Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati

Department of Electronics and Telecommunication Engineering

Multidisciplinary Minor Course S.Y. B. Tech E&TC

Engineering 2025-26

Multidisciplinary Minor Course of Electronics and Telecommunication Engineering w. e. f. AY:2025- 2026															
SEMESTER-III, IV, V, VI ,VII															
Course Code	Courses Name	Teaching Scheme			Examination Scheme and Marks							Credits			
		TH	PR	TUT	Activity	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
ET24051	Embedded Systems	3	2	-	10	30	60	30	-	-	**130**	3	1	-	4
ET24052	Drone Technology	2	2	-	10	-	60	30	-	-	**100**	2	1	-	3
ET24053	Internet of Things	2	2	-	10	-	60	30	-	-	**100**	2	1	-	3
ET24054	Microcontroller Architecture	3	2	-	10	30	60	30	-	-	**130**	3	1	-	4

SD Biradar
Autonomy Coord.

Dr. JS Rangole
HoD – E&TC

Dr. SM Bhosle
Dean Academics

Dr. SB Lande
Principal

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Bucket of Multidisciplinary Minor Course

Multidisciplinary Minor Subjects	
Subject Code	**Subject Name**
AI24051	AI & Machine Learning
AI24052	Data Science
AI24053	Generative AI (Sem V+)
CO24051	Cloud Computing
CO24052	High-Performance Computing (Sem V+)
CO24053	Computer Graphics & Gaming
IT24051	Cyber security
IT24052	Full Stack Development
ET24051	Embedded Systems
ET24052	Drone Technology
ET24053	Internet of Things
ET24054	Microprocessor Architecture
CE24051	Waste Management
CE24052	Green building & smart cities
ME24051	3-D Printing
ME24052	Robotics & Automation
EL24051	Solar Technology
EL24052	Industrial Automation
GS24051	Nanotechnology
GS24052	Linear Algebra and Statistics

Multidisciplinary Minor Course-1 ET24051:- Embedded Systems		
Teaching Scheme: Theory: 03 Hours/Week Practical: 02 Hours/Week	Credits 04	Examination Scheme: CAA: 10 Marks In Sem: 30 Marks End Sem: 60 Marks Term work: 30 Marks

Prerequisite Courses, if any:

1. Digital Logic Design

Course Objectives:

- To study and understand various microcontrollers and embedded systems
- To understand the design parameters of embedded systems applications.
- To study and impart different tools for embedded system and IoT application design.

Course Outcomes:

After the completion of the course, students will be able to-

CO1: Compare and interpret the architectures of Microprocessor and Microcontroller for generation of codes

CO2: Examine design metrics, design tradeoffs and software aspects of embedded systems.

CO3: Develop programming for real time applications.

CO4: To learn embedded networking and testing processes.

Course Contents

UNIT I: Microprocessor and Microcontrollers (06 Hrs.)

Microprocessor Technology: 8086- architectural overview & Programming model.

Microcontrollers: Introduction to microcontrollers, 8051 architecture, Memory Classification, Description of RAM, Description of CPU Registers, Functions of SFR.

UNIT II: Assembly Language Programming (08 Hrs.)

Introduction to Embedded C, Difference between C & Embedded C, Programming style, Basic structure of C program, Keywords & Identifiers, Data type & its memory representation Arrays and strings

UNIT III: Programming and Interfacing (08 Hrs.)

Types of Operators, Bitwise Operators explained, CONTROL STRUCTURES & LOOPS, Decision making with if statement, If....else statement, Switch statement, and GOTO, statement, The While and Do – While statements, For statement

Introduction to Software's: Keil, Compiler and Proteus.

Interfacing with 8051: ADC and DAC interfaces for microcontrollers, Real time interfacing with LED, Keypad, LCD display, Sensors interfacing.

UNIT IV: Embedded Networking (08 Hrs.)

I2C Bus Standard, Bluetooth, Zigbee, USB, UART, Linux Fundamentals, Linux Commands, VI Editors, Introduction to Device Driver, Role of Device Driver, Kernel Module Vs Application, Types of Device Driver, Character Driver, Block Driver & Network Drive.

