Gyanmanjari Innovative University

Syllabus
Gyanmanjari Science Colleges
Semester-3.(M.Sc. MLT)

Subject: Medical Biotechnology- MSCMT13516

Type of course: Major
Prerequisite: Basic knowledge of molecular biology, genetics, microbiology, immunology, and biochemistry, along with fundamental laboratory techniques like PCR and electrophoresis.

Rationale: This syllabus provides understanding of the molecular basis of diseases and advanced diagnostic techniques. It focuses on the application of biotechnology in disease detection, microbial analysis, and therapeutic development. The course enhances technical and analytical skills required for accurate laboratory diagnosis. It prepares students for clinical and research roles in healthcare.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					
				Theory Marks		Practical Marks		CA	Total Marks
CI	T	P	C	ESE	MSE	V	P	ALA	
4	0	0	4	60	30	10	00	50	150

Legends: CI-Class Room Instructions–Tutorial; P-Practical; C–Credit ;ESE- End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

3 Credits * 25 Marks = 75 Marks (each credit carries 25 Marks) Theory
1 Credits * 25 Marks = 25 Marks (each credit carries 25 Marks) Practical
SEE 100 Marks will be converted in to 50 Marks
CCE 100 Marks will be converted in to 50 Marks
It is compulsory to pass in each individual component.

Continuous Assessment:

Sr. No	Active Learning Activities	Marks
1	**Case Study Analysis** Faculty will provide clinical cases related to genetic or infectious diseases and students will analyze symptoms, identify the causative factor, correlate with molecular basis, and submit a brief diagnostic report on the GMIU web portal.	10
2	**Problem-Based Learning (PBL)** Faculty will provide patient history and laboratory data and students will analyze the information, interpret results, arrive at a possible diagnosis, and submit their conclusions on the GMIU web portal.	10
3	**Laboratory Demonstration & Hands-on Practice** Faculty will demonstrate techniques like PCR, gel electrophoresis, and ELISA and students will perform the procedures, record observations, understand the principle behind each step, and upload the results on the GMIU web portal.	10
4	**Therapeutic Product Study** Faculty will assign products like recombinant insulin or monoclonal antibodies and students will explain their production process, mechanism of action, and clinical applications, then upload the report on the GMIU web portal.	10
5	**Poster / Model Presentation** The faculty will guide students to design posters or models on disease pathways, diagnostic methods, or therapeutic approaches and students will present their work with explanations and upload photos on the GMIU web portal.	10
	Total	**50**

Course Content:

Unit No	Course content	Hrs	% Weightage
1	• **Human Molecular Biology & Genetics of Disease** • Structure of human genome • Gene expression & regulation in humans • Types of mutations: a. Mutation and its types b. Types of Mutagens c. Types of Mutants • DNA repair • Nucleotide excision repair a. Mismatch correction b. Photo reactivation.	15	25
2	• **Molecular Diagnostic Techniques** • PCR and its clinical applications (RT-PCR, qPCR) • DNA/RNA extraction from clinical samples • Gel electrophoresis • Blotting techniques (Southern, Northern, Western) • Molecular markers & biomarkers	15	25
3	• **Medical Microbial Biotechnology** • Molecular pathogenesis of infectious diseases • Detection of pathogens (bacteria, viruses, fungi) • Recombinant vaccines (Hepatitis B, COVID-19 concept) • Antimicrobial resistance (AMR) • Microbial genomics in diagnosis	15	25
4	• **Therapeutic Biotechnology** • Gene therapy (applications in genetic disorders & cancer) • Stem cell therapy & regenerative medicine • Recombinant therapeutics: i. Insulin ii. Vaccines • Monoclonal antibody therapy • Biosafety & biomedical waste management • Ethical, legal & social issues (ELSI) in biotechnology	15	25

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks (RevisedBloom'sTaxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage	20%	20%	30%	10%	10%	10%

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcome:

After learning the course the students should be able to:	
CO1	Explain the molecular basis of human diseases, including gene structure, mutations, and DNA repair mechanisms.
CO2	Apply molecular diagnostic techniques such as PCR, electrophoresis, and blotting for detection and analysis of diseases..
CO3	Analyze microbial pathogenesis and apply biotechnological methods for identification and diagnosis of infectious agents.
CO4	Understand and evaluate therapeutic approaches including gene therapy, stem cell therapy, and recombinant products along with biosafety and ethical considerations.

Instructional Method:

The course delivery method will depend upon the requirement of content and the needs of students. The teacher in addition to conventional teaching methods by black board, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment/Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

ReferenceBooks:

[1] Glick, B. R., Pasternak, J. J., & Patten, C. L. (2010). *Molecular Biotechnology: Principles and Applications of Recombinant DNA* (4th ed.). ASM Press.
[2] Brown, T. A. (2016). *Gene Cloning and DNA Analysis: An Introduction* (7th ed.): Wiley-Blackwell.
[3] Primrose, S. B., & Twyman, R. M. (2006). *Principles of Gene Manipulation and Genomics* (7th ed.). Blackwell Publishing.
[4] Nelson, D. L., & Cox, M. M. (2017). *Lehninger Principles of Biochemistry* (7th ed.). W.H. Freeman.
[5] Kuby, J., Kindt, T. J., Goldsby, R. A., & Osborne, B. A. (2013). *Kuby Immunology* (7th ed.). W.H. Freeman.
[6] Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2011). *Prescott's Microbiology* (8th ed.). McGraw-Hill.
[7] Brooks, G. F., Butel, J. S., & Morse, S. A. (2021). *Jawetz, Melnick & Adelberg's Medical Microbiology* (29th ed.). McGraw-Hill.
[8] Tille, P. M. (2014). *Bailey & Scott's Diagnostic Microbiology* (13th ed.). Elsevier.
[9] Paniker, C. K. J., & Ananthanarayan, R. (2017). *Textbook of Microbiology* (10th ed.). University Press.
[10] Strachan, T., & Read, A. (2018). *Human Molecular Genetics* (5th ed.). Garland Science.