Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: ELECTRONICS & TELECOMMUNICATION ENGINEERING

Name of the Course: Final Year B. Tech (Sem.– I & II)

(Syllabus to be implemented from w.e.f. Ay-2023-24)

PUNYASHLOK AHILYADEVI HOLKARSOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE& TECHNOLOGY

Electronics & Telecommunication Engineering

Programme Educational Objectives and Outcomes

A. Program Educational Objectives

1. To make students competent for professional career in Electronics & allied fields.
2. To build strong fundamental knowledge amongst student to pursue higher education and continue professional development in Electronics & other fields
3. To imbibe professional ethics, develop team spirit and effective communication skills to be successful leaders and managers with a holistic approach.
4. To nurture students to be sensitive to ethical, societal & environmental issues while conducting their professional work.

B. Program Outcomes

Electronics & Telecommunication Engineering Graduate will be able to –

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 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 life-long learning in the broadest context of technological change.

C. Program Specific Outcomes

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

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FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of Final Year B.Tech. Electronics & Telecommunication Engineering W**.E.F. 2023-24**

Semester I

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET411	Microwave Engineering	3	--	--	3	30	70	25	125
ET412	Data Communication	3	--	--	3	30	70	25	125
ET413	VLSI Design	3	--	--	3	30	70	25	125
ET414	Professional Elective-II	3	1	--	4	30	70	25	125
ET415	Research Methodology	3	--	--	3	30	70	25	125
Sub Total		15	1	--	16	150	350	125	625
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET411	Microwave Engineering	--	--	2	1	--	--	25	--	25
ET412	Data Communication	--	--	2	1	--	25	--	--	25
ET413	VLSI Design	--	--	2	1	--	25	--	--	25
ET416	Project Phase-I	_	_	4	2	_	_	--	25	25
ET417	Vocational Training	--	--	--	1	--	--	--	25	25
Sub Total		--	-	10	6	--	75		50	125
Grand Total		**15**	**1**	**10**	**22**	**150**	**425**		**175**	**750**

Abbreviations: L- Lectures, P –Practical, T- Tutorial, ISE- In Semester Exam, ESE - End Semester Exam, OE- Oral Examination, POE- Practical Oral Examination, ICA-Internal Continuous Assessment, ESE - University Examination (Theory &/ POE &/Oral examination)

PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF SCIENCE & TECHNOLOGY

Credit System structure of Final Year B.Tech. Electronics & Telecommunication Engineering W**.E.F. 2023-24**

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
ET421	Professional Elective-III	--	--	--	2	--	50	--	50
SLM41	Self Learning Module–II (Professional Course)	--	--	--	2	--	50	--	50
Sub Total		--	--	--	4	--	100	--	100
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
ET421	Project Phase-II (Capstone Project / Internship)	--	--	20	10	--	--	100	100	200
Sub Total		--	--	--	10	--	100		100	200
Grand Total			-	**20**	**14**	**--**	**200**		**100**	**300**

Note –

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining students exceeds 8, then a new batch shall be formed.
2. Vocational Training (evaluated at Final Year Part-I) of minimum 15 days shall be completed in any vacation after S.Y. Part-I but before Final Year Part-I & the report shall be submitted and evaluated in Final Year Part-I.
3. Project group for Final Year (Electronics & Telecommunication Engineering) Part I and Part II shall not be of more than **three** students.
4. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their attendance for theory and lab sessions as applicable.

5. Self-Learning Module II at Final Year B.Tech. – Semester II

   - Student shall select a Self Learning Module II (Professional Course) from Course List (SLM 41). Student must appear and pass university examination.
   - Minimum four assignments for Self Learning Modules (SLM 41) shall be submitted by the students which shall be evaluated by a Module Coordinator assigned by institute / department.

   OR

   - Student can select & enroll for university approved minimum eight week technical course from various MOOC technical courses, and complete its assignments. Student must appear and pass certificate examination conducted by MOOC courses.

6. Student shall select Professional Elective-II and III from course list. Student must appear and pass university examination.

- List of Professional courses–

Sr. No	B.Tech part I Professional Elective-II	B.Tech part II Professional Elective-III
1	PLC and Industrial Controllers	Wireless Sensor Networks
2	Mobile Communication	Satellite Communication
3	DSP Processor and application	Software Defined Radio

- **Self Learning Module-II**
  1. Electric Vehicles
  2. Mechatronics
  3. Biomedical Instrumentation
  4. MOOC / University Defined Courses

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics& Telecommunication Engineering)

Semester-I

ET 411: Microwave Engineering

Teaching Scheme:	**Examination Scheme:**
Lectures – 3 Hours/week, 3 credits	**ESE – 70 Marks**
Practical – 2 Hours/week ,1 credit	**ISE – 30 Marks**
	ICA – 25 Marks
	OE– 25 Marks

This course introduces importance of microwave engineering as emerging technology to be used for communication applications. It constitutes generation, transmission, and measurement of various parameters dealing with microwave frequency. The performance analysis is carried out using Microwave network analysis.

