Walchand Institute of Technology, Solapur

(An Autonomous Institute)

Affiliated to

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Choice Based Credit System (CBCS)

Structure and Syllabus

for

Multidisciplinary Minor Program in Electronics and Telecommunication Engineering

offered by

Department of Electronics and Telecommunication Engineering

for Batch Admitted in

2024-25

HEAD
Electronics & Telecommunication Departme..
Walchand Institute of Technology
SOLAPUR - 413006

WIT SOLAPUR

Dr. Mrs. M. A. Nirgude
Dean Academics

Multidisciplinary Minor Program in Electronics and Telecommunication Engineering

Legends Used	
L	Lecture Hours / week
T	Tutorial Hours / week
P	Practical Hours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
MOOC	Massive Open Online Course
HSS	Humanity and Social Science
NPTEL	National Programme on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B.Tech.	Bachelor of Technology

Multidisciplinary Minor Program in Electronics and Telecommunication Engineering

Course Code Format

2	**4**	**E**	**T**	**U/P**	**2**	**C**	**C**	**1**	**T/L**
Year of syllabus revision		Program Code		U-Under Graduate, P-Post Graduate	Semester No./ Year1/2/3/…8	Course Type		Course Serial No. 1-9	T-Theory, L-Lab session A-Tutorial P-Programming / Design

Program Code	
ET	Electronics and Telecommunication Engineering
Course Type	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course
CC	Programme Core Compulsory Course
SN*	Self-Learning (**N*** *indicates the serial number of electives offered in the respective category)*
EN*	Programme Core Elective Course (**N*** *indicates the serial number of electives offered in the respective category)*
SK	Skill-Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship
ON*	Open Elective (**N*** *indicates the serial number of electives offered in the respective category)*
MD	Multidisciplinary Minor
EM	Entrepreneurship/Economics/Management Courses
FP	Community Engagement Project / Field Project
AE	Ability Enhancement Course
VE	Value Education Course
IK	Indian Knowledge System
VS	Vocational & Skill Enhancement Course

RM	Research Methodology
HN	Honors' Degree Course
HR	Honors Research

Sample Course Code	
24ETU3MD6T	Fundamentals of Electronic Circuits

Multidisciplinary Minor Program in Electronics and Telecommunication Engineering

Semester	Course Code	Name of Course	Engagement Hours			Credits	SA		FA		Total
			L	T	P		Theory	OE/ POE	ISE	ICA	
III	24ETU3MD6T	Fundamentals of Electronic Circuits	2			2	60	-	40		100
IV	24ETU4MD6T	Electronics Design and Prototyping	1			1		-	50		50
V	24ETU5MD6T	Introduction to Embedded Systems	3			3	60	-	40		100
VI	24ETU6MD6T	Fundamentals of Communication Techniques	2			2	60	-	40		100
VII	24ETU7MD6T	Enclosure and Communication Design for IoT	3			3	60	-	40		100
VII	24ETU7MD6A	Enclosure and Communication Design for IoT (Tutorial)		1		1		-		25	25
		Subtotal	**11**	**1**	**-**	**12**	**240**	**-**	**210**	**25**	**475**
Laboratory Courses											
IV	24ETU4MD6L	Electronics Design and Prototyping Lab	-	-	2	1	-	-	-	25	25
VI	24ETU6MD6L	Fundamentals of Communication Techniques Lab	-	-	2	1	-	-	-	25	25
		Subtotal	**-**	**-**	**4**	**2**	**-**	**-**	**-**	50	50
		Grand Total	**11**	**1**	**4**	**14**	**240**	**-**	**210**	**75**	**525**

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(An Autonomous Institute)
Second Year B.Tech. (Multidisciplinary Minor in E&TC Engineering), Semester-III

24ETU3MD6T: Multidisciplinary Minor I – Fundamentals of Electronic Circuits

Teaching Scheme		**Examination Scheme**	
Lectures	2 Hours/week	**ESE**	60 Marks
Practical/Tutorial	-	**ISE**	40 Marks
Credits	2	**ICA**	-

Introduction:

Understanding basic electronics is fundamental for any electronic product design. This course provides students with a solid foundation in electronic components, sensors, actuators, and basic circuit principles, essential for designing and troubleshooting electronic systems.

Course Prerequisite:

This course requires knowledge of basic engineering mathematics and basic electronics engineering

Course Objectives:

1. Explain the function and characteristics of basic electronic components.
2. Demonstrate the principles of Kirchhoff's Voltage and Current Laws (KVL, KCL) in circuit analysis.
3. Analyze and design simple RLC circuits.
4. Introduce sensors and actuators and their applications in electronic systems.

