GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Microprocessor and Microcontroller in Medical Devices
(Course Code: 4340301)

Diploma programme in which this course is offered	Semester in which offered
Biomedical Engineering	4th Semester

1.   RATIONALE:

In modern process industries and power stations use of microprocessor, microcontroller is very common in order to control, monitor and process various parameters and data. Microprocessor and Microcontroller is specialized and essential field where the industries need highly skilled manpower. Hence this course is designed to develop skills to maintain microprocessor based medical system and the programming practices will develop the skills to indigenous real time applications.

2.   COMPETENCY

The course content should be taught and implemented with the aim to develop required skills in students so that they are able to acquire following competency:

Maintain Microprocessor, Microcontroller based medical devices and equipment

3.   COURSE OUTCOMES (COs)

The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

I.   Distinguish Microprocessor and 8085 Microprocessor

II.   Distinguish Microcontroller

III.   Use hardware concepts of microcontroller 8051 in bio medical applications.

IV.   Develop logic for data transfer operations and Develop logic for arithmetic, logical, branching and looping operations.

V.   Interface various peripheral devices and systems with microcontroller 8051.

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	
3	0	4	5	30*	70	25	25	150

(*): Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

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

5.   (1) SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) that are the sub-components of the COs. *These PrOs need to be attained to achieve the COs.*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	To study architecture of 8085 microprocessor.	I	2
2	Demonstrate of kit/simulator of 8085	I	2
3	Implement a program to compare two numbers.	I	2
4	To study architecture of microcontroller.	II	2
5	Check the 8051 oscillator circuit and timing diagram.	III	2
6	Check interrupts circuits using 8051.	III	4
7	Analyze 8051 Timer control Serial port control and External Interrupts	III	4
8	Interface external memory with 8051 microcontrollers.	III	4
9	Perform addition programming using 8051.	IV	2
10	Perform subtraction programming using 8051.	IV	2
11	Perform multiplication & division using 8051 microcontrollers.	IV	2
12	Demonstrate byte & bit level programming using assembly level programming.	IV	2
13	Interface A to D converter using 8051.	V	4
14	Interface D to A converter using 8051.	V	4
15	Interfacing LED and LCD Displays with 8051	V	4
16	Write assembly language program for the given application in bio medical instrumentation using 8051 and test	V	4
	Total Hrs.		**46**

Note

i.   More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list**.** While designing exercises make sure that all COs are covered equally.

ii.   Care must be taken in assigning and assessing study report. Teacher can assign group of students a drawing that is available from industry/catalog/manuals and ask them to answer simple questions related to interpretation of drawing. Teacher can also ask them to find material required from the problem of surface development and bill of material (part list). .

iii.   The following are some **sample** *'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed* **Practical Exercises** *of this course required which are embedded in the COs and ultimately the competency.*

Sr. No.	Sample Performance Indicators for the PrOs (1 to 12)	Weightage in %
1.	Put correct idea of assigned work.	30
2.	Shows each detail carefully and appropriately.	30
3.	Complete the solution of given problem with accuracy and neat work.	40
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

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

Sr. No.	Equipment Name with Broad Specifications
1	8085 Trainer Kit with programming facility
2	8051 Trainer Kit with programming facility
3	PC with 8085 and 8051 Simulator and Programming Software
4	Microcontroller Trainer Kit with bio medical instrumentation application interfacing cards for (ECG, Heart Rate, Blood Pressure, Temperature).

7.AFFECTIVE DOMAIN OUTCOMES

The following **sample** Affective Domain Outcomes (ADOs) are embedded in many of the above-mentioned COs. More could be added to fulfil the development of this course competency.

a) Practice & follow valid Design Standards to assure quality work in design of microprocessor and microcontroller system.

b) Follow ethical practices as Team leader and enable team members to do so at work.

c) Design microprocessor and/or microcontroller system considering human ergonomics.

The ADOs are best developed through the field based exercises/project work. 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.

