# 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 |
| MDET23051 | Drone Technology | 2 | 2 | - | 20 | 20 | 50 | 20 | - | - | **110** | 2 | 1 | - | 3 |
| MDET23052 | Embedded Systems | 2 | 2 | - | 20 | 20 | 50 | 20 | - | - | **110** | 2 | 1 | - | 3 |
| MDET23053 | Internet of Things | 2 | 2 | - | 20 | 20 | 50 | 20 | - | - | **110** | 2 | 1 | - | 3 |

# 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 | Drone Technology |
| ET23052 | Embedded Systems |
| 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
## MDET23051:- Drone Technology

| | | |
|---|---|---|
| **Teaching Scheme:**<br>**Theory: 02 Hours/Week**<br>**Practical: 02 Hours/Week** | **Credits**<br>**03** | **Examination Scheme:**<br>**Activity: 20 Marks**<br>**In Sem: 20 Marks**<br>**End Sem: 50 Marks**<br>**Practical: 20 Marks**<br>**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, 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

## Multidisciplinary Minor Course-2
## MDET23052:- Embedded Systems

| Teaching Scheme: | Credits | Examination Scheme: |
|---|---|---|
| **Theory: 02 Hours/Week**<br>**Practical: 02 Hours/Week** | **03** | **Activity: 20 Marks**<br>**In Sem: 20 Marks**<br>**End Sem: 50 Marks**<br>**Practical: 20 Marks**<br>**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

**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.

## Multidisciplinary Minor Course-3

## MDET23053:- Internet of Things (IOT)

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

**Prerequisite Courses, if any:**

1. Digital Systems
2. Microcontrollers

**Course Objectives:**

- To study fundamental concepts of IoT
- To understand roles of sensors in IoT
- To Learn different protocols used for IoT design
- To be familiar with data handling and analytics tools in IoT

**Course Outcomes:**

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

**CO1:** Understand the various concepts, terminologies and architecture of IoT systems.
**CO2:** Use sensors and actuators for design of IoT.
**CO3:** Understand and apply various protocols for design of IoT systems
**CO4:** Use various techniques of data storage and analytics in IoT
**CO1:** Understand various applications of IoT

**Course Contents**

**UNIT I: Fundamentals of IoT (06 Hrs.)**

Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

**UNIT II: Sensors Networks (06 Hrs.)**

Definition, Types of Sensors, Types of Actuators, Examples and Working, RFID Principles and components, Wireless Sensor Networks: History and Context, the node, Connecting nodes, Networking Nodes, WSN and IoT.

**UNIT III: Wireless Technologies for IoT (06 Hrs.)**

WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.

**UNIT IV: IP Based Protocols for IoT (06 Hrs.)**
IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.

**UNIT V: Data Handling& Analytics (05 Hrs.)**
Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Statistical Models, Analysis of Variance, Data Dispersion, Contingence and Correlation, Regression Analysis, Precision and Error limits.

**UNIT VI: Applications of IoT (05 Hrs.)**
Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, IoT design Ethics, IoT in Environmental Protection.

**Text Books:**

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. by 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**

1. Study & Survey of various development boards for IoT.
2. Study & Survey of various IoT platforms.
3. Interfacing sensors and actuators with Aurdino.
4. Build a cloud-ready temperature sensor with the Arduino Uno and the any IoT Platform: This project shows the building of a temperature sensor.
5. Interfacing Sensors and actuators with Raspberry Pi 2.
6. IoT based Stepper Motor Control with Raspberry Pi: The combination of Raspberry Pi and IoT is an exciting one. Raspberry Pi has many general purpose I/O pins and has the ability to control different actuators like stepper motors. In this project, an internet control of stepper motor using Raspberry

Pi computer is developed. The connectivity is divided into server side software and client side software.

7. IoT based Web Controlled Home Automation using Raspberry Pi.
8. A Simple IoT Project with the ESP8266 Wi-Fi module: Here is a simple project with ESP8266 Wi-Fi module. This project collects the temperature and is displayed on the network.
9. Implement a RFID Based IoT Project