EVEN SEMESTER LECTURE PLAN (AY 2025-2026)

Name of the college: Government College of Arts, Science and Commerce, Sanquelim Goa

Name of Faculty: Dr. Nisha Kevat	Subject: Molecular Biology and Genetic Engineering (THEORY)	
Paper code: BOT 306	Program/Course: T.Y B.Sc.	Division: - NIL
Academic year: 2025 - 2026	Semester: VI	Total Lectures: 45 (Theory)

Course Objectives:
1. Provide students with a comprehensive understanding of the principles of molecular biology.
2. Familiarize students with intricacies of genetic code and mechanisms of DNA replication, transcription and translation.
3. Enable students to understand the techniques used in recombinant DNA technology.
4. Impart knowledge of the applications of recombinant DNA technology and the ethical concerns related to it.

Course Learning Outcome:
1. Recall the structures of nucleic acids and characteristics of the genetic code.
2. Understand the fundamental concepts of DNA replication, transcription, translation, gene organization, gene regulation and recombinant DNA technology.
3. Apply the acquired knowledge of genetic engineering principles, methods of gene transfer in plants and DNA analyses to modify genetic material leading to production of novel crops and products.
4. Analyse the various applications of genetic engineering and their ethical concerns.

Month	Lectures From:	To:	No. of lectures allotted	Topic, Subtopic to be covered	Exercise/Assignments	ICT Tools	Reference books
Week 1 December	1/12/2025	6/12/25	03	Lecture 1: DNA/RNA as carriers of genetic information (Hershey & Chase experiment Lecture 2: Fraenkel Conrat's experiment).	Students prepare a **one-page comparison table** of Hershey–Chase and Fraenkel-Conrat experiments highlighting organism used, method, and conclusion.	Power Point Presentation, Chalk And Board, You Tube Study	1. Agarwal, P (2017). Basic Concepts of Genetic Engineering. Pearson India Education Services,

				Lecture 3: Salient features of Watson and Crick's model of DNA;	Students draw a **labelled diagram of DNA** and write **5 salient features** (antiparallel strands, base pairing, hydrogen bonds).	Videos	Chennai. 2. Alberts, B, Johnson, A, Lewis, J, Raff, M, Roberts, K and Walter, P (2014). Essential Cell Biology. 4th edition. Garland Science, New York. 3. Brown, TA (2017). Genomes 4. 4th edition. Garland Science, New York. 4. Chatterjee, R (2015). Molecular Biology of the Gene. Sapna Book 5. Dubey, RC (1993). A Textbook of Biotechnology. S. Chand and Company Pvt. Ltd., New Delhi. 6. Glick, BR and Pasternak, JJ (2003). Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press, Washington D.C. 7. Griffiths, AJ, Miller, JH, Suzuki, DT, Lewontin, RC and Gelbart, WM (2000).
Week 2 December	8/12/25	13/12/25	03	Lecture 4: Denaturation and renaturation of DNA	Students explain in **5–6 lines** how temperature and GC content affect DNA melting and reannealing.	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 5: RNA and its types	Prepare **three flash cards** (mRNA, tRNA, rRNA) mentioning structure and function.		
				Lecture 6: Replication of DNA: Characteristics of the genetic code;	Students create a **simple flow chart** showing steps of DNA replication and list **one key feature** of each replication model (theta, rolling circle, linear DNA).		
Week 3 December	15/12/25	20/12/25	03	Lecture, 7: Central and revised dogma of molecular biology	Students create a **simple flow chart** showing steps of DNA replication and list **one key feature** of each replication model (theta, rolling circle, linear DNA).	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 8: mechanism of DNA replication			
				Lecture 9: models of DNA replication (rolling circle model; theta replication,			
Week 4 December	15/12/25	20/12/25	03	Lecture 10: Replication of linear ds DNA).	Students create a **simple flow chart** showing steps of DNA replication and list **one key feature** of each replication model (theta, rolling circle, linear DNA).	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 11: Transcription and translation: Features of transcription and post-transcriptional processing.	Students write a **stepwise pathway** from DNA → RNA → Protein in **10 bullet points**.		

