

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF ZOOLOGY
COURSE CURRICULUM

PART-A: Introduction			
Program: Bachelor in Life Science (Honors/Honors with Research)		Semester - VII	Session: 2024-2025
1	CourseCode	ZOSE- 07T	
2	CourseTitle	Biotechnology & Genetic Engineering	
3	CourseType	Discipline Specific Elective	
4	Pre-requisite(if,any)	As per Program	
5	Course Learning Outcomes(CLO)	<p>After successfully completing this course, the students will be able to-</p> <ul style="list-style-type: none">➤ Define the concept of recombinant DNA and genetic engineering.➤ Understand the molecular techniques and their proficiencies.➤ Apply the knowledge of gene manipulation techniques.➤ Analyze different prospects and applications of genetic engineering and bioinformatics.➤ Develop understanding of ethical, social and legal implications of genetic engineering.	
6	CreditValue	3 Credits	Credit = 15 Hours -learning & Observation
7	TotalMarks	Max.Marks: 100	Min Passing Marks:40
PART -B: Content of the Course			
Total No. of Teaching-learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course Contents)		No. of Period
I	Introduction to Biotechnology: An overview of Biotechnology: History, Definition, scope, applications and ethical issues in biotechnology. Recombinant DNA, Restriction Enzymes, Application of different enzymes in Recombinant DNA technology, Restriction and modification system, Linkers & Adaptors, Restriction mapping. Vectors (Cloning and Expression Vectors). Gene Recombination and Gene transfer: Transfection, Transduction, Microinjection, Electroporation and Ultrasonication. Antibiotic Resistant Gene and their mode of action. Polymerase chain reaction (PCR): Principle and applications of different types of PCR. DNA and RNA Purification.		11
II	Elementary Genetic Engineering: Preparation and comparison of Genomic and cDNA library, screening of recombinants, Genome: organization, coding and non-coding sequences & genome mapping, Comparative genome hybridization. Whole genome shotgun sequencing, Chromosome Banding. Gene tagging, DNA Cloning, DNA Sequencing methods, DNA profiling. Genetic Markers, Molecular markers: Types & Features. Stem Cells: Embryonic Stem Cells, Adult Stem Cells and Induced Pluripotent Stem Cells, Formation and selection of recombinant ES cells, Role of ES cells in gene targeting in mice, Gene Probe, Colony Hybridization, Blotting Techniques (Southern, Northern, Western and Eastern Blotting), Animal Cell Culture (Primary Cultures, Cell line, Transformation characteristics, Culture Media & Growth Cycle).		11
III	Advancements in Genetic Engineering: Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis. Gene Editing, Gene shuffling, Genetic Manipulation of Animal Cells (Transgenesis and transgenic animals), Gene Knockout, Nuclear Transfer Technology and Animal Cloning, Gene Therapy, Gene Delivery System (Virus mediated transduction & non-viral transduction methods). Molecular Farming (Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines), Microarrays and next generation sequencing technologies.		12
IV	Applications of Genetic Engineering & Bioinformatics: Cord blood banking, Genetically Modified Organism (GMO), Animals as bioreactors: Genetically engineered animals for research. Conditional knock outs using cre-loxP recombination; tissue specific promoters, CRISPR-Cas9 and its applications in treating genetic disorders. Genetic modification of livestock for improved productivity and disease resistance. Ethical, Legal, and Social Implications (ELSI) of genetic engineering. Bioinformatics: Overview and its relation with molecular biology. Biological Databases: Overview, Applications & Prospects. Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, Pubmed, PDB) and software (RASMOL, Ligand Explorer), Data generation; Generation of large scale molecular biology data. (Through Genome sequencing) File Format (Genbank, DDBJ, FASTA, PDB, Swiss Prot). Sequence Alignments and Visualization, General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum).		11
Keywords	Recombinant DNA, Genome, Gene, Mutagenesis, Microarray, Techniques, Biological Database.		
Signature of Convener & Members (CBoS):			

PART-C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Lehninger – Principles of Biochemistry, WH Freeman.
- Satyanarayan U - Biotechnology, Saras Publication
- Gupta P.K. – Elements of Biotechnology, Rastogi Publications.
- Gupta P.K. – Biotechnology and Genomics, Rastogi Publications.
- Kumar Pranav, Verma Praveen, Meena Usha – Biotechnology: A problem approach- Pathfinder Publications.
- Rastogi S.C., Rastogi P., Mendiratta N : Bioinformatics: Methods and Applications: Genomics, Proteomics and Drug Discovery, PHI Learning.
- Bosu Orpita, Thukral S.K.- Bioinformatics: Experiments, Tools, Databases, and Algorithms – Oxford University Press

Reference Books Recommended –

- Lodish H et al., - Freeman
- Watson JD et al.- Macmillan - Recombinant DNA: Genes and Genomes, A Short Course.
- Alberts B et al., Molecular Biology of the Cell, - Garland
- Brown TA – Genomes, Garland

Online Resources–

- <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=31BI+Y/JyQo+vtlwaZoj+g==>
- http://ndl.iitkgp.ac.in/he_document/swayamprabha/swayam_prabha/ksrdg67pyn8?e=1|bioinformatics|||
- http://ndl.iitkgp.ac.in/he_document/nptel/nptel/courses_102_106_102106065_video_lec66?e=3|bioinformatics|||
- [http://ndl.iitkgp.ac.in/he_document/cec/cec/0F_oDrArwTU_PLNsppmbLKJ8K5HAWWhRVvEHrBSI1XVO-oE?e=0|biotechnology%20:%20genome%20editing%20tools%20-%203%20\(crispr/cas9\)|||](http://ndl.iitkgp.ac.in/he_document/cec/cec/0F_oDrArwTU_PLNsppmbLKJ8K5HAWWhRVvEHrBSI1XVO-oE?e=0|biotechnology%20:%20genome%20editing%20tools%20-%203%20(crispr/cas9)|||)