Course Outcomes:

At the end of the course, students will be able to:
1. Identify and describe the function of various electronic components.
2. Apply KVL and KCL to analyze basic circuits.
3. Design and analyze RLC circuits.
4. Integrate sensors and actuators in simple electronic systems.

Unit – I	**Electronic Components**	**7 Hours**

- Resistors, capacitors, inductors
- Diodes, transistors, and integrated circuits

Unit – II	**Circuit Analysis Principles**	**7 Hours**

- Kirchhoff's Voltage Law (KVL)
- Kirchhoff's Current Law (KCL)
- Series and parallel circuits

Unit – III	RLC Circuits	8 Hours
● Resonance in RLC circuits ● Impedance and reactance ● Time constant and transient analysis		
Unit – IV	**Sensors and Actuators**	**8 Hours**
● Types of sensors (temperature, pressure, etc.) ● Types of actuators (motors, relays, etc.) ● Applications in electronic systems		

Text Books

1. Electronic Devices and Circuit Theory by Robert L. Boylestad, 12th Edition, Pearson.
2. Fundamentals of Microelectronics by Behzad Razavi, 2nd Edition, Wiley.
3. The Art of Electronics by Paul Horowitz and Winfield Hill, 3rd Edition, Cambridge University Press.

Reference Books

1. Principles of Electronic Materials and Devices by Safa O. Kasap, 4th Edition, McGraw-Hill.
2. Microelectronic Circuits by Adel S. Sedra and Kenneth C. Smith, 7th Edition, Oxford University Press.
3. Introduction to Electronics by Earl Gates, 6th Edition, Cengage Learning.

e-Resources

1. Khan Academy - Introduction to Electronics
2. MIT OpenCourseWare - Circuits and Electronics
3. Coursera - Introduction to Electronics by Georgia Tech
4. EdX - Electronic Interfaces by TU Delft
5. All About Circuits - Basic Electronics

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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Second Year B.Tech. (Multidisciplinary Minor in E&TC Engineering), Semester-IV

24ETU4MD6T: Multidisciplinary Minor II – Electronics Design and Prototyping

Teaching Scheme		**Examination Scheme**	
Lectures	1 Hour/week	**ESE**	-
Practical/Tutorial	2 Hours/week	**ISE**	50 Marks
Credits	2	**ICA**	25 Marks

Introduction:

This course introduces students to the fundamentals of electronic circuit design and the tools and techniques used to create and prototype electronic circuits. It emphasizes hands-on learning through the use of design software.

Course Prerequisite:

This course requires knowledge of basic engineering mathematics and fundamentals of electronics components and electronic circuits.

Course Objectives:

1. Teach the fundamentals of electronic circuit design.
2. Familiarize students with design software tools like Altium, KiCad, or Eagle.
3. Demonstrate the process of creating prototypes.
4. Integrate design principles with practical prototyping skills.

Course Outcomes:

At the end of the course, students will be able to:
1. Design basic electronic circuits.
2. Use software tools to create electronic circuit designs.
3. Prototype electronic circuits using appropriate methods.
4. Evaluate and troubleshoot prototypes for design improvements.

Unit – I	**Fundamentals of Electronic Circuit Design**	**3 Hours**

- Schematic diagrams
- Circuit theory and applications

Unit – II	**Design Software Tools**	**4 Hours**

- Introduction to Altium, KiCad, and Eagle
- Creating and editing schematics
- PCB layout design

Unit – III	**Prototyping Techniques**	**4 Hours**

- Breadboarding
- Soldering and assembling PCBs
- Testing and troubleshooting prototypes

Unit – IV	Integrating Design and Prototyping	4 Hours
● Case studies of electronic product design ● Iterative design process ● Documenting and presenting designs		
Internal Continuous Assessment (ICA): ICA shall consist of a minimum 6 experiments based on above syllabus.		
Text Books		
1. The Circuit Designer's Companion by Peter Wilson, 4th Edition, Newnes. 2. PCB Design Using AutoCAD by Chris Schroeder, 1st Edition, Newnes. 3. Make: Electronics: Learning Through Discovery by Charles Platt, 3rd Edition, Maker Media.		
Reference Books		
1. Printed Circuit Boards: Design and Technology by Walter C. Bosshart, McGraw-Hill. 2. The Art of PCB Design by Wayne Stambaugh, Elektor. 3. Complete PCB Design Using OrCAD Capture and PCB Editor by Kraig Mitzner, 2nd Edition, Elsevier.		
e-Resources		
1. Coursera - PCB Design by University of Colorado Boulder 2. Altium Designer - Online Learning 3. KiCad EDA - Official Documentation 4. Eagle - Learn to Use Eagle 5. YouTube - GreatScott! (Electronics Tutorials)		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

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Third Year B.Tech. (Multidisciplinary Minor in E&TC Engineering), Semester-V

24ETU5MD6T: Multidisciplinary Minor III – Introduction to Embedded Systems

Teaching Scheme		**Examination Scheme**	
Lectures	**3 Hours/week**	**ESE**	**60 Marks**
Practical/Tutorial	**-**	**ISE**	**40 Marks**
Credits	**3**	**ICA**	**-**

Introduction:

Embedded systems are central to modern electronic products. This course provides an introduction to embedded systems with a focus on popular platforms like Arduino, Raspberry Pi, and Espressif.