Course Prerequisite:

Student shall have knowledge of Electromagnetic Field Theory

Course Objectives:

1. To make students aware about Microwave communication and its importance,
2. To do analysis of microwave components performance using network analysis techniques.
3. To learn about different ways of microwave generation and transmission using active and passive components.
4. To acquaint students about measurement of various microwave parameters.

Course Outcomes:

After successfully completing the course student will able to

1. Formulate the wave equation in wave guide for analysis.
2. Explain the working principles of all the microwave tubes and solid state devices.
3. Identify the use of microwave components and devices in microwave applications.
4. Derive S matrix for given passive component.
5. Choose a suitable microwave measurement instruments and carry out the required measurements.

Section I

Unit 1–Microwave Waveguides (08Hrs)

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands, Microwave Hazards, Applications of Microwave.

Introduction to Waveguide: Comparison between Transmission Line and Waveguide, Solution of wave equations in rectangular coordinates, Waveguide parameters (fc,λc, λg, Vp,Vg, Z), TE modes, TM modes, Power transmission and losses

Unit 2–Microwave Components (08Hrs)

Multi port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers.

Ferrites components: Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator.

Unit 3– Microwave Network Analysis (08Hrs)

The Transmission (ABCD) matrix: Introduction to Impedance and Admittance matrix, Relation to impedance matrix, Equivalent circuits for two port networks

Scattering Matrix: Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler

Section II

Unit 4- Microwave Tubes (10Hrs)

Limitations of conventional tubes, O and M type classification of microwave tubes, concept of reentrant cavity, velocity modulation.

O-type tubes: Two cavity Klystron: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram and efficiency.

M-type tubes: Magnetron: Construction and Principle of operation of 8 cavity cylindrical magnetron, Hull's cut off voltage equation, modes of resonance, zero and PI mode operation, o/p characteristics, Applications.

Slow wave devices: Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.

(Only Hull's cut off voltage equation in Magnetron and it's related problems will be included)

Unit 5-Microwave Solid State Devices (08Hrs)

Structural details, Principle of operation, specifications, and applications of Varactor Diode, PIN Diode, Schottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode.

Unit 6- Microwave Measurements **(06Hrs)**

Measurement of power, frequency, attenuation, phase shift, VSWR

Internal Continuous Assessment (ICA):

ICA consists of minimum eight practical shall be performed using Klystron and Gunn diode based microwave bench based upon above curriculum.

List of Practical's:

1. Study Microwave Components and Instruments
2. Study the characteristics of Klystron Tube and determine its electronics tuning range
3. Study practical and theoretical aspects of V-I characteristics of Gunn Diode
4. Study Output power and frequency as a function of voltage of Gunn Diode
5. Study the frequency & wavelength in a rectangular waveguide working on TE_{10} mode
6. Study the Standing Wave-Ratio and Reflection Coefficient
7. Study the voice communication by using microwave test bench
8. Study the PC to PC communication by using Microwave test bench.
9. Study functions of multihole directional coupler by measuring following parameters
   a) Main line and Auxiliary line SWR
   b) Coupling Factor and Directivity
10. Study of magic Tee
11. Study of Circulator
12. Study of Isolator
13. Study the substitution method for attenuation measurement and determine the attenuation due to a component under test
14. Study reflectometer principle for measuring VSWR of a load under test
15. Study Phase shift measurement

Text Books:

1. Samuel Y. Liao, "Microwave Devices and Circuits", 3rd edition, Pearson

2. David M. Pozar, "Microwave Engineering", Fourth edition, Wiley publications.

3. M. Kulkarni, "Microwave and Radar engineering", 3rd edition, Umesh Publications

Reference Books:

1. Foundations for Microwave Engineering by Robert Collin, Wiley publications

2. Microwave Engineering (Passive Circuit) by Peter Rizzi, Pearon Eucation

3. M L Sisodia& G S Raghuvanshi, "Basic Microwave Techniques and Laboratory Manual", New Age International (P) Limited, Publishers

4.Reinhold Ludwing and G. Bogdanov, RF Circuit Design: Theory and applications, Pearson Education, Asia.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B. Tech (Electronics and Telecommunication Engineering)

