



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechatronics Engineering

Subject Code: DI05020011

Subject Name: Microcontroller - 8051

w. e. f. Academic Year:	2026-27
Semester:	5th
Category of the Course:	PCC

Prerequisite: -	• Basic Knowledge of components like resistor, capacitor, diode, transistor • Understanding voltage, current, and simple circuits Digital electronics topics, such as Logic gates (AND, OR, NOT, etc.) • Number systems • Basic programming basics and mathematical & logical Skills should be known.
Rationale:	The objective of course on Microcontrollers is to impart knowledge of programming expertise for embedded systems and to provide Strong foundation in Embedded systems to the students of Mechatronics Engineering. Microcontroller is the sole of all embedded electronic equipment's and is used in most of the areas of automation. They include product ranges from tiny consumer electronic products to complex industrial process controllers. Hence, this advance course will assist student in programming practices to develop indigenous microcontroller-based applications.

2. Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Definition & features of 8051 microcontroller	R/U
02	To Study Various Instructions Regarding 8051 Microcontroller.	R/ U/ A
03	Write and Execute Assembly Language programs for given application.	U / A
04	Identify Various Special Function Registers for given application.	R /U / A
05	Interface 8051 Microcontroller with hardware for given application and study Basics of Arduino.	R/U/A



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechatronics Engineering

Subject Code: DI05020011

Subject Name: Microcontroller - 8051

3. Suggested Specification Table with Marks (Theory):

Sr.No	Unit Title	Teaching Hours	Distribution of Theory Marks (in %)						Total Marks
			R	U	A	N	E	C	
1.	8051 Architecture	09	7	8	1	-	-	-	16
2.	8051 Instruction Set	12	8	5	3	-	-	-	16
3.	8051 Programming	06	-	4	6	-	-	-	10
4.	8051 Special Function Register	10	6	8	-	-	-	-	14
5.	8051 Interfacing with various devices & Arduino Basics	08	5	5	4	-	-	-	14
		45	26	30	14	-	-	-	70
			37%	43%	20%	-	-	-	100%

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

4. Teaching and Examination Scheme: (*): PA (Progressive Assessment)

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA(M)	PA(I)	ESE (V)	
03	00	02	04	70	30	20	30	150



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechatronics Engineering

Subject Code: DI05020011

Subject Name: Microcontroller - 8051

5. Course Content:

Unit No.	Course Content	No. of Hours	% of Weightage
1.	8051 Architecture 1.1 Block diagram of 8051 1.2 Program Status Word of 8051 1.3 Pin Diagram of 8051 1.4 Clock and reset of 8051 1.5 Internal RAM Organization of 8051 1.6 Comparison of Microprocessor & Microcontroller 1.7 RISC & CISC architectures	09	18%
2.	8051 Instruction Set 2.1 Addressing Modes 2.2 Data Transfer and Data Exchange Instructions 2.3 Stack Operation 2.4 Arithmetic Instructions 2.5 Bit and Byte Level Logical Instructions 2.6 Rotate and Swap Instructions 2.7 Jump and Call range Instructions	12	24%
3.	8051 Programming 3.1 Programs based on Data Transfer Instructions 3.2 Programs based on Data Exchange Instructions 3.3 Programs based on Arithmetic Instructions 3.4 Programs based on Logical Instructions 3.5 Programs based on Jump Instructions 3.6 Program to transmit data serially	06	14%
4.	8051 Special Function Register 4.1 Timers/Counters Registers (TMOD, TCON) 4.2 Modes of Timers/Counters 4.3 Serial Data Communication (SCON) 4.4 Types of Interrupts (IE, IP)	10	24%
5.	8051 Interfacing with various devices & Arduino basics 5.1 LED Interfacing 5.2 LCD Interfacing 5.3 7 Segment Display interfacing 5.4 Relay Interfacing 5.5 DC Motor Interfacing	08	18%



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechatronics Engineering

Subject Code: DI05020011

Subject Name: Microcontroller - 8051

	5.6 Arduino block diagram, sketch structure and on board LED blinking		
	Total	45	100%

6. SUGGESTED PRACTICAL EXERCISES: -

Suggested Course Practical List: The Suggested list of PROGRAMS is based on 8051 Microcontroller.

Sr. No.	Practical Outcomes (PrOs)	Approx. Hrs. required
1.	Introduction to EdSim51 Software of the 8051 microcontroller.	02
2.	Learn architecture and pin diagram of Microcontroller chip 8051.	02
3.	Use 8051 Simulation tool / Trainer kit for running ASM programs.	02
4.	Execute assembly language programs based on Internal Data transfer Instructions (Datamoves)	02
5.	Develop and execute assembly language programs based on Arithmetic Instructions (e.g. 8-bit Addition, Subtraction, Multiplication, Division)	02
6.	Develop and execute assembly language programs based on Logical Instructions (AND, OR etc.)	02
7.	Develop and execute assembly language programs based on Rotate and Swap Instructions	02
8.	Develop a program to interface LED with 8051	04
9.	Develop a program to interface Push Button switch with 8051	02
10.	Interface LCD Module with 8051	04
11.	Study Architecture / Block diagram of Arduino Uno	02
12.	Develop a sketch for On board LED blinking using Arduino Uno	02
13.	Develop a sketch for External LED blinking using Arduino Uno	02
	Total (Hours)	30



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechatronics Engineering

Subject Code: DI05020011

Subject Name: Microcontroller - 8051

7. NOTES: -

I. More Practical Exercises can be designed and offered by the concerned course teacher to develop the industry-relevant skills/outcomes to match the COs. The above table is only a representative list.

