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

W.E.F. 2024-25

Electronics and Telecommunication Engineering Department

Department Vision

To be a distinguished center for nurturing the holistic development of competent young engineers in the electronics and allied field.

Department Mission

1. To inculcate and stimulate Electronics & allied Engineering proficiency amongst students through quality education and innovative educational practices.
2. To create engineering professionals with social consciousness.
3. To foster technical skills of students through creativity and critical thinking.
4. To enhance soft skill set of students which is crucial for career success through effectual training.

Electronics and Telecommunication Engineering
Under Graduate Program
Program Educational Objectives (PEOs)

1. Graduates will exhibit strong fundamental knowledge and technical skills in Electronics and Telecommunication Engineering and allied fields.
2. Graduates will manifest technological progression, hardware & software skills to fabricate sustainable, energy efficient and futuristic solutions to pursue successful professional careers in multidisciplinary fields.
3. Graduates will demonstrate professional ethics, effective communication, teamwork, leadership qualities and ability to relate engineering issues to broader social context along with lifelong learning.

Program Outcomes (POs)

The program outcomes of B. Tech. E&TC Engineering Program are summarized as following:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities, relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Electronics and Telecommunication Engineering Programme will be able to do-

1. Graduates will be able to attain a solid foundation in Electronics and Telecommunication Engineering with an ability to function in multidisciplinary environment.
2. Graduates will be able to use techniques and skills to design, analyze, synthesize, and simulate Electronics and Telecommunication Engineering components and systems.
3. Graduate will be capable of developing programs in Assembly, High level and HDL languages using contemporary tools for software development.

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Department of Electronics and Telecommunication Engineering

Multidisciplinary Minor in Electronics and Telecommunication Engineering

Semester	*Course Code*	*Theory Course Name*	*Engagement Hours*			*Credits*	*FA*	*SA*		*Total*
			L	*T*	*P*		*ESE*	*ISE*	*ICA*	
III	23ETU3MD6T	Fundamentals of Electronic Circuits	2			2	60	40		100
IV	23ETU4MD6T	Electronics Design and Prototyping	1			1		50		50
V	23ETU5MD6T	Introduction to Embedded Systems	3			3	60	40		100
VI	23ETU6MD6T	Fundamentals of Communication Techniques	2			2	60	40		100
VII	23ETU7MD6T	Enclosure and Communication Design for IoT	3			3	60	40		100
VII	23ETU7MD6A	Enclosure and Communication Design for IoT (Tutorial)		1		1			25	25
	Sub Total		**11**	**1**	**-**	**12**	**240**	**210**	**25**	**475**
	Course Code	***Laboratory Course Name***					***POE***	***OE***		
IV	23ETU4MD6L	Electronics Design and Prototyping	-		2	1			25	25
VI	23ETU6MD6L	Fundamentals of Communication Techniques			2	1			25	25
	Sub Total				**4**	**2**	**0**	**0**	**50**	**50**
	Grand Total		**11**	**1**	**4**	**14**	**240**	**210**	**75**	**525**

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S.Y.B.Tech. - Semester-III

Multidisciplinary Minor in Electronics and Telecommunication Engineering

23ETU3MD6T – Fundamentals of Electronic Circuits

Teaching Scheme:
Lecture: 2 Hrs./week, 2 credits

Examination Scheme:
ESE : 60 Marks
ISE : 40 Marks

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.

Prerequisites:
Basic understanding of C language, Basic engineering mathematics, Fundamental STEM concepts covered in the first year of 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 1: Electronic Components **[7 Hrs]**

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

Unit 2: Circuit Analysis Principles **[7 Hrs]**

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

Unit 3: RLC Circuits **[8 Hrs]**

- Resonance in RLC circuits
- Impedance and reactance
- Time constant and transient analysis

Unit 4: Sensors and Actuators **[8 Hrs]**

- Types of sensors (temperature, pressure, etc.)
- Types of actuators (motors, relays, etc.)
- Applications in electronic systems

Internal Continuous Assessment (ICA): NA

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.

Additional Online Resources:

- Khan Academy - Introduction to Electronics
- MIT OpenCourseWare - Circuits and Electronics
- Coursera - Introduction to Electronics by Georgia Tech
- edX - Electronic Interfaces by TU Delft
- All About Circuits - Basic Electronics

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S.Y.B.Tech. - Semester-IV

Multidisciplinary Minor in Electronics and Telecommunication Engineering

23ETU4MD6T - Electronics Design and Prototyping

Teaching Scheme:
Lecture: 1 Hr./week, 1 credit
Practical: 2 Hrs./week, 1 credit

Examination Scheme:
ISE : 50 Marks
ICA : 25 Marks

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.