Semester-I

ET412: Data Communication

Teaching Scheme:
Lecture: 3 Hrs/Week, 3 Credits
Practical: 2 Hr/Week, 1 Credit

Examination Scheme:
ISE: 30 Marks
ESE: 70 Marks
ICA: 25 Marks
POE: 25 Marks

Course Objectives:

1. To explain need of Data Communications System and network components.
2. To aware students about the layers of the OSI model and TCP/IP with function(s) ofeach layer.
3. To develop building skills of subnetting and understand routing mechanisms.
4. To introduce students with the different types of network topologies and standards.
5. To acquaint students with the basic protocols of computer networks and how they canbe used to assist in network design and implementation.

Course Outcomes:

After completion of this course, student will be able to

1. Explain Data Communications System and its components.
2. Develop building skills of subnetting and understand routing mechanisms.
3. Enumerate the layers of the OSI model and TCP/IP and explain the function(s) of eachlayer.
4. Identify the different types of network topologies and protocols.
5. Acquaintance with the basic protocols of computer networks, and how they can beused to assist in network design and implementation.

Section – I

Unit 1- Data Communication and Network (08Hrs)

Introduction to Data Communication, Network- Need, Types (LAN, MAN, WAN), Topologies, Layer communication, OSI model, TCPIP Suite, OSI Versus TCP/IP, Network Devices at each layer (RS232, MODEM, Repeaters, Switches, bridges, routers, gateway).

Unit 2- Data Link Layer **(12Hrs)**

Framing, Circuit Switching and Packet Switching, Error detection and error correction, Block parity code ,CRC code, Hamming code , Flow control methods- Stop and wait protocol, sliding window protocol, Piggybacking, MAC: Collision oriented and collision based protocols, ALOHA, CSMA, CSMA/CD, CSMA/CA, HDLC, STP Protocol.

Unit 3- Wireless LAN Standards **(04Hrs)**

IEEE Standards, IEEE802.3, IEEE802.4, IEEE802.5, USB-OTG, Bluetooth 5.1, 5.2.

Section-II

Unit 4- Network Layer **(08Hrs)**

Virtual circuit & datagram approach, Routing- Principle of optimality, shortest path routing, flow based routing, distance vector routing, link state routing routing protocols – shortest path, distance vector routing,link state, ICMP, ARP,RARP.

Unit 5- Transport Layer **(08Hrs)**

TCP & IP header format, encapsulation, IPv4 addressing ,IPv6 addressing subnetting& masking, user datagram protocol (UDP) – transmission control protocol (TCP) - three way handshake – congestion & its control,TCP practical applications.

Unit 6- Application Protocols: **(08Hrs)**

FTP, DNS, TELNET, HTTP, SMTP, E-mail, DHCP, Case study, Cisco DNA-Center Controller, IBM Virtual Router Appliance (VRA).

Internal Continuous Assessment (ICA):

ICA shall consist of a minimum eight experiments based on the above curriculum. Sample list is provided below.

1. Network Ethernet LAN driver installation and working.
2. Network topologies using CISCO packet tracer.
3. RS 232 based lab sessions-
    a. Character transfer using half duplex and Full duplex mode of operation.
    b. File transfer using serial port.
4. Flow control and error control mechanism using CISCO packet tracer.
5. Implementation of Scrambler and descrambler.
6. IP subnetting and masking in Intranet using CISCO Packet tracer.

7. All network protocol tree model setup in command prompt.
8. Internet application protocol-FTP and DNS.
9. Network analyzer (Protocol analyzer)-wire shark.

Text books:

1. Data communication- B.A. Forouzan, 4th Edition Tata Mc Graw hill Publication.
2. TCP/IP protocol suit- B.A. Forouzan, 4th Edition Tata Mc Graw hill Publication.
3. Computer networks- Andrew S. Tanenbaum.

Reference Books:

1. Internetworking TCP/IP Principal, Protocol and Architecture -Douglas Comer- Wesley
2. TCP/IP Illustrated, The Protocols – W. Richard Slevens, G.Gabrani –PE pub.
3. Data and computer communication – William Stallings. - PE pub.
4. Cisco-The complete reference-Brian Hills.

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Final Year B.Tech (Electronics & Telecommunication Engineering)

Semester-I

ET 413: VLSI Design

Teaching Scheme:	**Examination Scheme:**
Lectures – 3 Hours/week, 3 Credits	**ESE – 70 Marks**
Practical – 2 Hours/week, 1 Credits	**ISE – 30 Marks**
	ICA – 25 Marks
	POE– 25 Marks

This course introduces how to design, simulate and test digital logic circuits using the hardware description language of Verilog HDL and CMOS logic. It also introduces the CPLD and FPGA architectures used to implement the digital logic circuits.