'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major supporting theory is given below based on the higher level UOs of Revised Bloom's taxonomy that are formulated for development of the COs and competency. If required, more

such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
UNIT – I **Basics of** **Microprocessor** **and** **Microprocessor** **8085**	1a. Describe functions of each block of generalize microprocessors 1b. List Advantages and disadvantages of microprocessor 1c. Explicate microprocessor architecture with the help of suitable block diagram 1d. Describe memory organization of 8085 microprocessor. 1e. Explain importance of timing and control section 1f. Classify instruction set of 8085 microprocessor	1.1 Introduction to microprocessor 1.2 Advantages and disadvantages of microprocessor 1.3 Structure of microprocessor, generalized architecture of microprocessor, Functions of each block 1.4 Functional block diagram of 8085 microprocessor with pin diagram, logical block diagram of 8085 microprocessor-Registers, ALU, memory organization, decoder, serial control section, interrupt section, timing and control section 1.5 Classification of instructions.
Unit– II **Introduction to Microcontroller**	2.a Understand the basic block diagram of microcontroller. 2.b Draw and explain basic block diagram of microcomputer system. 2.c Compare the microcontroller With microprocessor. 2.d Give the specification of basic microcontroller and Microprocessor	2.1 Microcontroller : Introduction , Technical specification. 2.2 Block diagram of a microcontroller 2.3 Block diagram of microcomputer system. 2.4 Comparison between microprocessor and microcontroller
Unit-III **8051** **Microcontroller** **Hardware**	3.a Write the specification and features of microcontroller 8051. 3.b Draw and explain microcontroller 8051 Hardware model. 3.c Draw and explain Programming model of 8051. 3.d Draw and explain	3.1 Introduction. 3.2 8051 micro controller hardware. 3.3 8051 block diagram. 3.4 8051 Programming model. 3.5 8051 DIP Pin assignment. 3.6 8051 oscillator and clock. 3.7 Ceramic resonator oscillator circuit. 3.8 Program counter and data pointer. 3.9 A and B CPU registers. 3.10 Flags and the program

	pin-out Diagram of 8051. 3.e Describe the ceramic Resonant circuit in 8051. 3.f Describe the all special function registers with Figure. 3.g Draw and explain Internal RAM organization and ROM 3.i Describe the external memory interfacing with 8051. 3.j Explain all timer modes of 8051. 3.k Understand serial communication of microcontroller 8051 with External peripheral devices. 3.l Evaluate all serial communication modes in 8051. 3.m Explain need of interrupts and its type in detail.	status Word (PSW). 3.11 Internal memory. 3.12 Internal RAM. 3.12.1 Internal RAM Organization. 3.13 Stack and stack pointer. 3.14 Special function registers. 3.15 Internal ROM 3.16 External memory. 3.16.1 Connecting external memory 3.17 Counters and timer. 3.17.1 TCON and TMOD function registers 3.17.2 TCON (Timer control) function registers 3.17.3 TMOD Time mode control Function Register 3.18.4 Timer counter interrupts 2.18.4. Timer mode 1, 2 & 3 3.18 Serial Data input / output. 3.19 Interrupts. Introduction and types of interrupt
Unit– IV Moving Data Instruction Set. Arithmetic and Logical Operations	4.a Classify various Instruction set. 4.b Describe different instruction syntax and It's memory Occupation. 4.c Write a simple programs Using different instructions. 4.d Explain different addressing modes and Demonstrate data moving Instructions. 4.e Describe different types of programming techniques & write simple programs	4.1 Addressing Modes. 4.2 External Data Moves. 4.3 Code memory Read-only Data Moves. 4.4 Push and Pop opcodes. 4.5 Data exchanges. Example programs 4.1 Byte Level Logical Operation. 4.2 Bit Level Logical Operation. 4.3 Rotate and Swap Operation. 4.4 Flags. 4.5 Incrementing and Decrementing. 4.6 Additions. 4.7 Subtraction. 4.8 Multiplications and Division. 4.9 Decimal Arithmetic. 4.10 Example Programs. 4.11 Jump and Call Program Range.

	on different programming Techniques	4.12 Calls and Subroutines.
Unit-V **Biomedical Applications using Microprocessor and microcontroller**	5.a Microprocessor based temperature monitoring system 5.b Describe the microcontroller interfacing with external peripherals like keyboard, LCD, ADC etc 5.c Draw and explain Patient data acquisition system using 8051.	5.1 Application of microcontroller in medical field 5.2 Interface the microcontroller System to A/D and D/A Converters. 5.3 Patient data acquisition system with block diagram. 5.4 Microprocessor based ECG. 5.5 Temperature monitoring using Microprocessor.