Text Books:

1. Muhammad Ali Mazidi, the 8051 Microcontroller & Embedded System using assembly & C, Pearson Education.
2. Muhammad Ali Mazidi, ARM Assembly language programming and Architecture,
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education India, 2009, Second

References:

1. Shibu K. V. Introduction to Embedded System, The McGraw Hill.
2. Ajay V. Deshmukh, Microcontrollers - Theory and Applications, Tata McGraw Hill,
3. Kenneth J. Ayala, The 8051 Microcontroller – Architecture, Programming & Applications, Penram International & Thomson Asia.

MOOC / NPTEL Courses:

1. https://nptel.ac.in/courses/108/105/108105102/

List of Experiments

1) Configure timer control registers of 8051 and develop a program to generate a given time delay.
2) Port I / O: Use one of the four ports of 8051 for O / P interfaced to eight LED's. Simulate binary counter (8 bit) on LED's.
3) Serial I / O : Configure 8051 serial port for asynchronous serial communication with serial port of PC exchange text messages to PC and display on PC screen. Signify end of message by carriage return.
4) Interface 8051 with D/A converter and generate square waves of given frequency on an oscilloscope.
5) Interface 8051 with D/A converter and generate triangular waves of given frequency on an oscilloscope.
6) Using a D/A converter generates sine waves on an oscilloscope with the help of a lookup table stored in the data area of 8051.
7) Interface Stepper motor with 8051 and write a program to move the motor through a given angle in clockwise or counterclockwise direction.
8) Generate traffic signals.
9) Temperature controller.
10) Elevator control.

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Multidisciplinary Minor Course-2 ET24052:- Drone Technology		
Teaching Scheme: Theory: 02 Hours/Week Practical: 02 Hours/Week	Credits 03	Examination Scheme: Activity: 10 Marks End Sem: 60 Marks Term work: 30 Marks

Preamble: Nil

Course Objectives:

- To learn and understand the basics of Drones and UAVs.
- To learn and understand the various battery technologies, charging technologies and Battery management in drones.
- To learn and understand principles and applications of sensors and actuators Drones
- To understand and learn various communication technologies in modern Drones.

Course Outcomes:

After the completion of the course, students will be able to-

1. Identify components and basic building blocks of drones, their classifications, and applications.
2. Identify and analyze different battery technologies, charging technologies, and battery management systems in drones.
3. Recognize and apply the various sensors and actuators in drone design.
4. Describe and demonstrate the various communication technologies in UAVs.

Course Contents

Unit I: Introduction to Drones (06 Hrs.)

Definition, Classification of Drones, Classification of Multirotor, Concept of Payload, Different frame configurations, Basic Components of Drones, Types of Drones: based on aerial platform and body material, Current and Future applications of drones.

Unit II: Battery Electronics in Drones (06 Hrs.)

Different types of batteries used in Drones: NiMH, NiCd, Li-Po, Li-ion, Battery Specifications, Selection Criteria of Battery for best performance, charging technologies of drone batteries- Constant Current and Constant Voltage, TRICKLE Charging, Building blocks of Drone Battery Management System.

Unit III: Sensors and Actuators in Drones (06 Hrs.)

Sensor-Definition, Role of Sensors in Drones, Core Sensors used in Drones and their principle of operation- Accelerometer, Gyroscope, Magnetometer and Barometer sensors, Selection Criteria for Sensors in Drones, Inertial Measurement Unit (IMU). Actuator-Definition, DC Motor and its principle, BLDC Motors- Construction and Operation, Speed Control Technique of BLDC Motor, Servomotor, PID Control.

Unit IV: Communication Technology and Advances in Drones (06 Hrs.)

Radio Frequency Spectrum, RF Transmitter and Receiver Circuit, Fundamentals of GPS, GPS Module for base station, Flight Controller Boards (FCB), Electronic Speed Controllers (ESC), Case Studies- LIDAR and Time of Flight (ToF) based UAV for Remote Sensing Applications.
Text Books: 1. John Baichtal: "BUILDING YOUR OWN DRONES: A Beginner's Guide to Drones, UAVs, and ROVs", Que Publishing USA, 2016. 2. Ian Cinnamon, Romi Kadri, Fitz Tepper: "DIY Drones for the Evil Genius: Design, Build, and Customize Your Own Drones", McGraw Hill TAB, 2016. **Reference Books:** 1. Neeraj Kumar Singh, Porselvan Muthukrishnan, Satyanarayana Sanpini, "Industrial System Engineering for Drones: A Guide with Best Practices for Designing", Apress. 2. Felipe Gonzalez Toro, Antonios Tsourdos, "UAV or Drones for Remote Sensing Applications". **Web resources:** 1. https://enterprise-insights.dji.com/blog/lidar-equipped-uavs 2. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SECA4003.pdf 3.https://www.bharatskills.gov.in/pdf/E_Books/CTS/443/English/TT/Drone%20Technician%20-%20TT%20(NSQF%202022).pdf
List of Experiments
1. Study of Drone Frame 2. Study of Motor 3. Study of ESC 4. Study of Flight Controller 5. Learn Soldering Techniques 6. Assembling Drone 7. Drone Flight Control

