GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Instrumentation and Control Engineering

Subject Code : DI04017091

Subject Name : Microcontroller in Instrumentation

w. e. f. Academic Year:	2025-26
Semester:	4th
Category of the Course:	MOPEC

Prerequisite:	Fundamental of Electronics, Basic Programming Knowledge, Digital Techniques
Rationale:	In the present industrial scenario the role of instrumentation is becoming more vital day by day specially in case of industrial automation. Microcontroller is the key device in automation. It is being used in domestic, commercial, industrial and consumer goods from low end to high end applications. Microcontroller enhancing the pace of technology. Diploma engineers shall deal with various Microcontroller based systems and its maintenance. This course intends to develop skills to build and maintain the Microcontroller based systems.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
CO1	Distinguish microprocessor and Microcontroller based systems.	R,U,A
CO2	Interpret the functions of different internal parts of microcontroller 8051.	R,U,A
CO3	Interpret the basic functions of Arduino Uno.	R,U,A
CO4	Interface 8051 and Arduino for Input and Output devices.	R,U,A
CO5	Build Microcontroller based measurement systems using Arduino.	R,U,A

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE(E)	PA(M)	PA(I)	ESE(V)	
3	0	0	3	70	30	0	0	100

Course Content:

Unit	Topics and Sub-topics	No. Of Hrs.	% Weightage
Unit – I Introduction to Microcontroller	1.1 Basic Concepts of microprocessor and microcontroller includes block diagram. 1.2 Comparison of microprocessor and microcontroller 1.3 Features and selection factors for microcontroller 1.4 Derivatives of microcontroller (from manufacturers Intel, Atmel, Microchip, Arduino). 1.5 Advantages, Disadvantages and Applications of microcontroller.	4	10
Unit – II 8051 Microcontroller Architecture	2.1 Architecture of 8051 microcontroller. 2.2 Pin diagram of 8051 microcontroller and function of each pin. 2.3 Boolean processor. 2.4 Input/ output ports, circuits & their alternate functions. 2.5 Internal memory organization (RAM & ROM). 2.6 Program counter and stack pointer. 2.7 Flag and PSW register. 2.8 Timers/ counters– block diagram of timer control, TMOD, TCON, THx, TLx registers, modes of operation. 2.9 Interrupts- block diagram of interrupt control, vector addresses, priority, IE, IP registers. 2.10 Serial data: Modes, block diagram of serial control, SBUF, SCON, PCON registers 2.11 Software development tools: editor, assembler, compiler, cross compiler, linker, locator	14	30
Unit – III AVR Microcontroller	3.1 Features of At-mega 328P and Arduino Uno board. 3.2 Arduino open-source community. 3.3 Arduino boards and their specifications. [Uno, Due, Lilypad, Robot, Esplora, Mega] 3.4 Block diagram of Arduino uno. 3.5 Function of pins on Arduino uno. 3.6 Arduino library functions 3.6.1 Data types, variables, operators 3.6.2 I/O functions	10	25

	3.6.3 PWM functions 3.6.4 Random functions 3.6.5 Serial functions: UART, I2C, SPI		
Unit – IV I/O Interfacing	4.1 Switch, LED, 7 segment display, LCD, relay, 4x4 matrix keyboard, DC motor, stepper motor, ADC and DAC interfacing with 8051. 4.2 Simple c programs for above I/O interfacing using 8051. 4.3 HC-04 ultrasonic module, HC-05 Bluetooth module, DHT11/22 humidity/ temperature, LPG detector module, DC motor, Servo motor, stepper motor interfacing with Arduino uno. 4.4 Simple c programs for above I/O interfacing using Arduino.	10	20
Unit – V Microcontroller Applications	5.1 Microcontroller based measurement systems includes data logging, control and display using Arduino 5.1.1 Room Temperature Indicator 5.1.2 Level detection application 5.1.3 Water level Control 5.1.4 Car parking - (Motion and obstacle sensing) 5.1.5 Traffic light control 5.1.6 Stepper motor control for clockwise and anticlockwise rotation	7	15
	Total	**45**	**100 %**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**45**	**35**	**-**	**-**	**-**

Suggested Student Activities

Other than the classroom 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 about 5 pages for each

activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Present seminar on various topics from course content.
b) Prepare poster of microcontroller application used for instrumentation.
c) Prepare journals based on practical performed in laboratory.

SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

Following Sample strategies teacher can use to accelerate the attainment of the various outcomes in this course:

i. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
ii. Some of the topics/sub-topics is relatively simple and very easy to the students for self-learning, but to be assessed using different assessment methods.
iii. Guide students for using latest Technical Magazine.
iv. Arrange visit to relevant industry.
v. Show video lectures on Microcontroller Applications with help of internet.
vi. Inspire Student to read books on development and evolution networking, instruct them to take notes in form of summary
vii. Guide students to make presentation on applications of instrumentation.
viii. Guide students Criteria for choosing microcontroller.

SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	The 8051 Microcontroller: Architecture, programming and applications	Kenneth J. Ayala,	Cengage Learning, 3rd edition, 2005, 978-1401861582
2	The 8051Microcontroller and Embedded System using assembly and C	Muhammad Ali Mazidi, Janice Gillispe Mazidi, Rlin D. McKinlay	Pearson/ Prentice Hall New Delhi, 2nd edition, 2008, 978-8131710265
3	Microcontroller Theory and application	Ajay V. Deshmukh	McGraw Hill New Delhi, 1st edition, 2011, 978-0070585959
4	Microprocessors and Microcontrollers: Architecture, Programming and System Design	Krishna Kant	PHI New Delhi, kindle edition, 2016, 978-8120331914
5	Introduction to Arduino: A piece of cake	Alan G. Smith	Create Space Independent Publishing Platform, 1st edition, 2011 , 978-1463698348

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
6	Getting Started with Sensors	Kimmo Karvinen and Tero Karvinen	Maker Media, 1st edition, 2014, 978-1449367084

SUGGESTED LEARNING WEBSITES

i. https://nptel.ac.in/courses/108105102
ii. VLAB: http://vlabs.iitkgp.ac.in/rtes/exp10/index.html#
iii. https://studytronics.weebly.com/8051microcontroller.html
iv. https://www.spcmc.ac.in/uploads/1731941275_Introduction_Microcontroller_Arduino.pdf
v. https://sripc.edu.in/data/uploads/eee/Notes/5%20Sem/5%20MC.pdf
vi. https://www.geeksforgeeks.org/pin-diagram-of-8051-microcontroller/?ref=lbp
vii. https://www.electronicshub.org/microcontrollers/
viii. https://www.elprocus.com/8051-assembly-language-programming/
ix. https://microcontrollerslab.com/category/8051-microcontroller/
x. https://www.elprocus.com/types-interfacing-devices-applications-with-microcontroller/
xi. https://nptel.ac.in/courses/117104072
xii. https://www.engineersgarage.com/8051-microcontroller
xiii. https://freevideolectures.com/course/3018/microprocessors-and-microcontrollers

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