				Lecture 12: Features of translation and post-translational modification.			An Introduction to Genetic Analysis. W. H. Freeman, New York. 8. Khushu, S (2019). Molecular Genetics and Biotechnology. ABD Publishers, Jaipur. 9. Klug, WS, Cummings, MR, Spencer, CA and Palladino, MA (2017). Concepts of Genetics. 11th edition. Pearson Education, Boston. 10. Kulkarni, VM (2018). Molecular Biology: Concepts and Applications. McGraw-Hill Education, New Delhi. 11. Lewin, B (2019). Genes XII. Jones & Bartlett Learning, Sudbury, MA. 12. Lewin, B, Cassimeris, L, Lingappa, VR, Plopper, G and Sakai, RK (2015). Genes IX. Jones & Bartlett Learning, Sudbury, MA. 13. Lodish, H, Berk, A, Kaiser, CA,
Week 5 January	2/01/26	3/01/26	01	Lecture 13: Gene organization and regulation - Gene organization and regulation in prokaryotes (lac-operon model	Prepare a **table comparing lac operon, trp operon, and eukaryotic gene regulation** (inducer/repressor, regulation type).		
Week 6 January	5/01/26	10/01/26	03	Lecture 14: trp operon model	Prepare a **table comparing lac operon, trp operon, and eukaryotic gene regulation** (inducer/repressor, regulation type).	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 15: Gene organization and regulation eukaryotes.			
				Lecture 16: Module 2: Techniques in genetic engineering Recombinant DNA technology: Concept of recombinant DNA technology;	Students list **restriction enzyme, ligase, vector**, and write **one function each**.		
Week 7 January	12/01/2026	17/01/26	03	Lecture 17: Steps in genetic engineering	Students list **restriction enzyme, ligase, vector**, and write **one function each**.	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 18: Enzymes used in recombinant DNA technology (restriction enzymes, DNA ligases.			
				Lecture 19: cloning vectors (pBR322, Ti Plasmid	Match the vector (pBR322, Ti plasmid, YAC, λ phage) with its **application**.		
Week 8 January	19/01/2026	24/01/26	03	Lecture 20: YAC, λ phage, cosmid	Match the vector (pBR322, Ti plasmid, YAC, λ phage) with its **application**.	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 21: Construction of genomic library	Explain the concept of a genomic library in **6–8 simple sentences**.		
				Lecture 22: Methods of gene transfer in plants: *Agrobacterium* mediated	Draw and label **Agrobacterium-mediated gene transfer** and name **one selectable and one reporter gene**		
Week 9 January	27/01/2026	31/01/26	02	Lecture 23: Gene gun (biolistic) method;	Draw and label **Agrobacterium-mediated gene transfer** and name	Power Point Presentation,	

				Lecture 24: Selectable marker (antibiotic resistance)	**one selectable and one reporter gene**	Chalk And Board, You Tube Study Videos	Krieger, M, Bretscher, A and Ploegh, H (2015). Molecular Cell Biology. W.H. Freeman, New York. 14. Malacinski, GM (2019). Essentials of Molecular Biology. Jones & Bartlett Learning, Sudbury, MA. 15. Nagar, S and Adhav, M (2009). Practical Biotechnology and Plant Tissue Culture. S. Chand and Company Ltd., New Delhi. 16. Primrose, SB and Twyman, RM (2006). Principles of Gene Manipulation and Genomics. 7th edition. Wiley-Blackwell, Hoboken, New Jersey, United States. 17. Purohit, SS (2008). Biotechnology: Fundamentals and Applications. Agrobios, Jodhpur. 18. Rao, CR (2016). Molecular Biology and Genetic Engineering. Universities Press,
Week 10 February	2/02/26	7/02/26	03	Lecture 25: Scorable marker/reporter genes (luciferase, GUS, GFP).			
				Lecture 25: Methods of DNA analyses: Southern, Northern and Western blotting;			
				Lecture 26: Polymerase Chain Reaction (PCR);	Match **PCR, Southern blot, DNA sequencing, RFLP** with their **specific use**.		
Week 11 February	9/02/26	14/02/26	03	Lecture 27: DNA sequencing (Sanger & Coulson's method,	Match **PCR, Southern blot, DNA sequencing, RFLP** with their **specific use**.	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 28 Maxam & Gilbert's method);			
				Lecture 29: fingerprinting technique (RFLP).			
Week 12 February	16/02/26	21/02/26	03	Lecture 30: fingerprinting technique (RFLP).	Match **PCR, Southern blot, DNA sequencing, RFLP** with their **specific use**.	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 31: Module 3: Applications of genetic engineering and ethical concerns of GM crops .Applications of genetic engineering: Genetically engineered plants for pest resistance (Bt-cotton);	Students choose **GM product** (Bt cotton, and write **advantages and use**.		