II. It is compulsory to prepare log book/continuous records of exercises. It is also required to get each exercise recorded in log book/continuous records, checked and duly dated signed by teacher. CA component of practical marks is dependent on continuous and timely evaluation of exercises.

III. Term work report must not include any photocopy/ies, printed manual/pages, litho, etc. It must be hand written / hand drawn by student only.

a. Brief details of industry visited.

b. Type, location, products, rough layout, human resource, etc., of industry.

c. Details, description and broad specifications of machineries/processes observed.

d. Safety norms and precautions observed.

e. Student's own observation on industrial environment, productivity concepts, quality consciousness and quality standards, cost effectiveness, culture and attitude.

f. Any other details/ observations asked by accompanying faculty.

IV. For practical ESE part, students are to be assessed for competencies achieved. They should be assigned the necessary data and should be given any one experience to perform. 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.

➤ **SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

Microcontroller-8051 being a most important subject of Mechatronics, teachers are expected to lay considerable stress on understanding the basic concepts, principles, and applications. For this purpose, teachers are expected to give simple problems in the classroom and provide tutorial exercises to develop the necessary knowledge for comprehending the basic concepts and principles. As far as possible, teaching the subject is supplemented by demonstrations and practical work in the laboratory using various Microcontroller 8051 Simulation Software's.

Sr. No.	Unit	Unit Name	Strategies
1	I	8051 Architecture	Show PPT on Microcontroller 8051.
2	II	8051 Instruction Set	Assemble level instruction practices on simulators
3	III	8051 Programming	Assemble level programming practices on simulators



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechatronics Engineering

Subject Code: DI05020011

Subject Name: Microcontroller - 8051

4	IV	8051 Special Function Register	Show PPT on special function register and perform programs on simulator.
5	V	8051 Interfacing with various devices& Arduino Basics	Live projects, Video Lectures with the help of internet.

8. References/Suggested Learning Resources:

➤ Books:

Sr. No	Title of Book	Author	Publication
1.	The 8051 microcontroller and embedded systems	Mazidi, Muhammad Ali; Mazidi, Janice Gillespie; McKinley Rolin D.	PHI Learning, New Delhi, (2nd edition, 2005)
2.	The 8051 Microcontroller: Architecture, Programming, and Applications	Ayala, Kenneth J.	Thomson Delmar Learning, (3rd edition, 2004)
3.	Microcontrollers : Principles And Applications	Pal, Ajit	PHI Learning, New Delhi, (1st edition, 2011)
4.	The 8051 Microcontrollers: Architecture, Programming and Applications	Rao, K Uma	Pearson Education India, New Delhi, (2nd edition, 2011)

➤ Open-source software and website:

- i. www.academia.edu
- ii. www.nptel.iitm.ac.in
- iii. www.8051.com
- iv. <http://www.slideshare.net/aismahesh/memory-8051>
- v. <http://www.intorobotics.com/8051-microcontroller-programming-tutorialssimulators-compilers-and-programmers/>
- vi. <http://www.ikalogic.com/part-1-introduction-to-8051-microcontrollers>
- vii. <http://www.edsim51.com>
- viii. <http://www.8051projects.net/download-c4-8051-projects.html>
- ix. <http://cse.iitkgp.ac.in/~soumya/embs/the-8051-microcontroller-314772782.pdf>
- X. Arduino tutorial: <https://www.arduino.cc/reference/en/>
- Xi. Online Simulator for Arduino: <https://www.tinkercad.com/dashboard>



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Mechatronics Engineering

Subject Code: DI05020011

Subject Name: Microcontroller - 8051

9. Major Equipment / Instruments and Software Required

Sr. No.	Equipment Name with Broad Specifications	PrO. No.
1.	8051 Simulator tool - EdSim51	1,2
2.	Computer system with latest operating system.	1,2
3.	Interfacing Cards Seven Segment Display, Keyboard, LCD	1,2,4
4.	8051 Microcontroller Trainer Kits (with keypad, 7-segment, LCD, I/O ports, ADC/DAC, motor driver interface)	3
5.	LEDs, Switches, Push Buttons, Seven Segment Display modules.	6,7,8, 12, 13
6.	LCD Display (16×2) modules.	1 to 10
7.	Digital Multimeter & CRO (optional) for observing signals.	1 to 10
8.	Breadboards, Resistors, Capacitors, ICs, Connecting Wires.	1 to 10
9.	Arduino Uno Board, Bread board	11 to 13

10. Suggested Project List& Student Activities:

Sr. No.	Activity.
1.	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.
2.	They should also collect/record physical evidence for their (student's) portfolio which may be useful for their placement interviews: a) Present seminar on various topics from course content b) Prepare poster of 8051 Microcontroller based automation system.
3.	Prepare chart to represent the instruction set of 8051 microcontroller.
4.	Prepare a Power point Presentation of given topic.
