GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)
Semester: 8
Subject Name: Point of care testing and Automation
Subject Code: 1380410

Prerequisite: The prerequisites for Point-of-Care Testing (POCT) and Laboratory Automation include fundamental knowledge of clinical diagnostics, analytical techniques, and biomedical instrumentation. A strong foundation in biochemistry, microbiology, and molecular biology is essential to understand test methodologies. Additionally, expertise in microfluidics, biosensors, and data analytics helps in developing efficient POCT devices. Familiarity with regulatory standards (e.g., FDA, ISO 13485) and quality control measures ensures compliance and reliability. For laboratory automation, proficiency in robotics, AI-driven data processing, and LIMS (Laboratory Information Management Systems) is beneficial for streamlining workflows and improving accuracy.

Rationale: Point-of-Care Testing (POCT) and Laboratory Automation play a crucial role in modern healthcare by improving diagnostic efficiency, reducing turnaround times, and enhancing patient outcomes. POCT enables rapid, on-site testing, minimizing delays in critical decision-making, especially in emergency and remote settings. Laboratory automation streamlines workflows, reduces human errors, and enhances reproducibility by integrating robotics and AI-driven systems. Together, these advancements optimize resource utilization, lower costs, and improve accessibility, ultimately contributing to better disease management and personalized healthcare.

Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		**Practical**		
L	**T**	**PR**	**C**	ESE (E)	PA(M)	ESE (V)	PA (I)	
0	0	4	2	0	0	0	50	50

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage

1	**Unit 1: Fundamentals of Point-of-Care Testing (POCT)**
	• **Introduction to POCT and Its Role in Modern Healthcare**
	  ○ Definition and Scope of POCT
	  ○ Advantages and Challenges of POCT
	• **Technologies Used in POCT**
	  ○ Biosensors, Lateral Flow Assays, Microfluidics, Lab-on-a-Chip (LOC)
	  ○ Portable and Handheld Diagnostic Devices
	• **Clinical Applications of POCT**
	  ○ Rapid Testing for Infectious Diseases (COVID-19, HIV, Malaria, Influenza)
	  ○ POCT for Diabetes (Glucometers, CGM Sensors)
	  ○ POCT for Cardiac Markers (Troponin, BNP)
		20	**33**

	• **Regulatory and Quality Control Aspects of POCT** ○ FDA, ISO 22870, CLIA Waivers		

2	**Unit 2: Microfluidics and Biosensor Technology for POCT**
	• **Microfluidics in POCT**
	  ○ Principles of Microfluidic Devices in Diagnostics
	  ○ Paper-Based Microfluidics for Rapid Testing
	  ○ Integration of Microfluidics with Smartphone-Based Diagnostics
	• **Biosensors in POCT**
	  ○ Optical, Electrochemical, and Piezoelectric Biosensors
	  ○ CRISPR-Based and AI-Assisted Biosensors for Disease Diagnosis
	• **Advances in Wearable POCT Devices**
	  ○ Smart Biosensors for Continuous Monitoring
	  ○ POCT in Personalized and Digital Health
		20	**33**

3	**Unit 4: Future Trends and Challenges in POCT and Laboratory Automation** • Integration of IoT with POCT for Remote Patient Monitoring • Blockchain for Secure Laboratory Data Management • Regulatory, Ethical, and Cost Considerations in POCT and Automation • Sustainability and Eco-Friendly Approaches in Laboratory Automation • Case Studies on Successful POCT Implementations in Public Health	**20**	**33**

Reference Books:

1. Point-of-Care Diagnostics: Current Status and Future Directions – Christopher P. Price
2. Biosensors and Nanotechnology for Point-of-Care Diagnostics – Kaushik Roy
3. Microfluidics in Medicine and Biology – Tim J. Evans
4. Laboratory Automation in the Chemical and Life Sciences – Jörg P. Kutter
5. AI in Medical Diagnostics and Laboratory Medicine – Michael Fuchs

List of Experiments (Minimum 6 to be performed):

1. Analysis of samples through Lateral Flow Assay for Disease Detection
2. Demonstration of a Microfluidic-Based POCT Device
3. Analysis of Glucose level through of Biosensor
4. Automated ELISA System for Biomarker Detection
5. Smartphone-Integrated POCT for Rapid Disease Detection

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