

**SES's L.S. RAHEJA COLLEGE OF ARTS AND COMMERCE  
(AUTONOMOUS)**



**BOARD OF STUDIES:** Information Technology and Data Science

**PROGRAMME:** Bachelor of Science (Information Technology)

**SEMESTER:** IV

**NOMENCLATURE OF THE COURSE:** EMBEDDED SYSTEMS

**NEP Vertical:** MAJOR

**Credit:** 04

(As Per Choice Based Credit System (under NEP 2020) with effect from the academic year 2025-26)



<b>Programme:</b>	<b>Bachelor of Science (Information Technology)</b>
<b>Nomenclature of the Course</b>	<b>Embedded Systems</b>
<b>Total Marks</b>	<b>100</b>
<b>Semester:</b>	<b>IV</b>
<b>Academic year</b>	<b>2025-26</b>

**LEARNING OBJECTIVES:**

1. To educate in various microcontrollers used in Embedded Development
2. To Introduce Bus Communication in processors, Input/output interfacing.
3. To impart knowledge in sensors and actuators.
4. To familiar with the real world application development using embedded system.

**COURSE OUTCOMES:**

1. Describe features of various Arduino boards.
2. Use different types of sensors and actuators to create prototypes.
3. Design and develop embedded systems.
4. Utilize embedded systems concepts in robotic prototype designing

Unit	Course Content	Andragogy	No of Lectures
I	<p><b>1.1 PIC MICROCONTROLLER:</b> Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly &amp; C –I/O port, Data Conversion, RAM &amp; ROM Allocation, Timer programming</p> <p><b>1.2 Advanced ARM Controllers:</b> Introduction to ARM and its Features, Architecture – memory organization – addressing modes –The ARM Programmer’s model -Registers – Pipeline - Interrupts – Coprocessors – Interrupt Structure</p> <p><b>1.3 Getting Started with Arduino:</b> Introduction, Arduino Variants, Install the Drivers, Arduino IDE, Internal Architectural, Block diagram of controller of ATmega328, Functions of each pins of ATmega328, Atmega328: port, counter, timer, Bootloader Circuit, ISP of Atmega328, Comparison of ATmega8 and ATmega328</p>	<ul style="list-style-type: none"> <li>• Use real-life examples: Incorporate real-life examples into lessons.</li> <li>• Give students problems: Provide problems for students to solve independently or in groups.</li> <li>• Focus on practical applications: Present knowledge and abilities in terms of their practical uses.</li> </ul>	15
II	<p><b>2.1 Basic Arduino Functions:</b> Overview, Structure, Digital I/O Functions, Analog I/O Functions, Advanced I/O Functions, Timer Functions, Communication Functions, Interrupt Functions, Math Functions, Programming Language Reference</p> <p><b>2.2 Communication Protocol &amp; Implementation:</b> Introduction to Communication Protocol, I2C - Interfacing with micro controller using bit-banking method, I2C devices – RTC, Memory,</p>	<ul style="list-style-type: none"> <li>• Use real-life examples: Incorporate real-life examples into lessons.</li> <li>• Give students problems: Provide problems for students to solve independently or in groups.</li> <li>• Focus on practical applications: Present</li> </ul>	15

	ADC-DAC, Port Expander, SPI (Serial Peripheral Interface), Bluetooth, Wi-Fi and RFID. Understanding Serial, Communication, Bluetooth Communication, SPI Interface ZigBee, Wi-Fi, I2C, Infrared, RFID, GSM, GPS, PDH/SDH/Ethernet	knowledge and abilities in terms of their practical uses.	
III	<p><b>3.1 Using Sensors with the Arduino:</b> Light Sensitive Sensors, Temperature Sensors, Temperature and Humidity Sensor, Line-Tracking Sensor, Ultrasonic Sensors, Digital Infrared Motion Sensor, Joystick Module, Gas Sensor, Hall Sensor, Color Sensor, Digital Tilt Sensor, Triple Axis Acceleration Sensor, Analog Sound Sensor, Voice Recognition Module, Digital Vibration Sensor, Flame Sensor, Capacitive Touch Sensor</p> <p><b>3.2 Using Actuators with the Arduino:</b> 7-seg display, DC Motor, Stepper Motor, Servo Motor, LCD display, Matrix keypad</p> <p><b>Case study:</b> Interface various sensors and actuators with Arduino</p>	<ul style="list-style-type: none"> <li>• Use real-life examples: Incorporate real-life examples into lessons.</li> <li>• Give students problems: Provide problems for students to solve independently or in groups.</li> <li>• Focus on practical applications: Present knowledge and abilities in terms of their practical uses.</li> </ul>	15
IV	<p><b>4.1 Utilize the embedded system concepts in robotics:</b> History of robots, Classification of robots, Present status and future trends. Basic components of robotic systems. Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom. Specifications of robots. Definition of Forward and Reverse Kinematics, Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.</p> <p><b>4.2 Case Studies:</b></p> <ul style="list-style-type: none"> <li>• Air Quality Monitor Using Arduino</li> <li>• A Fire-Fighting Robot Using Arduino</li> <li>• Intelligent Lock System Using Arduino</li> <li>• Vehicle parking System Using Arduino</li> </ul>	<ul style="list-style-type: none"> <li>• Use real-life examples: Incorporate real-life examples into lessons.</li> <li>• Give students problems: Provide problems for students to solve independently or in groups.</li> <li>• Focus on practical applications: Present knowledge and abilities in terms of their practical uses.</li> </ul>	15

#### SUGGESTED READINGS

1. Monk, S. (2019). Programming Arduino: Getting Started with Sketches (3rd ed.). McGraw-Hill Education.
2. Bivins, A. PIC microcontrollers: An introduction to microelectronics (2nd ed.). Delmar Cengage Learning.
3. Tianhong Pan, Yi Zhu, Designing Embedded Systems with Arduino A Fundamental Technology for Makers, Springer Nature Singapore

## QUESTION PAPER PATTERN

### (A) FOR CONTINUOUS EVALUATION

Particulars	Marks
Class Test	20
Presentation/Viva Voce/Quiz	10
Assignment/Project	10
<b>Total</b>	<b>40</b>

### (B)

### QUESTION PAPER PATTERN FOR SEMESTER END EXAMINATION

Maximum Marks: 60

Duration: 2 Hours

Question No.	Description	Total Marks
Q. 1	<b>Attempt the following Unit I</b>	<b>15</b>
A	Remembering	
B	Analysing	
C	Applying	
	<b>OR</b>	
P	Remembering	
Q	Analysing	
R	Applying	
Q. 2	<b>Attempt the following Unit II</b>	<b>15</b>
A	Understand	
B	Analysing	
C	Evaluating	
	<b>OR</b>	
P	Understand	
Q	Analysing	
R	Evaluating	
Q. 3	<b>Attempt the following Unit III</b>	<b>15</b>
A	Understand	
B	Apply	
C	Evaluating	
	<b>OR</b>	
P	Understand	
Q	Apply	
R	Evaluating	
Q. 4	<b>Attempt the following Unit IV</b>	<b>15</b>
A	Understand	
B	Evaluating	
C	Creating	
	<b>OR</b>	
P	Understand	
Q	Evaluating	
R	Creating	