Course Prerequisite:

This course requires knowledge of basic analog and digital electronics, basic understanding of C language

Course Objectives:

1. Introduce the concept and applications of embedded systems.
2. Familiarize students with Arduino, Raspberry Pi, and Espressif platforms.
3. Teach basic programming and interfacing techniques for embedded systems.
4. Demonstrate the integration of hardware and software in embedded projects.

Course Outcomes:

At the end of the course, students will be able to:

1. Describe the basics of embedded systems and their applications.
2. Program and interface with Arduino, Raspberry Pi, and Espressif.
3. Develop simple embedded projects.
4. Integrate hardware and software components in embedded systems.

Unit – I	**Introduction to Embedded Systems**	**8 Hours**

- Definition and applications
- Microcontrollers vs. microprocessors
- Basic architecture and components

Unit – II	**Arduino Platform**	**10 Hours**

- Overview of Arduino hardware
- Basic programming in Arduino IDE
- Interfacing sensors and actuators with Arduino

Unit – III	Raspberry Pi Platform	12 Hours
● Overview of Raspberry Pi hardware ● Introduction to Linux OS on Raspberry Pi ● Python programming for Raspberry Pi		
Unit – IV	**Espressif (ESP8266/ESP32) Platform**	**12 Hours**
● Overview of ESP8266/ESP32 hardware ● Programming with Arduino IDE and ESP-IDF ● Wi-Fi and Bluetooth applications ● DAC system fundamentals		

Text Books

1. Exploring Arduino: Tools and Techniques for Engineering Wizardry by Jeremy Blum, 2nd Edition, Wiley.
2. Raspberry Pi Cookbook by Simon Monk, 3rd Edition, O'Reilly Media.
3. Internet of Things with ESP8266 by Marco Schwartz, Packt Publishing.

Reference Books

1. Programming Arduino: Getting Started with Sketches by Simon Monk, 2nd Edition, McGraw-Hill.
2. Getting Started with Raspberry Pi by Matt Richardson and Shawn Wallace, 3rd Edition, Maker Media.
3. ESP32 Development using the Arduino IDE by Neil Kolban, Kolban Technical Services.

e-Resources

1. Arduino - Official Website
2. Raspberry Pi - Official Documentation
3. Espressif - Official Documentation
4. Coursera - Introduction to Embedded Systems Software and Development Environments
5. YouTube - The Raspberry Pi Guy (Tutorials)

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(An Autonomous Institute)
Third Year B.Tech. (Multidisciplinary Minor in E&TC Engineering), Semester-VI

24ETU6MD6T: Multidisciplinary Minor IV – Fundamentals of Communication Techniques

Teaching Scheme		**Examination Scheme**	
Lectures	2 Hours/week	**ESE**	60 Marks
Practical/Tutorial	2 Hours/week	**ISE**	40 Marks
Credits	3	**ICA**	25 Marks

Introduction:

Effective communication techniques are crucial for modern electronic product design, especially in IoT applications. This course covers communication protocols and software design necessary for implementing communication in electronic systems.

Course Prerequisite:

This course requires knowledge of basic electronics, basic understanding of analog and digital signal, basic engineering mathematics

Course Objectives:

1. Introduce fundamental communication techniques and protocols.
2. Teach the principles of data transmission and reception.
3. Familiarize students with communication protocols for IoT.
4. Demonstrate software design for communication systems.

Course Outcomes:

At the end of the course, students will be able to:
1. Describe various communication techniques and protocols.
2. Implement basic data transmission and reception methods.
3. Utilize communication protocols in IoT applications.
4. Design software for effective communication in electronic systems.

