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 2024–25

Multidisciplinary Minor Course of Electronics and Telecommunication Engineering

w. e. f. AY:2024-2025

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
ET23051	Embedded Systems	2	2	-	20	20	50	20	-	-	110	2	1	-	3
ET23052	Drone Technology	2	2	-	20	20	50	20	-	-	110	2	1	-	3
ET23053	Internet of Things	2	2	-	20	20	50	20	-	-	110	2	1	-	3

SD Biradar
Autonomy Coord.

Dr. BH Patil
HoD – E&TC

Dr. SM Bhosle
Dean Academics

Dr. RS Bichkar
Principal

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Bucket of Multidisciplinary Minor Course

Multidisciplinary Minor Subjects	
Subject Code	**Subject Name**
AI23051	AI & Machine Learning
AI23052	Data Science
AI23053	Generative AI (Sem V+)
CO23051	Cloud Computing
CO23052	High Performance Computing (Sem V+)
CO23053	Computer Graphics & Gaming
IT23051	Cyber security
IT23052	Full Stack Development
ET23051	Embedded Systems
ET23052	Drone Technology
ET23053	Internet of Things
CE23051	Waste Management
CE23052	Green building & smart cities
ME23051	3-D Printing
ME23052	Robotics & Automation
EL23051	Solar Technology
EL23052	Industrial Automation
GS23051	Nanotechnology
GS23052	Linear Algebra and Statistics

Multidisciplinary Minor Course-1

ET23051:- Embedded Systems

Teaching Scheme: Theory: 02 Hours/Week Practical: 02 Hours/Week	Credits 03	Examination Scheme: Activity: 20 Marks In Sem: 20 Marks End Sem: 50 Marks Term work: 20 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

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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

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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

ET23052:- Drone Technology

Teaching Scheme: Theory: 02 Hours/Week Practical: 02 Hours/Week	Credits 03	Examination Scheme: Activity: 20 Marks In Sem: 20 Marks End Sem: 50 Marks Term work: 20 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,

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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
ET23053: - Internet of Things (IoT)

Teaching Scheme:	Credits	Examination Scheme:
Theory: 02 Hours/Week Practical: 02 Hours/Week	03	Activity: 20 Marks In Sem: 20 Marks End Sem: 50 Marks Term work: 20 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.)

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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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