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Multidisciplinary Minor Course-3 ET24053: - Internet of Things (IoT)		
Teaching Scheme: Theory: 02 Hours/Week Practical: 02 Hours/Week	Credits 03	Examination Scheme: Activity: 10 Marks End Sem: 60 Marks Term work: 30 Marks

Prerequisite Courses, if any:

1. Digital Systems
2. Microcontrollers

Course Objectives:

- To introduce the fundamentals concepts of an IoT.
- To give Insights IoT Design Outlooks with sensors and actuators.
- To make aware of the usage of communication protocols in IoT.
- To develop design skills with IoT Physical devices and endpoints with programming.

Course Outcomes: On completion of the course, learner will be able to

- CO1: Comprehend and analyze concepts of IoT.
- CO2: Interpret IoT Design Outlooks with sensors and actuators.
- CO3: Comprehend the operation of communication protocols in IoT.
- CO4: Describe various IoT Physical devices and endpoints with programming and apply programming skills for application development.

Course Contents

Unit I: IoT Fundamentals (06 Hrs.)

Internet of Things -History, Basic Definitions, Characteristics, Features, & Design; Physical & Logical Design of IoT; Enabling Technologies in IoT; About Things in IoT; The Identifiers in IoT; IoT frameworks, IoT and M2M; Networking- Types, Devices, and Topology.

Unit II: IoT Design Outlooks and Sensors & Actuators (06 Hrs.)

M2M and IoT; Devices and Gateways in IoT; Introduction to the sensors and actuators with types and principle of working; Basics of Wireless Sensor Networks; Fundamentals of Edge and Cloud; Cloud Services: SaaS, IaaS, PaaS & XaaS.

Unit III: Communication Protocols (06 Hrs.)

Short-Range Communication Protocols: Zigbee, Z-Wave, Bluetooth, Wi-Fi

Long-Range Communication Protocols: LoRaWAN

Application Layer Protocols: MQTT (Message Queuing Telemetry Transport) CoAP (Constrained Application Protocol), HTTP/HTTPS

Unit IV: IoT Physical devices and endpoints (06 Hrs.)

IoT development and deployment hardware; Interfacing sensors and actuators to the development

boards; Applications of IoT: Home Automation, Smart Cities, Energy, Agriculture, Health and Lifestyle, etc. What is the IoE? Difference between IoT and IoE. Introduction to IIoT.

Textbooks:

1.Hakima Chaouchi, – The Internet of Things Connecting Objects to the Web ISBN: 978-1- 84821-140-7, Wiley Publications

2. Olivier Hersent, David Boswarthick, and Omar Elloumi, –The Internet of Things: Key Applications and Protocols, Wiley Publications

3. Vijay Madisetti and ArshdeepBahga, –Internet of Things (A Hands-On-Approach), 1st Edition, VPT, 2014.

References:

1. Daniel Minoli, –Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications‖, ISBN: 978-1-118-47347-4, Willy Publications

2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

3.http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

4. https://onlinecourses.nptel.ac.in/noc17_cs22/course

List of Experiments

Group A: Any 4

1. Study & Survey of various IoT platforms.
2. Study & Survey of various development boards for IoT. Understanding the process of OS installation on Raspberry Pi.
3. Program digital read/write using LED and Switch.
4. Measure the distance of an object using ultrasonic sensor.
5. Interfacing sensors (Temperature, PIR, LDR) and actuators (Motors) using Arduino.

Group B: Any 3

6. Install Google App Engine. Create a Hello world app and other simple web applications using python / java. Use GAE launcher to launch the web applications.
7. Building a Motion-Activated Alarm System using Arduino/Raspberry Pi.
8. To study simple application using IoT analytics platform service.
9. IoT based small project implementation on the topics based on small problem statements of the fields like Smart Home (Home Automation), social issues and environmental issues etc. This project can be built on any IoT simulation platform like TinkerCAD.

