GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Branch: ALL (Expect Instrumentation and Control Engineering & Allied Branches)
Level: UG
Subject Code: BE05000491
Subject Name: Introduction to Biomedical Technology

WEF Academic Year:	2025-2026
Semester:	5
Category of the Course:	Multidisciplinary Open Professional Elective Courses (MOPEC-02)

Prerequisite:	Physics, Basic science, Basics of electrical and electronics engineering,
Rationale:	The course Introduction to Biomedical Technology introduces engineering students to the application of engineering principles in healthcare by covering basic physiology, biomedical instruments, and modern medical technologies. It promotes interdisciplinary understanding and prepares students for emerging opportunities in technology-driven healthcare systems.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level*
01	To understand basic physiological systems such as cardiovascular, respiratory and nervous systems, its overview and brief function.	RM, UN
02	To understand basic principles of sensors, transducers and electrodes to capture biomedical signals.	AP, CR
03	To understand working principles of diagnostic instrumentation used for physiological monitoring and medical imaging.	UN, AP
04	To understand working principles and applications of therapeutic instruments and electrical safety practices in healthcare environments.	UN, AP
05	To explore emerging trends in biomedical technology.	AP, AN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Teaching and Examination Scheme:

Teaching-Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial/Practical			
L	T	P	TW/SL	TH		ESE (E)	PA (M)	PA/ (I)	TW/ SL (I)	ESE (V)	
45	00	00	15	60	02	70	30	00	30	00	130

The syllabus of Introduction to Biomedical Technology directly contributes to

SDG 3	**Good Health and Well-Being** The course focuses on biomedical instruments, patient monitoring, healthcare technologies, and medical safety for improved healthcare services.
SDG 4	**Quality Education** The syllabus provides interdisciplinary learning in physiology, biomedical sensors, instrumentation, and emerging healthcare technologies.
SDG 8	**Decent Work and Economic Growth** The course develops foundational biomedical technology skills that improve employability in healthcare, medical device, and biomedical industries.
SDG 9	**Industry, Innovation and Infrastructure** Topics such as healthcare IoT, digital health systems, wearable devices, and AI in healthcare encourage technological innovation in medical engineering.
SDG 10	**Reduced Inequalities** Digital health systems, remote monitoring, and wearable healthcare technologies support accessible and inclusive healthcare services for wider populations.

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	**Basics of Human Physiology:** Organization of human body (cells → tissues → organs → systems), Overview of major systems: cardiovascular, respiratory, nervous, Basic physiological parameters: heart rate, blood pressure, oxygen saturation, Body temperature, Bioelectric signals (ECG, EEG, EMG – concept only).	10	20
2	**Biomedical Signals & Sensors:** Types of biomedical signals (electrical, mechanical, chemical), Basics of transducers and sensors, Transducer classification & Characteristics, Common sensors: Temperature, Pressure, Flow. Signal acquisition: electrodes for the measurement of physiological parameters.	10	20
3	**Diagnostic Instrumentation Overview**: Basic block diagram of biomedical instrumentation system. **Physiological monitoring instruments:** Electrocardiograph (ECG), Electroencephalography (EEG), Electromyography (EMG), Blood pressure measurement, Pulse oximeter.	12	25

	Medical imaging instruments: Introduction to X-ray imaging, Computed Tomography (CT) and Ultrasonography.		
4	**Therapeutic Instrumentation Overview:** Cardiac Pacemaker, Defibrillator, Ventilator, Electrotherapy: TENS and Ultrasound Therapy. **Drug Delivery Systems:** Infusion Pump **Safety concepts**: Electrical Safety in Health Care.	08	20
5	**Emerging Trends in Biomedical Technology:** Introduction to digital health systems, Electronic Health Records (EHR), Healthcare IoT, Wearables and remote monitoring, introduction to AI in healthcare.	05	15
	Total	**45**	**100**

Reference Books:

1. Derasari & Gandhi's Elements of Human Anatomy Physiology and Health Education 37th Edition 2025 by Dr RK Goyal | BS Shah.
2. Guyton and Hall Textbook of Medical Physiology, John E. Hall PhD, and Saunders; 13th Edition, ISBN-10: 1455770051.
3. Medical Instrumentation: Application and Design, John G. Webster, Wiley.
4. Handbook of Biomedical Instrumentation, R S Khandpur, MC Graw Hill Education, 3rd Ed.
5. Introduction to Biomedical Equipment Technology, Joseph Carr, John Michael Brown, Pearson.
6. Biomedical Transducers & Instruments, By Tatsuo Togawa, Toshiyo Tamura, P. Ake Oberg., CRC Press.
7. Biomedical Transducers, H T Kashipara, Akshat Publication
8. Sakharkar, Principles of Hospital Administration and Planning, Jaypee Medical publishers 1/e, Reprint 2004.
9. A.V. Srinivasan, Managing a Modern Hospital, response books, Second Edition 2008.
10. Applications of Artificial Intelligence and Machine Learning in Healthcare, by Dr.S.Balamurugan, CEng. Radhey Shyam Meena Dr.Ramasamy V, 2022, Technoarete Publishing.
11. Arjun Panesar, Machine Learning and AI for Healthcare Big Data for Improved Health Outcomes, 2nd edition, 2019.

Term Work /Self Learning (TW/SL) Suggested Activities:

Sr. No.	Name of the Activity	No. of Hours	Evaluation Criteria
1	Industry/Research laboratory visit	Visit: 5h Report preparation: 5h Total: 10h	Based on the report submitted. Report should contain observations and calculations based on industry/lab data.

Sr. No.	Name of the Activity	No. of Hours	Evaluation Criteria
2	Assignment writing.	4 assignments × 5h each Total: 20h	Based on the assignments submitted.
3	Technical video-based learning related to the subject	Duration of video: 5h Report preparation: 5h Total: 10h	Report/presentation based on the video learning outcomes.
4	Self-learning online course	Minimum duration: 10h	Examination-based assessment at the end of the course. Based on the certificate produced.
5	Videos on Industrial Safety/Disaster Management aspects based on subject	Duration of video: 5hReport preparation: 5h Total: 10h	Based on quiz/report submitted.
6	Discussion on research paper based on relevant subject	5 research papers: 20h	Summarize research papers and evaluate critical parameters.
7	Poster/Chart/PowerPoint preparation on technical topics	Duration: 6h	Based on poster/chart preparation and presentation skills.
8	Group discussion on emerging/trending technical topics based on subject	Duration: 1h each	Based on performance in group discussion, technical depth, and knowledge.
9	Expert lecture/session	Duration: 2h Attendance: 2h Report writing: 2h Total: 4h	Based on proof of attendance and report submitted.
10	Real world case studies based learning	Data collection/study: 5h Report preparation: 5h Total: 10h	Based on in-depth study, technical depth, data collected, and fact finding.

* * * * * * *