Prerequisites:
Fundamentals of Basic Electronics, Basic understanding of C language, Basic engineering mathematics

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, learners 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 1: Fundamentals of Electronic Circuit Design [3 Hrs]

- Schematic diagrams
- Circuit theory and applications

Unit 2: Design Software Tools [4 Hrs]

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

Unit 3: Prototyping Techniques [4 Hrs]

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

Unit 4: Integrating Design and Prototyping **[4 Hrs]**

- Case studies of electronic product design
- Iterative design process
- Documenting and presenting designs

Internal Continuous Assessment (ICA):
ICA shall consist of a minimum 6 practicals 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.

Additional Online Resources:

- Coursera - PCB Design by University of Colorado Boulder
- Altium Designer - Online Learning
- KiCad EDA - Official Documentation
- Eagle - Learn to Use Eagle
- YouTube - GreatScott! (Electronics Tutorials)

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T.Y.B.Tech. - Semester-V

Multidisciplinary Minor in Electronics and Telecommunication Engineering

23ETU5MD6T - Introduction to Embedded Systems

Teaching Scheme:
Lecture: 3 Hrs./week, 3 credits

Examination Scheme:
ESE : 60 Marks
ISE : 40 Marks

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.

Prerequisites:
Fundamentals of Basic Electronics, Basic understanding of C language, Basic engineering mathematics

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, learners will be able to:

1. Understand 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 1: Introduction to Embedded Systems **[8 Hrs]**

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

Unit 2: Arduino Platform **[10 Hrs]**

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

Unit 3: Raspberry Pi Platform **[12 Hrs]**

- Overview of Raspberry Pi hardware
- Introduction to Linux OS on Raspberry Pi
- Python programming for Raspberry Pi

Unit 4: Espressif (ESP8266/ESP32) Platform [12 Hrs]

- Overview of ESP8266/ESP32 hardware
- Programming with Arduino IDE and ESP-IDF
- Wi-Fi and Bluetooth applications
- DAC system fundamentals

Internal Continuous Assessment (ICA): NA

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.

Additional Online Resources:

- Arduino - Official Website
- Raspberry Pi - Official Documentation
- Espressif - Official Documentation
- Coursera - Introduction to Embedded Systems Software and Development Environments
- YouTube - The Raspberry Pi Guy (Tutorials)

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T.Y.B.Tech. - Semester-VI

Multidisciplinary Minor in Electronics and Telecommunication Engineering

23ETU6MD6T - Fundamentals of Communication Techniques

Teaching Scheme:
Lecture: 2 Hrs./week, 2 credits
Practical: 2 Hrs./week, 1 credit

Examination Scheme:
ESE : 60 Marks
ISE : 40 Marks
ICA : 25 Marks

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.

Prerequisites:
Fundamentals of Basic Electronics, Basic understanding of C language, 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, learners will be able to:
1. Understand and 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 1: Introduction to Communication Techniques [7 Hrs]

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

Unit 2: Data Transmission and Reception [7 Hrs]

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

Unit 3: Communication Protocols for IoT [8 Hrs]

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

Unit 4: Software Design for Communication Systems [8 Hrs]

- Programming communication interfaces
- Implementing communication protocols
- Debugging and testing communication software

Internal Continuous Assessment (ICA):
ICA shall consist of a minimum 6 practicals 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.

Additional Online Resources:

- Coursera - Wireless Communication for Everybody
- edX - IoT Communications and Networks
- YouTube - Ben Eater (Communication Protocols)
- MIT Open Course Ware - Principles of Digital Communication
- Udemy - Mastering Data Communication

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Final Year B.Tech. - Semester-VII

Multidisciplinary Minor in Electronics and Telecommunication Engineering

23ETU7MD6T - Enclosure and Communication Design for IoT

Teaching Scheme:
Lecture: 3 Hrs./week, 3 credits
Tutorial: 1 Hr./week, 1 credit

Examination Scheme:
ESE : 60 Marks
ISE : 40 Marks
ICA : 25 Marks

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.

Prerequisites:
Fundamentals of Basic Electronics, Basic understanding of C language, Basic engineering mathematics

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, learners will be able to:

1. Design functional, aesthetically pleasing enclosures for IoT devices.
2. Understand and 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 1: Principles of Enclosure Design [8 Hrs]

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

Unit 2: Wireless Communication Technologies for IoT **[10 Hrs]**

- 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 3: Optimizing IoT Communication **[12 Hrs]**

- Overview of IoT communication
- Error detection and correction
- Data encoding and decoding
- Integration with IoT middleware

Unit 4: Integration of Enclosures and Communication Systems **[12 Hrs]**

- Layout and assembly of IoT components
- Cable management in IoT devices
- Testing and validation of IoT systems
- Documentation and presentation of IoT designs

Internal Continuous Assessment (ICA):
ICA shall consist of a minimum 6 tutorials based on above syllabus.

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.

Additional Online Resources:

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