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Multidisciplinary Minor Course-4 ET24054: Microcontroller Architecture		
Teaching Scheme: Theory: 02Hours/Week Practical: 02 Hours/Week	Credits 03	Examination Scheme: CAA: 10 Marks End Sem: 60 Marks Term work: 30 Marks

Course Objectives:

1. To study architectural details of PIC 18 microcontroller.
2. Explore the knowledge and skills required to interface PIC microcontrollers with external peripherals and to develop embedded applications
3. To study applications of PIC through various interfacing devices

Course Outcomes: On completion of the course, the learner will be able to–

CO1: Apprehend the fundamentals of PIC Microcontroller

CO2: Students will be able to analyze the difference between microprocessor and microcontroller-based systems.

CO3: Apply embedded C programming to configure and control I/O ports, and implement timer-based applications using polling and interrupt techniques on PIC18 microcontrollers.

CO4: Interface and program external devices with a PIC microcontroller to design functional embedded system solutions.

Course Contents

Module I: Fundamentals of PIC Microcontroller (07 Hrs.)

Introduction of Microcontroller, Microprocessor Vs Microcontroller, What is PIC Microcontroller, Architecture, Core Components of Microcontroller, Types of PIC Microcontrollers, Development Tools, Programming Languages for PIC Microcontroller, Typical Applications of PIC Microcontroller.

Module II: PIC Microcontroller Architecture (06 Hrs.)

Introduction to microcontroller, Criteria for selection of microcontroller, Features and architecture, Comparison of PIC 18 series microcontrollers; Details of Pins, Pin Diagram PIC 18 internal Architecture: ALU, EEPROM, RAM, IO Ports, Timer, ADC, Serial port PIC18 microcontroller programming model, Bus architecture Registers of PIC18F, Interrupts of PIC18F Program memory and data memory organization.

Module III: PIC I/O Ports Timer, Counter (06 Hrs.)

I/O Port Programming in PIC18 Microcontroller (Structure and configuration of I/O Ports (PORTx, TRISx, LATx), Bit-level I/O Control and Manipulation (Bitwise operations), Programming examples using Embedded C), Timers and Counters in PIC18 Microcontroller (Timer/Counter modules (Timer0, Timer1, etc.) and associated Registers, Delay Generation using Timers, Timer Programming in Embedded C).

Module IV: PIC Interfacing (08 Hrs.)

Interrupt: Interrupt Structure of PIC18F with SFR, PORTB change Interrupts, use of timers with interrupts CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP, Block diagram of in-built ADC with Control registers, Sensor interfacing using

ADC: All programs in embedded C.

Interfacing of LED, interfacing 16X2 LCD and keyboard, 7-segment display interfacing, Interfacing Relay & Buzzer.

Basics of Serial communication protocols: Study of RS232, I2C, SPI, UART, Serial communication programming using Embedded C.

Text Books:

1.Muhammad Ali Mazidi, Danny Causey, RolinMcKinlay, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", 4th Edition by, Pearson international Edition.

Reference Books:

1. 1.Peatman, John B, "Design with PIC Microcontroller", Pearson Education PTE
2. 2. Ramesh Gaonkar, "Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)" Thomson/Delmar Learning; 1 edition (January 8, 2007), ISBN:978-14018791433.
3. Microchip's PIC18FXXX Data Sheet

e-sources:

Course Title: Microprocessors and Microcontrollers by Prof. Santanu Chattopadhyay, Dept. of Electrical engineering, IIT Kharagpur Course

Details : https://onlinecourses.nptel.ac.in/noc22_ee12/preview Lectures available on https://archive.nptel.ac.in/courses/108/105/108105102/

List of Experiments (Any Eight)

1. Write a program for interfacing LED
2. Write a program for interfacing Seven Segment Display
3. Write a program for interfacing relay
4. Write a program for interfacing buzzer
5. Interfacing of LCD to PIC 8FXXXX
6. Interfacing of 4X4 keypad and displaying key pressed on LCD
7. Interfacing serial port with PC both side communication.
8. Generation of PWM signal for DC Motor control.
9. Write a program for interfacing Stepper Motor

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