GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering Syllabus

Branch: Robotics and Automation

Subject Code: BE05041011

Subject Name: Microcontroller and Microprocessor

WEF Academic Year:	2025-26
Semester:	5
Category of the Course:	Professional Core Course

Prerequisite:	Nil
Rationale:	Nil

Course Outcome :

After Completion of the Course, Student will able to :

No	Course Outcomes	RBT Level*
01	Understand the architectures of Microprocessor and Microcontroller.	UN
02	Apply the basic concepts of digital fundamentals to Microprocessor and Microcontroller based systems.	EL
03	Analyze the properties of microprocessor and microcontroller and perform programming to solve real world problems.	AN, CR
04	Illustrate how the different peripherals are interfaced with Microcontroller	CR

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Teaching and Examination Scheme:

Teaching/Learning Scheme in hrs/semester					Total Credits	Assessment Pattern and Marks					Total Marks
						Theory		Practical			
L	T	P	PBL*	TH	TH/30	ESE (E)	PA (M)	PA (I)	PBL(I)	ESE (V)	
45	0	30	15	90	3	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

*** Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content :

Sr. No.	Content	Total Hrs
1	Introduction of Microprocessor of 8085: Introduction of Microprocessors, Microcomputer System, Difference between Microcontrollers & Microprocessors.	4
2	Architecture of Microprocessor of 8085 & 8051 Microcontroller: 8085 Microprocessor Architecture, Address, Data and Control Buses, Pin Functions, De-multiplexing of Buses, Generation Of Control Signals, Memory Interfacing, Architecture of 8051, Pin Function of 8051 microcontroller	9
3	Introduction To 8-bit AVR Microcontroller: Overview of AVR family, AVR Microcontroller architecture, Register, AVR status register, ROM space and other hardware modules, ATmega32 pin configuration & function of each pin	9
4	AVR Assembly Language Programming: Addressing modes of AVR, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions. AVR data types and assembler directives, AVR assembly language programs, AVR I/O Port Programming, Time delay loop.	13
5	AVR Programming in C: Data types, I/O programming, logic operations, Timer programming in assembly and C, Interrupt programming in assembly and C, Serial Port programming in assembly and C.	10
6	Peripheral Interfacing: 7-Segment LED Display, LCD and Keyboard Interfacing, ADC, DAC and sensor interfacing, Relay, Opto-isolator and Stepper Motor Interfacing, DC motor control, I2C Protocol and RTC interfacing.	11

This syllabus is mapped with following United Nation's Sustainable Development Goals:
SDG 3 - Good Health and Well-being
SDG 4 - Quality Education.
SDG 7 – Clean and affordable energy,
SDG 8 - Decent Work and Economic Growth,
SDG 9 - Industry, Innovation and Infrastructure,
SDG 11 - Sustainable Cities and Communities,
SDG 12 - Responsible Consumption and Production,
SDG 13 -Climate Action

Relevant BIS standards:
IS 13252 (Part 1) – Safety of Information Technology Equipment
IS 616 – Safety of Electrical Equipment
IS/IEC 60529 – Degrees of Protection (IP Code) for embedded hardware enclosures
IS 14700 series – Electromagnetic Compatibility (EMC)

Also explore other relevant Indian and international standards.

Reference Books:

1. The AVR Microcontroller and Embedded Systems Using Assembly and C, by Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson EducationElectronic Communication Systems, George Kennedy, Bernard Davis, S R M Prasanna.
2. Microprocessor Architecture Programming and Applications by R. S. Gaonkar – Fourth Edition (WEL).
3. Mohammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay ,The 8051 Microcontroller and Embedded Systems using Assembly and C, 2/e Second Edition, Pearson Education .
4. Programming and Customizing the AVR Microcontroller, by Dhananjay Gadre, McGraw Hill Education.

Suggested Course Practical List :

Faculty can provide any circuit and ask students to design and develop PCB throughout semester.

1. To study the PIN Diagram & block diagram of 8085 Microprocessor & 8051 Microcontroller.
2. To study the AVR Studio and Arduino Software.
3. Write and simulate minimum of 5 programs (Assembly) to be written making effective use of all the instructions and on-chip peripheral.
4. Write program for blinking LED.
5. Read Push-button switch and display its status on LED.
6. Interfacing Buzzer with AVR Board.
7. Interfacing 7-Segment LED Display with AVR Board
8. Interfacing of 16x2 LCD with Arduino board and display message on it.
9. Interface 4x4 matrix keyboard with AVR microcontroller. Display value of pressed switch on LCD.
10. Interface temperature sensor LM35 with Arduino board and display temperature on LCD.
11. Write a Program for the Relay, Stepper Motor Interfacing.
12. Write a Program for DC motor control in clockwise and anticlockwise direction.

Major Equipment/software:

1.AVR ATmega32 microcontroller trainer kit with peripheral devices.

2.Arduino Software, Proteus Software for Simulation, Arduino Board.

3.Computer system.

Laboratory/Learning Resources Required:

1. Open source AVR simulator
2. http://www.atmel.com/
3. http://www.arduino.cc/

Activities suggested under Self-learning/Team Work:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h	Based on report submitted. Report should contain

		Total = 10h	observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
4.	Problem solving/Coding using C, C++, Python, SCILAB, MATLAB, MS-EXCEL or any other relevant software	5 small coding based assignment of 2h each. Total = 10h	Based on the coding solution submitted.
5.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Complex problem solving	Maximum 2 problem. Study of the problem and solution finding, Total = 10h	Based on the depth of the solution submitted.
7	Videos on Industrial safety aspects based on subject	Duration of video = 5h Report preparation = 5h Total = 10h	Based on quiz/report submitted
8	Discussion on research paper based on relevant subject	5 research paper = 20 h	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.

13.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software development	Duration = 10 h	Depending on the complexity of the Application/Software

Note:
1. All the suggested activity should be related to the subject.
2. The number of hours are suggestive. Faculty can sub-divide the number of hours based on the activity. However, total number of hours is fixed.
3. Rubrics for the evaluation can be prepared by the faculty.

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