Online Resources–

- <https://vlab.amrita.edu/?sub=3&brch=274&sim=1428&cnt=1>
- http://ndl.iitkgp.ac.in/he_document/cec/PRwJGpzUSYM_PLNsppmbLKJ8K5HAWWhRVvEHrBSI1XVO-oE

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 20 +20 Assignment/Seminar- 10 Total Marks -30	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against 30 Marks
End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20Marks Section B: Descriptive answer type qts., 1 out of 2 from each unit-4x10=40Marks	

Name and Signature of Convener & Members of CBoS:

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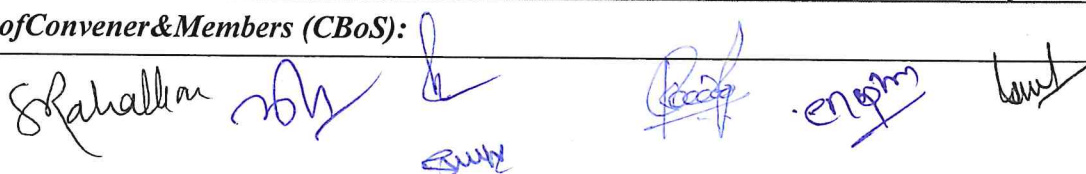
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Program: Bachelor in Life Science (Honors/Honors with Research)		Semester - VII	Session: 2024-2025
1	CourseCode	ZOSE- 07P	
2	CourseTitle	Biotechnology & Genetic Engineering	
3	CourseType	Discipline Specific Elective Lab Course	
4	Pre-requisite(if,any)	As per Program	
5	Course Learning Outcomes(CLO)	After successfully completing this course, the students will be able to: ➤ Learn to prepare aseptic techniques in laboratory for biotechnology experiments. ➤ Understand the fundamental experiments & techniques of biotechnology & genetic engineering. ➤ Develop practical skills in genetic engineering techniques and laboratory procedures. ➤ Learn characteristics of genetic material. ➤ Analyze applications of diverse genetic engineering protocols.	
6	CreditValue	1 Credits	Credit =30 Hours Laboratory or Field learning/Training
7	TotalMarks	Max.Marks:50	Min Passing Marks:20
PART -B: Content of the Course			
TotalNo.of learning-Training/performance Periods:30 Periods (30 Hours)			
Module	Topics(Course contents)		No. of Period
Lab./Field Training/ Experiment Contents of Course	<ul style="list-style-type: none">• Sterilisation of glassware, media and laboratory.• Working principle and applications of- Hot Air Oven, Autoclave & Laminar flow hood.• Demonstration of cell culture techniques.• Demonstration of gene library and cDNA library.• Isolation of DNA from plant sample.• Isolation of plasmid DNA from E. coli cells.• Isolation of genomic DNA from whole blood.• Demonstration of Gel electrophoresis techniques.• Separation and visualization of DNA fragments using agarose gel electrophoresis.• Spectrophotometric estimation of isolated DNA.• Restriction digestion of plasmid DNA and genomic DNA.• Study related to working principle of PCR machine.• Preparation of Minimal Essential Growth medium.• Staining the cultured cells using dyes such as hematoxylin and eosin (H&E), and observe them under a light microscope to study cell morphology and structure.• Bioinformatics: Analyse DNA or protein sequences using online tools and databases.• Demonstration of online data bases for bioinformatics-based studies.• Demonstration of DNA band visualization techniques (e.g., Ethidium bromide staining, DNA intercalating dyes)• Group discussion/ Quiz/Project/Seminar presentation on related topics.• Practical Record <p>Note: Virtual mode of demonstration can be opted if required.</p>		30
Keywords	Sterilization, Autoclave, Electrophoresis, Restriction, PCR, Plasmid, Genomic, Bioinformatics		
Signature of Convener & Members (CBoS):			



PART-C: Learning Resources

Text Books Recommended -

- Aneja K.R.; Laboratory manual of microbiology and biotechnology; Medtech.
- Ramdass P; Practical Biotechnology; Jaypee Brothers Medical Publishers; First Edition.

Reference Books Recommended -

- Wilson, K., & Walker, J. Principles and Techniques of Biochemistry and Molecular Biology (8th ed.). Cambridge University Press.
- Kurian K. Noble; A complete lab manual for Biotechnology; Notion Press.
- Borah Debajit; Biotechnology Lab Practices; Global Vision Publishing House.
- Portner Ralph; Animal Cell Biotechnology: Methods and Protocols: Humana Press Springer Protocols

Online Resources-

- <https://indiabioscience.org/media/articles/DBT-Life-Science-Protocol-Manual.pdf>
- https://webstor.srmist.edu.in/web_assets/downloads/2021/20BTC502J-lab-manual.pdf

Online Resources-

- <https://learn.genetics.utah.edu/content/labs/>

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): 10 & 10 Assignment/Seminar + Attendance- 05 Total Marks -15	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 15 Marks
End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment A. Performed the Task based on lab. work - 20 Marks B. Spotting based on tools & technology (written) - 10 Marks C. Viva-voce (based on principle/technology) - 05 Marks	Managed by Course teacher as per lab. status

Name and Signature of Convener & Members of CBoS:

