GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Biomedical Engineering Project-I
(Course Code: 4350304)

Diploma programmer in which this course is offered	Semester in which offered
Biomedical Engineering	5th Semester

1. RATIONALE

Biomedical engineering is an interdisciplinary field that applies concepts of engineering to solve problems in medicine & healthcare. 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. Design & Troubleshooting
    c. Programming/simulation/debugging skills.
    d. Documentation & Presentation Skill.
    e. Repair & maintain medical equipment.

3. 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 various possible solutions for selected problem.
3. Analyze the hardware and software of selected solution cohesively & effectively in team.
4. Create project report having organized documentation.
5. Demonstrate the project 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	2	1	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

6. 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 Volatge 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 above-mentioned COs and PrOs. More could be added to fulfill the development of this course 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. 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, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course. Students should perform 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) Survey existed real time problems in industry.
   b) Define your problem.
   c) Understand the objective of your project/problem.
   d) Find its existed solution in the market.
   e) Create your own idea to solve the problems with better solution.
   f) Survey and study literature on problem.
   g) Design circuit/algorithm/configuration for the project and verify using simulation software.
   h) Implement your work in steps to provide solution to the problems.
   i) Create proper documentation related to the project.
   j) Demonstrate your work with complete technical solution and suggest future work.
   k) 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)   Survey Industry Problems by meeting with industrial resources.
   c)   Faculty can suggest user defined problems and motivate students to find its solution.
   d)   Group discussion on industrial problems
   e)   Faculties can encourage students to participation in project competition.
   f)   Arrange expert lectures from industrial persons /resources.
   g)   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, laboratory-based, or field-based. Each micro-project 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 in 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 project by the end of the semester to develop the industry-oriented COs.

A suggestive 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 incubator.
   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

13. SUGGESTED LEARNING RESOURCES

1. Biomedical Engineering Magazines
2. Electronics for you
3. Scientific Journals and Papers
4. Research Projects and Internships
5. Online Courses
6. Online Forums
7. 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/ Develop -ment 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	-	-	-	-	2
CO2 Select proper solution from various possible solutions for	3	2	3	-	1	-	1

selected problem							
CO3 Analyze the hardware and software of selected solution cohesively & effectively in team	2	3	2	3	-	2	2
CO4 Create project report having organized documentation.	1	-	-	2	-	-	2
CO5 Demonstrate the implemented project hardware and software.	3	-	-	2	2	1	1

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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