GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021) Semester-VI

Course Title: Biomedical Engineering Project-II
(Course Code: 4360304)

Diploma programmer in which this course is offered	Semester in which offered
Biomedical Engineering	6th Semester

1. RATIONALE

Biomedical engineering is an interdisciplinary field that applies concepts of engineering to solve problems in medicine & healthcare. This project work is an extension of pervious work. Project work gives an opportunity to students to use their knowledge and technical fundamentals to solve real life problems in the field of healthcare.

2. COMPETENCY

The purpose of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

a. Identify real life problems in the field of healthcare.
b. Demonstrate strong problem-solving skills to address challenges related to medical device design, implementation, and performance.
c. Design & Troubleshooting
d. Programming/simulation/debugging skills.
e. Documentation & Presentation Skill.
f. Repair & maintain medical equipment.
g. Drafting and comprehending the specifications of medical equipment in preparation for manufacturing and procurement for the hospital.

2. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

1. Describe objectives and problem definition of the identified industry problem as project.
2. Select proper solution from possible solutions for defined problem.
3. Design and develop the hardware and software of the chosen solution collaboratively and effectively. as a team.
4. Prepare a project report with well-organized documentation.
5. Demonstrate the project's hardware and software.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
0	0	4	2	0	0	50	50	100

***Legends: L**-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** - End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES: NA

7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to use in uniformity of practicals in all institutions across the state.

Sr.No.	Equipment Name with Broad Specifications	PrO. No.

1	D.C. supply, 250 Volt, 25 Amp.	
2	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude	
3	Digital Storage Oscilloscope	
4	Digital multimeter (3 1/2 digit) 3 1/2-digit display, 9999 counts digital multimeter measures: AC and DC Voltage and Current, Resistance (0 - 100 MΩ), Capacitance.	
5	Universal Programmer	

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the abovementioned COs and PrOs. More could be added to fulfill the development of this course's competency.

a. Work as a leader/a team member.
b. Follow safety practices while using D.C. and AC supply for project work.
c. Work as a group member (while performing project work in laboratory)
d. Follow ethical practices.
e. Students will enhance their ability to communicate technical information to both technical and non-technical audiences.
f. Students will develop an entrepreneurial mindset and embrace innovation in their biomedical engineering projects.
g. Practice environmentally friendly methods and processes. (Environment related)

The ADOs are best developed through the laboratory/field-based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year.
ii. 'Organization Level' in 2nd year.

iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY: NA

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN: NA

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, the following are the suggested studentrelated ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should perform the following activities in group (or individual) and prepare reports of about 5 pages for each activity. They should also collect/record physical evidence for their (student's) portfolio which may be useful for their placement interviews:

a) Identify and analyze a real-world biomedical problem by conducting a needs assessment. b) Define your problem.
c) Understand the objective of your project/problem.
d) Find its existing solution in the market.
e) Create your own idea to solve the problems with better solutions.
f) Conduct an in-depth literature review related to the chosen biomedical engineering project.
g) Develop a detailed project proposal, including goals, scope, timeline, and resource requirements.
h) Design circuit/algorithm/configuration for the project and verify using simulation software.
i) Test prototypes, gather data, and iterate on design based on feedback.
j) Implement your work in steps to provide a solution to the problems.
k) Create proper documentation related to the project.
l) Demonstrate your work with a complete technical solution and suggest future work.
m) Organize a final project showcase or presentation event.
n) Publish your work in reputed journals.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Hospital/Industrial Visit.
b) Structure the course around real-world biomedical projects where students can apply their knowledge to solve practical problems.
c) Encourage collaboration with students from other disciplines, such as medicine, business, or computer science, to simulate real-world multidisciplinary teams.
d) Survey Industry Problems by meeting with industrial resources.
e) The faculty can suggest user defined problems and motivate students to find its solution.
f) Group discussion on industrial problems
g) Faculties can encourage students to participate in project competitions.
h) Invite professionals from the biomedical engineering industry to deliver guest lectures.
i) Guide students on how to address issues on environment and sustainability.

12. SUGGESTED PROJECT LIST

The project could be industry application based, internet-based, workshop-based, laboratorybased, or field-based. Each microproject should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain a dated work diary consisting of individual contributions to the project work and give a seminar presentation of it before submission. The duration of the project should be about **12-14** ***(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit a project by the end of the semester to develop the industry-oriented COs.

A suggested list of projects is given here. This must match the competency and the COs. Similar micro-projects could be added by the concerned course teacher:

a) ECG signal Conditioning circuit
b) EEG signal Conditioning circuit
c) EMG signal Conditioning circuit
d) Automatic blood pressure measurement.
e) Make a working model of hemodialysis machine.
f) Make a working model of TENS.
g) Body temperature measurement
h) Dry hand washing machine to save water.
i) Precise temperature control for baby incubators.

j) Modules for patient monitoring system
k) Wireless health checker
l) Controllable foot massager
m) Heart rate counter
n) Digital stethoscope
o) Model of ventilator
p) IOT based biomedical application.
q) Arduino Uno based biomedical application.
r) Automatic wheelchair.
s) Assistive prototype for disabled person.

13. SUGGESTED LEARNING RESOURCES

1. Biomedical Engineering Magazines
2. Industry Reports & Guidelines
3. Textbooks & Reference Materials
4. Electronics for you
5. Scientific Journals and Papers
6. Research Projects and Internships
7. Online Courses & MOOCs
8. Online Forums
9. Webinars & Workshops

14. SOFTWARE/LEARNING WEBSITES

1. http://www.electronics-tutorials.com/
2. http://www.electronics-project-design.com
3. http://etechsystems.blogspot.in/
4. http://www.electronicsproject.org
5. http://www.efymag.com/

15. PO-COMPETENCY-CO MAPPING:

Semester V	Biomedical Engineering Project-I (Course Code:4350304)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design / development of solution	PO4 Engineering Tools, Experimen-tation& Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Manage-ment	PO 7 Life-long learning
Competency	**Maintain various types of A.C. machines and three -phase transformers safely.**						
Course Outcomes CO1 Describe objectives and problem definition of the identified industry problem as project.	2	2	1	-	-	-	2
CO2 Select proper solution from possible solutions for defined problem	3	3	3	-	3	-	2
CO3 Design and develop the hardware and software of the chosen solution collaboratively and effectively	2	3	3	3	1	3	3
CO4 Prepare a project report with well-organized documentation.	1	-	-	2	-	-	3
CO5 Demonstrate the implemented project's hardware and software.	3	-	-	2	-	3	2

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

Sr. No	Name and Designation	Institute	Contact No.	Email

1.	Mr. Rakesh Motka Lecturer Biomedical Engg.	G.G.P, Ahmedabad	8128679479	motkarakesh@gmail.com
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