Note: *The UOs need to be formulated at the 'Application Level' and above of Revised Bloom's Taxonomy' to accelerate the attainment of the COs and the competency.*

9.SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basics of microprocessor and microprocessor 8085	08	04	04	04	12
II	Introduction to microcontroller	06	03	04	08	15
III	8051 Microcontroller hardware	10	03	06	06	15
IV	Moving data instruction and arithmetic and logical operation	10	02	07	06	15
V	Biomedical application using microprocessor and microcontroller	08	04	03	06	13
	Total	42	16	24	30	70

 Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

<u>*Note*</u>: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions to assess the attainment of the UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may slightly vary from above table.*

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 conduct following activities in group and prepare reports of each activity. They should also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- Build various trainer kits for control system applications.
- Interface microprocessor and microcontroller with external devices for developing mini project.
- Prepare flow chart and assembly language programming for basic arithmetic operations.

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)   Massive open online courses (**MOOCs**) may be used to teach various topics/sub topics.

b)   Guide student(s) in undertaking micro-projects.

c)   *'L' in section No. 4* means different types of teaching methods that are to be employed by teachers to develop the outcomes.

d)   About **20% of the topics/sub-topics** which are relatively simpler or descriptive in nature is to be given to the students for **self-learning**, but to be assessed using different assessment methods.

e)   Teachers need to ensure to create opportunities and provisions for *co-curricular activities*.

f)   Guide students on how to address issues on environment and sustainability

g)   Theory, Tutorial & Practical aspects is covered in best way which every student must learn before undergoing actual Design of automobile component.

12.SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably being **individually** undertaken to build up the skill and confidence in every student to become problem solver so that she/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should **not exceed three.**

The micro-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 dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should be about **14 - *16 (fourteen to sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

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

LPG gas leakage detection system
Door Access Security System

Stock Empty or Full indicator using Weight sensor
SMS based Baby Incubator using GSM technology
Attendance Management System
Microcontroller based Line Follower Robot
Alcohol detection system

13.SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Microprocessor Architecture, Programming and Applications with 8085	Gaonkar, Ramesh S.	Penram International Publishing (India)Pvt.Ltd. New Delhi (5th Edition)
2	Fundamentals of Microprocessors and Microcontrollers	Ram, B.	Dhanpat Rai Publications, New Delhi
3	Microprocessors and Interfacing Programming and Hardware	Hall, Douglass V.	TMH publication, New Delhi, (latest Edition)
4	The 8051 Microcontroller Architecture, Programming and Applications	Ayala, Kenneth J.	Penram International Publishing (I) Pvt. Ltd. New Delhi
5	The 8051 Microcontroller and Embedded Systems using Assembly and C	Ali, Muhamad Mazidi, Janice Mazidi Gillispie, Rolin D. Mckinleay	PHI Learning, New Delhi, (latest Edition)

14. SOFTWARE/LEARNING WEBSITES

   i.   www.keil.com/
   ii.   www.allaboutcircuits.com
   iii.   www.nmbtc.com
   iv.   http://nptel.ac.in/courses/Webcourse-contents/IIT-
         KANPUR/microcontrollers/micro/ui/Course_home1_1.htm

15. PO-COMPETENCY-CO MAPPING

Semester III	Automobile Design & Drafting (4330206)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency Maintain Microprocessor, Microcontroller based medical devices and equipment							
CO I. Distinguish Microprocessor and 8085 Microprocessor	2	-	-	1	1	2	2
CO II. Distinguish Microcontroller	2	-	-	1	1	2	2
CO III. Use hardware concepts of microcontroller 8051 in bio medical applications.	1	3	3	1	2	-	3
CO IV. Develop logic for data transfer operations and Develop logic for arithmetic, logical, branching and looping operations.	3	3	1	-	-	-	2
CO V. Interface various peripheral devices and systems with microcontroller 8051.	3	2	3	2	-	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

S. No	Name and Designation	Institute	Contact No.	Email
1	Mr. Punit D. Dave Lecturer in Biomedical Engineering	Government Polytechnic, Gandhinagar.	9429903316	punitdave1987@gmail.com
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