				Lecture 32: herbicide resistance (Roundup Ready soybean	Students choose **GM product** (Roundup Ready soybean) and write **advantages and use**.		Hyderabad. 19. Russell, PJ (2010). i-Genetics - A Molecular Approach. 3rd edition. Benjamin Cummings, U.S.A. 20. Sharma, A (2017). Principles of Genetic Engineering. Tech-Max Publications, Mumbai. 21. Singh, **R** (2016). Genetic Engineering: Fundamentals and Applications. PHI Learning Private Limited, New Delhi. 22. Snustad, **DP** and **Simmons**, **MJ** (2012). Principles of Genetics. John Wiley & Sons Inc., U.S.A. 23. Stewart, **CN Jr** (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc., U.S.A. 24. Verma, **PS** and **Agarwal**, **VK** (2009). Molecular Biology. S. Chand and Company Ltd., New Delhi. 25. Verma, S (2019). Genetic Engineering: P
Week 13 February	23/02/26	28/02/26	03	Lecture 33: Improved nutritional content (golden rice);	Students choose **GM product** (Golden rice) and write **advantages and use**.	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 34: extended shelf life (Flavr Savr tomato);	Students choose **GM product** (Flavr Savr tomato) and write **advantages and use**.		
				Lecture 35: Production of pharmaceuticals (edible vaccines);	Write the flow chart of Edible vaccine formation		
Week 14 March	2/03/26	7/03/26	03	Lecture 36: phytoremediation (*Arabidopsis*, poplar);	Conduct a review of literature to find more plants used for Phytoremediation	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 37: production of biofuels (switchgrass)	Conduct a review of literature to find more plants used for biofuels		
				Lecture 38: Genetically engineered microorganisms for bioremediation (superbug);	Conduct a review of literature to find more plants used for Bioremediation		
Week 15 March	9/03/26	14/3/26	03	Lecture 39: Production of pharmaceuticals (humulin, HGH).	Prepare a flowchart for the process of Humulin Production	Power Point Presentation, Chalk And Board, You Tube Study Videos	
				Lecture 40: Ethical concerns of GM crops: Potential harm to human health;	**Write a** short note (150 words) **on** any one ethical concern **of GM crops (health, environment, farmers).**		
				Lecture 41: potential damage to the environment;			
Week 16 March	16/03/26	21/03/26	03	Lecture 42: Environment; negative impact ontraditional farming practice; excessive corporate dominance		Power Point Presentation, Chalk And Board, You	

				Lecture 43: excessive corporate dominance	-	Tube Study Videos	
				Lecture 44: REVISION	REVISION	Discussion	
Week 17 March	23/03/26	28/03/26	03	Lecture 45: REVISION	REVISION		
				Lecture 46: REVISION	REVISION		
				Lecture 47: REVISION	REVISION		
Week 18 March/April	30/03/26	31/3/26	02	Lecture 48: REVISION	REVISION		
				Lecture 49: REVISION	REVISION		

*Note: Data filled in the above form is sample data.

* Assessment Rubrics

Component	Max Marks
ISA 1	7.5
ISA 2	7.5
ISA 3 (Best 2 of 3)	7.5
Practical	NA
Project	NA
Semester End Exam	80