



# Mahatma Gandhi University Kottayam

<b>Programme</b>	<b>BSc (Honours) Electronics with Computer Technology</b>				
<b>Course Name</b>	Embedded Systems with AVR Microcontroller				
<b>Type of Course</b>	DSC				
<b>Course Code</b>	MG5DSCECT302				
<b>Course Level</b>	<b>300-399</b>				
<b>Course Summary &amp; Justification</b>	This course provides a comprehensive understanding on Embedded System development, knowledge on AVR microcontroller, AVR based Assembly language programming and Embedded C programming				
<b>Semester</b>	5	<b>Credits</b>			4
<b>Course Details</b>	<b>Learning Approach</b>	<b>Lecture</b>	<b>Tutorial</b>	<b>Practical</b>	<b>Total Hours</b>
		3		1	
<b>Pre-requisites</b>					

## COURSE OUTCOMES (CO)

CO No:	Expected Course Outcome	Learning Domains *	PO No:
1	Understand AVR architecture and develop Assembly programs	U	1,2
2	Understand concepts of Timers and Interrupts of AVR microcontroller	U	1,2
3	Apply embedded C programs to control peripherals	A	1,2,10
4	Implement embedded programming using AVR microcontroller	A	1,2,10

*\*Remember (K), Understand (U), Apply (A), Analyse(An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

## COURSE CONTENT

### Content for Classroom transaction (Units)

Module	Units	Course description	Hours	CO No.
1	1.1	Embedded systems overview, Microcontroller vs Microprocessor, AVR family and features, RISC and Harvard architecture	3	1
	1.2	AVR Architecture- ATmega32 pin configuration & function of each pin, Block diagram of AVR, Register file and Status Register (SREG), Program Counter, Program memory and Data memory	6	
	1.3	AVR Instruction Set - Addressing modes, Data transfer instructions, Arithmetic and logic instructions, Rotate and shift instructions.	3	
	1.4	Branch and loop instructions, CALL instructions and stack operations, Bit manipulation instructions, Delay generation using loops, Assembler directives	3	

2	2.1	Embedded C Programming- Data types and structure of embedded C program, Logic operations and control structures, I/O programming in C, Time delay generation in C	3	2
	2.2	I/O Port Programming (Assembly & C)-AVR I/O ports <b>structure, DDR, PORT, PIN registers, Input/output</b> programming	3	
	2.3	Timer Programming- Timers 0, 1, and 2, Timer modes and delay generation	3	
	2.4	Interrupt Programming- Interrupt structure, Interrupt vector table, External and timer interrupts, Interrupt priority	3	
	2.5	Serial Communication- USART programming, Data transmission and reception, PWM programming, SPI and I2C	3	
3	3.1	LED blinking, LED sequencing, interfacing with push button, IR sensor, ultrasonic sensor, opto-isolator interfacing, LCD keyboard interfacing	5	3
	3.2	Relay interfacing, DC Motor direction and speed control, Stepper motor and servo motor Interfacing, ADC, DAC, MUX interfacing	5	
	3.3	Advanced peripheral interfacing techniques - DS1307 I2C RTC, Serial RFID Reader, 433MHz wireless module, Bluetooth Module, RGB Pixel LED	5	
4	4.1	<p><b>AVR BASED EXPERIMENTS</b>            (any 8 experiments from 1 to 10 and any 7 from 11 to 23):            1. 8 bit addition, subtraction            2. Multiplication with and without using MUL instruction            3. Division            4. Ascending order            5. Descending order            6. Find out largest number            7. Find out smallest number            8. Swapping            9. Count number of ones in a byte            10. Find out odd and even numbers in an array</p> <p><b>Interfacing programs</b>            11. Stepper motor interface            12. DC motor interface            13. Keyboard interface            14. LCD interface            15. PWM            16. LED interface and Delay programming            17. Buzzer interface            18. Relay interface            19. Timer programming            20. Optoisolator interface            21. DS1307 RTC interfacing            22. RGB LED Interfacing</p>	30	4

		23. RFID Interfacing		
5		<b>Teacher Specific Content</b>		

<b>Teaching and Learning Approach</b>	<b>Classroom Procedure (Mode of transaction)</b> Leverage a blended learning approach with a mix of lectures, interactive discussions, Industrial visit and hands-on lab sessions
<b>Assessment Types</b>	<p><b>MODE OF ASSESSMENT (Internal Evaluation)</b></p> <p><b>A. Continuous Comprehensive Assessment (CCA)</b></p> <p><b>1. Theory: - 25 Marks</b> Internal Tests – MCQ type and short/extended answer types Seminar Presentation – identify a real time application of and seminar presentation</p> <p><b>2. Practical: 15 Marks</b> Components for assessment (suggestions): A combination of lab tests, quizzes, assignments, Performance, Case Study.</p> <hr/> <p><b>B. End Semester Evaluation</b></p> <p><b>1. Written Test (50 marks)- Time Duration: 1½ hours</b></p> <p>a. MCQ - 10 Marks (Answer all - 10x1=10 Marks) b. Short answer questions (4 out of 6 questions)-4x5=20 marks c. Essay questions -2 out of 4 - 2x10=20 marks</p> <p><b>2. Practical Exam (35 marks) – Time Duration: 2 Hour</b></p> <p>a. Viva - 10 Marks b. Lab report - 5 Marks c. Demonstration - 20 Marks</p>

#### References

1. The AVR Microcontroller and Embedded Systems Using Assembly and C, by Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education

#### Suggested Readings

1. Programming and Customizing the AVR Micro controller, Dhananjay Gadre, McGraw Hill Education  
2. AVR ATmega32 data sheet

# Syllabus