

FACULTY OF COMPUTER APPLICATIONS

Programme	Master of Computer Applications					Branch/Spec.	Computer Application		
Semester	II					Version	1.0.0.0		
Effective from Academic Year				2026-27		Effective for the batch Admitted in		July 2026	
Subject Code	P12E5ESM		Subject Name			Embedded Systems & Microcontroller Programming			
Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture (DT)		Practical (Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	2	0	2	0	4	Theory	40	60	100
Hours	2	0	4	0	6	Practical	20	30	50

Objective:

- Understand the architecture and working principles of embedded systems.
- Develop applications using modern microcontrollers and development boards.
- Design and interface embedded hardware with peripheral devices.
- Build IoT-ready embedded solutions for real-world applications.

Pre-requisites:

- Fundamentals of Computer Organization, Programming in C/C++, Basic Electronics, Digital Logic Fundamentals

Course Outcomes:

Name of CO	Description
CO1	Explain embedded system architecture, microcontrollers, and development environments.
CO2	Develop programs for embedded systems using C/C++ and embedded IDEs.
CO3	Interface sensors, displays, communication modules, and peripheral devices.
CO4	Design and implement embedded applications integrated with IoT platforms.

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	2	–	–	–	1
CO2	3	2	3	3	1	–	–	2
CO3	2	3	3	3	2	1	1	2
CO4	2	3	3	3	2	2	2	3

Content:		
Unit	SECTION – I	Hrs
1	Introduction to Embedded Systems: Fundamentals of Embedded Systems, Embedded System Architecture, Types of Embedded Systems, Microcontrollers vs Microprocessors , ARM Cortex Architecture, ESP32, STM32, Arduino Overview, Embedded Development Tools, IDE Installation and Configuration	07
2	Embedded Programming: Embedded C Programming, GPIO Programming, Digital Input and Output, Interrupt Handling, Timers and Counters, PWM Generation, Memory Organization, Debugging Embedded Applications	08
SECTION – II		
3	Peripheral Interfacing: LCD/OLED Display, Keypad Interface, Temperature Sensor, Motion Sensor, Relay Module, Servo Motor, ADC & DAC, UART, SPI, I2C Communication	08
4	Embedded IoT Applications: ESP32 Wi-Fi Programming, MQTT Basics, Cloud Connectivity, Data Acquisition, Smart Home Applications, Smart Agriculture Prototype, Energy Monitoring System, Mini Embedded IoT Project	07
Practical Content:		
List of programs specified by the subject teacher based on above mentioned topics		
Text Books:		
1	Raj Kamal , <i>Embedded Systems: Architecture, Programming and Design</i> , 3rd Edition, McGraw-Hill Education.	
2	Frank Vahid & Tony Givargis , <i>Embedded System Design: A Unified Hardware/Software Introduction</i> , 2nd Edition, Wiley India.	
3	Michael J. Pont , <i>Embedded C</i> , 2nd Edition, Pearson Education.	
4	Jonathan W. Valvano , <i>Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers</i> , CreateSpace Independent Publishing.	
5	Muhammad Ali Mazidi, Sarmad Naimi & Sepehr Naimi , <i>The AVR Microcontroller and Embedded Systems Using Arduino</i> , Pearson Education.	
Reference Books:		
1	Steve Heath , <i>Embedded Systems Design</i> , 2nd Edition, Newnes (Elsevier).	
2	Peter Marwedel , <i>Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems</i> , Springer.	
3	Tammy Noergaard , <i>Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers</i> , Elsevier.	
4	Shibu K. V. , <i>Introduction to Embedded Systems</i> , 2nd Edition, McGraw-Hill Education.	
5	Michael Barr & Anthony Massa , <i>Programming Embedded Systems: With C and GNU</i>	

	<i>Development Tools</i> , 2nd Edition, O'Reilly Media.
Web References / MOOC / Certification Course	
1.	NPTEL – Embedded System Design https://nptel.ac.in/courses
2.	Arduino Documentation https://docs.arduino.cc
3.	Espressif ESP32 Documentation https://docs.espressif.com/projects/esp-idf
4.	Arm Developer https://developer.arm.com
5.	Coursera – Introduction to Embedded Systems Software and Development Environments (University of Colorado Boulder) https://www.coursera.org/learn/introduction-embedded-systems
Question Paper Scheme:	
	University Examination Duration: 3 Hours Note for Examiner: - (I) Questions 1 and 4 are compulsory with no options. (II) Internal options should be given in questions 2, 3, 5 and 6. SECTION – I Q.1 –8 Marks Q.2 –11 Marks Q.3 –11 Marks SECTION - II Q.4 –8 Marks Q.5 –11 Marks Q.6 –11 Marks