and Apply Statistical Concepts
CO5	Analyze Data Using Descriptive Statistics
CO6	Apply Statistical Methods for Data Interpretation

Semester	**IV**
Paper Code	**BT425**
Paper Title	**Molecular Biology**
Number of Teaching Hours per week	**03 hours Theory and 03 hours Practical**
Number of Teaching hours per semester	**45 Theory + 33 Practicals**
Number of Credits	**3 + 2**

Objective of the Paper: This course deals with the fundamentals of Molecular Biology: DNA structure, replication, gene expression and regulation. The practical sessions train the student in selected basic techniques in DNA isolation and analysis.

Content of Course: BT425: Molecular Biology	**45h**
Molecular Biology	**45h**
Unit 1: DNA structure and function	**6h**
Classical experiments: Griffith's, Avery, and Hershey - Chase experiments The race to enumerate the structure of DNA, Watson and Crick's model of the DNA double helix DNA Compaction and Structure of eukaryotic chromosomes/eukaryotic gene Active learning exercise: Analysis of data from classical experiments that led to the discovery of DNA structure	1h 2h 2h 1h
Unit 2: DNA Replication	**7h**
Semiconservative model of replication (Meselson & Stahl experiment) Bidirectionality and semi-discontinuous nature of replication Replication fork and the main scheme of DNA replication Replication in Prokaryotes: Initiation, elongation and termination Replication in Eukaryotes: Initiation, elongation and termination, telomeres, telomerase	1h 1h 1h 2h 2h
Unit 3: DNA Damage and Repair	**8h**
Radiation Damage, DNA instability, Oxidative damage, Alkylation Damage Introduction to mutagens, types of mutagens (chemical, physical and biological) Active learning exercise: Mutations Repair mechanisms: Photoreactivation, Excision Repair, Mismatch repair and SOS response Non homologous end joining and Homologous recombination to repair Double stranded DNA breaks	2h 1h 1h 2h 2h
Unit 4: Gene expression: Transcription	**8h**
Promoters, General Transcription factors, DNA binding domains Bacterial Transcription Initiation, Elongation and Termination	2h 2h 2h

Active learning: Eukaryotic RNA Polymerases, Promoters, Eukaryotic Transcription Initiation, Elongation and Termination Processing of eukaryotic mRNAs-Capping, Splicing and Polyadenylation.	2h
UNIT 5: Gene expression: Translation	**8h**
Structure of Ribosomes, Transfer RNA, Aminoacylation, mRNA and the Genetic Code Molecular events of Translation initiation, elongation and termination in prokaryotes Overview of the molecular events of Translation Initiation, Elongation and Termination in eukaryotes Active learning: Post translational modifications of proteins	2h 2h 3h 1h
Unit 6: Gene expression regulation	**8h**
Concept of regulation, overview of gene regulation Prokaryotic Gene Regulation-Lac and Trp operons Eukaryotic Gene Regulation- Regulatory promoter elements, epigenetic changes in chromatin structure and DNA methylation Active learning - RNAi	1h 4h 2h 1h

Practical IV: BT 4P25: Molecular Biology

1. Introduction to DNA Isolation and Discussion of Cheek cell DNA isolation
2. Preparation of buffers and Cheek cell DNA Isolation
3. Agarose Gel electrophoresis of cheek cell DNA
4. DNA isolation from *E.coli*, *S. cerevisiae*, and plant leaf samples (Part A)
5. DNA isolation from *E.coli*, *S. cerevisiae*, and plant leaf samples (Part B)
6. DNA isolation from *E.coli*, *S. cerevisiae*, and plant leaf samples (Part C)
7. Analysis/Comparison of DNA quality and concentration, Agarose gel electrophoresis
8. Understanding Protein Structure and SDS PAGE set up
9. Extraction of total protein from dal / lentil samples
10. Electrophoresis of extracted protein through SDS PAGE

Text Books / References

1. Genomes 3.0, T.A Brown
2. Genes to Proteins, Burton E Tropp, Fourth Edition
3. Principles of Biology, Brooker, Widmaier, Graham and Stiling
4. Molecular Biology of the Gene, James D. Watson

COURSE OUTCOMES for BT425:

After successful completion of the course, students will:

CO1	Critically Evaluate DNA Structure and Chromatin Organization
CO2	Integrate DNA Replication and Repair Mechanisms
CO3	Examine the Complexity of Transcription and Translation
CO4	Investigate Post-Transcriptional and Post-Translational Modifications
CO5	Analyze Gene Regulation and Epigenetic Modifications