Unit – I	**Introduction to Communication Techniques**	**7 Hours**

- Signal processing basics
- Analog and digital communication
- Modulation and demodulation

Unit – II	**Data Transmission and Reception**	**7 Hours**

- Serial and parallel communication
- Error detection and correction
- Data encoding and decoding

Unit – III	**Communication Protocols for IoT**	**8 Hours**

- MQTT, CoAP, HTTP
- Wireless communication (Wi-Fi, Bluetooth, Zigbee)
- Case studies of IoT communication systems

Unit – IV	Software Design for Communication Systems	8 Hours
● Programming communication interfaces ● Implementing communication protocols ● Debugging and testing communication software		
Internal Continuous Assessment (ICA): ICA shall consist of a minimum 6 experiments based on above syllabus.		
Text Books		
1. Communication Systems by Simon Haykin, 5th Edition, Wiley. 2. Data Communications and Networking by Behrouz A. Forouzan, 5th Edition, McGraw-Hill. 3. Internet of Things: Principles and Paradigms by Rajkumar Buyya and Amir Vahid Dastjerdi, 1st Edition, Morgan Kaufmann.		
Reference Books		
1. Wireless Communications: Principles and Practice by Theodore S. Rappaport, 2nd Edition, Prentice Hall. 2. IoT: Building Arduino-Based Projects by Peter Waher, Packt Publishing. 3. Computer Networking: A Top-Down Approach by James F. Kurose and Keith W. Ross, 7th Edition, Pearson.		
e-Resources		
1. Coursera - Wireless Communication for Everybody 2. edX - IoT Communications and Networks 3. YouTube - Ben Eater (Communication Protocols) 4. MIT OpenCourseWare - Principles of Digital Communication **5.** Udemy - Mastering Data Communication		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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Final Year B.Tech. (Multidisciplinary Minor in E&TC Engineering), Semester-VII

24ETU7MD6T: Multidisciplinary Minor V – Enclosure and Communication Design for IoT

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical/Tutorial	1 Hour/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course combines the principles of enclosure design and communication techniques essential for IoT applications. Students will learn to design physical enclosures considering aesthetics, usability, and manufacturability while also gaining knowledge of communication protocols necessary for IoT devices.

Course Prerequisite:

This course requires knowledge of basic electronics, embedded and IoT systems, digital modulation techniques.

Course Objectives:

1. Introduce principles of IoT enclosure design emphasizing functionality, aesthetics, and manufacturability.
2. Teach fundamental wireless communication technologies and protocols for IoT applications.
3. Integrate enclosure design with communication systems to optimize performance and usability.
4. Implement communication protocols effectively in IoT applications, focusing on reliability and efficiency.

Course Outcomes:

At the end of the course, students will be able to:

1. Design functional, aesthetically pleasing enclosures for IoT devices.
2. Apply wireless communication technologies and protocols essential for IoT connectivity.
3. Integrate usability and manufacturability principles into enclosure design to enhance product quality.
4. Implement and optimize communication protocols for efficient data exchange in IoT applications.

Unit – I	**Principles of Enclosure Design**	**8 Hours**

- Importance of IoT enclosures
- Material selection for IoT enclosures
- Thermal management considerations
- Case studies of successful enclosure designs

Unit – II	Wireless Communication Technologies for IoT	10 Hours
● Basics of wireless communication ● Wireless protocols for IoT (e.g., Wi-Fi, Bluetooth, Zigbee) ● Antenna design and optimization ● Security and reliability in wireless IoT communication		
Unit – III	**Optimizing IoT Communication**	**12 Hours**
● Overview of IoT communication ● Error detection and correction ● Data encoding and decoding ● Integration with IoT middleware		
Unit – IV	**Integration of Enclosures and Communication Systems**	**12 Hours**
● Layout and assembly of IoT components ● Cable management in IoT devices ● Testing and validation of IoT systems ● Documentation and presentation of IoT designs		

Text Books

1. Product Design for Manufacture and Assembly by Geoffrey Boothroyd, Peter Dewhurst, and Winston Knight, 3rd Edition, CRC Press.
2. Wireless Communications: Principles and Practice by Theodore S. Rappaport, 2nd Edition, Prentice Hall.
3. Internet of Things: Principles and Paradigms by Rajkumar Buyya and Amir Vahid Dastjerdi, 1st Edition, Morgan Kaufmann.

Reference Books

1. Plastic Part Design for Injection Molding by Robert A. Malloy, Hanser.
2. Wireless Communications: Principles and Practice by Theodore S. Rappaport, 2nd Edition, Prentice Hall.
3. Product Design for Manufacture and Assembly by Geoffrey Boothroyd, Peter Dewhurst, and Winston Knight, 3rd Edition, CRC Press.

e-Resources

1. Coursera - Design Thinking for Innovation
2. edX - IoT Communications and Networks
3. YouTube - Engineering Explained (Enclosure Design)
4. MIT Open Courseware - Principles of Digital Communication
5. Autodesk - Fusion 360 Learning