GUJARAT TECHNOLOGICAL UNIVERSITY

Syllabus for Master of Computer Applications, 3rd Semester
Subject Name: Embedded System Design
Subject Code: 639408

With effective from academic year 2020-21

1. Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	-	2	4	70	30	30	20	150

2. Course Outcomes:

Course Outcome Component	Course Outcome (Learner will be able to)
CO1: Comprehension	• Explain various architecture and components of the Embedded System
CO2: Apply	• Develop Arduino program for various interface
CO3: Apply	• Select the Arduino shield for a given application
CO4: Design	• Implement various communication interface for data exchange between Arduino and other devices/systems
CO5: Design, Document, Project Management (mini project)	• Develop Arduino based system for a given real-life application in a team

3. Course Duration: The course duration is of **40 sessions of 60 minutes each.**

4. Course Contents:

Unit No:	Contents	No. of Sessions	70 Marks (External Evaluation)
I	• **Introduction to Embedded System:** Difference between microprocessor and microcontroller, RISC and CISC architecture, Harward and Von Neumann Architecture, Applications of Embedded System	2	4
II	• **The Arduino Family:** Types of Arduino Devices, Software Compatible Devices, Use of Arduino Devices, Arduino Technical Features	3	4
III	• **Programming Arduino:** Installing Arduini IDE, Writing Arduino programs (Sketches), Write programs to implement various mathematical operation, Install various Arduino Libraries (EEPROM, Ethernet, GSM, LCDs, SD Card, Firmata, Servo, SPI, SoftwareSerail, TFT, WiFI, Wire, Esplora, USB, Keyboard, Mouse etc.)	6	10
IV	• **Arduino Shields:** Electrical and Physical Characteristics of the Shields, Various types of Ardunio Shields	2	6
V	• **Serial Communication** Serial hardware and software, Serial message protocol, sending data from Arduino to Computer, Sending formatted text and numerical data from Arduino,	5	10

	Receiving serial data in Arduino, Sending and receiving multiple text in single message, Sending and receiving binary values, sending serial data to two devices, receiving serial data from two devices, Sending serial data to file in a computer		
VI	• **Interfacing with Input Devices and Sensor** Using serial communication, Digital and Analog Inputs, Interfacing Sensors (Movement, Motion, Light, Temperature, Humidity, distance, sound, vibration, mouse, GPS, acceleration, gyroscope, RFID Tag)	6	12
VII	• **Interfacing Output Devices** Visual output (LEDs, Seven Segment, LED Matrix), Physical output (Servo, Solenoid, Stepper motor, Brushless DC motor), Remote Controlling External Devices using IR remote controller, Using Displays (Text LCD display, Graphical LCD display)	6	08
VIII	• **Using Times and Dates** Creating delays, determine duration, measuring duration of pulse, Arduino as a Clock, create alarm, using real-time clock	4	08
IX	• **Various Communications** Communication using I2C, SPI; Wireless communication, Ethernet and Networking,	6	08

5. Pedagogy:

- ICT enabled Classroom teaching
- Case study
- Practical / live assignment
- Interactive classroom discussions
- Application Demonstration
- Mini Project

6. Suggestive list of experiments

1. Interface digital input and output devices to the Arduino
2. Interface ADC with Arduino
3. Interface DAC with Arduino
4. Interface Seven Segment LED display with Arduino
5. Interface LED Matrix display with Arduino
6. Interface LCD Display with Arduino
7. Interface Graphical LCD with Arduino
8. Interface Temperature and Humidity Sensors with Arduino
9. Interface Real Time Clock with Arduino
10. Interface I2C device with Arduino
11. Interface SPI device with Arduino
12. Interface and control speed of servo motor with Arduino
13. Interface and control speed of stepper motor with Arduino
14. Design IR remote control system using Arduino to operate remote devices
15. Interface Arduino through wireless communication to other devices
16. Interface Arduino through ethernet

7. Evaluation:

Students shall be evaluated on the following components:

A	**Internal Evaluation**	**(Total - 20 Marks)**
	• Continuous Evaluation Component	10 marks
	• Class Presence & Participation	10 marks
B	**Mid-Semester examination**	**(30 Marks)**
C	**End –Semester Examination(Theory)**	**(70 Marks)**
D	**End –Semester Examination(Practical/Viva)**	**(30 Marks)**

8. Software Tools:

1. **Arduino IDE (https://www.arduino.cc/en/software)**
2. **Arduino Simulator – UnoArduSim (https://www.sites.google.com/site/unoardusim/services)**

9. Reference Books:

No.	Author	Name of the Book	Publisher
1.	Michael Margolis	Arduino Cookbook	O'Reilly
2.	J. M. Hughes	Arduino: A Technical Reference	O'Reilly
3.	Ashwin Pajankar	Arduino Made Simple	BPB
4.	Muhammad Ali Mazidi, Sarmad Naimi, Sepher Naimi	The AVR Microcontroller and Embedded System: Using Assembly and C	Pearson