Course Prerequisite:

Students shall have knowledge of Digital Devices, combinational logic circuit design, and simulation.

Course Objectives:

1. To make students learn EDA Tools for Verilog HDL programming and CMOS Logic Design and simulation
2. To enable students to design Verilog HDL modules for combinational and sequential logic circuits.
3. To acquaint students with CPLD and FPGA architecture.
4. To introduce students to MOS Transistor Theory and CMOS Logic-based design of combinational logic circuits.

Course Outcomes:

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

1. Explain the different syntax of Verilog HDL language.
2. Analyze combinational circuits using Verilog HDL.
3. Analyze sequential logic circuits using Verilog HDL.
4. Describe MOS transistor theory and behavior of E-MOSFET
5. Analyze combinational logic circuit design using E-MOSFETs.
6. Describe the architecture and internal components of CPLD and FPGA.

Section I

Unit 1- Introduction to Verilog HDL [08 Hrs]

Structure of Verilog module, Operators, Data Types, Styles of Description. Verilog Models for Gate Propagation Delay (Inertial Delay), Time Scales for Simulation, Verilog Models for Net Delay (Transport Delay), Module Paths and Delays, Path Delays and Simulation, Inertial Delay Effects and Pulse Rejection, Examples using Verilog.

Unit 2- Combinational logic using Behavioral Descriptions [08 Hrs]

Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Adder, Subtractor, Comparator, Multiplexer, Demultiplexer, Encoder, Decoder.

Unit 3 – Sequential logic using Behavioral Descriptions [08 Hrs]

Behavioral models of Flip-flops, counters and shift registers, Verilog HDL model using state machine for sequence detector

Section II

Unit 4 - MOS Transistor Theory [08 Hrs]

Physical structure of MOS transistor, accumulation, depletion & inversion modes, MOS device design equations, second order effects, Technology scaling, Static and dynamic behavior of CMOS inverter, power and energy delay, impact of technology scaling on inverter.

Unit 5 – Combinational Logic Design in CMOS [10 Hrs]

Static CMOS design- complementary CMOS, Implementation of Boolean Expressions using CMOS Logic, Ratioed logic and pass transistor logic; dynamic CMOS design- dynamic logic basic principle, speed and power dissipation, issues in dynamic design, cascading dynamic gates, comparison of static and dynamic designs in CMOS, Timing Issues in Digital Circuits.

Unit 6: Architecture of Commercial Devices [06 Hrs]

CPLD Architecture, Xilinx XC9500, Altera Max7000, FPGA organization and architecture, Altera Flex 10k.

Internal Continuous Assessment:

ICA shall be based on a minimum of eight experiments based on the above syllabus using any EDA software tool for Verilog HDL modules and CMOS logic design.

Suggested List of experiments:

Design and Implementation of the following using Verilog HDL and write test bench for-

1. Design of half adder and full adder
2. Design of 4 bit adder using structural style modelling

3. Design of code converters
4. Design of comparators
5. Design of encoder and decoder
6. Design of multiplexer and demultiplexer
7. Design of flip flops
8. Design of asynchronous and synchronous counters
9. Design of sequence detector using state machine
10. Design of ADD and Shift multiplier using state machine

Design and Implementation of the Following using CMOS / Ratioed Logic / Dynamic CMOS Logic.

1. Logic Gates
2. Universal Logic Gates
3. Boolean Expression
4. Half adder and full adder
5. Half subtractor and full subtractor

Text Books:

1. Digital Systems Design using Verilog, Charles H. Roth, Lizy Kurian John, Byeong Kil Lee-Cengage Learning.
2. HDL Programming VHDL And Verilog, Nazeih M.Botros, Dreamtech Press
3. HDL with Digital Design: VHDL and Verilog, Nazeih Botros. Mercury Learning And Information LLC. ISBN: 978-1-938549-81-6
4. Modeling, Synthesis and Rapid Prototyping with the Verilog HDL, M.D. CILETTI ,Prentice-Hall.
5. Digital Integrated Circuits, Rabey, Chandrakasan, Nikolic, Pearson Education
6. CMOS VLSI design, Neil H. E. Weste, David Harris, Ayan Banerjee, Pearson Education

Reference Books :

1. Digital Design Principles and Practices, John F. Wakerly, Printice Hall, 3rd Edition.
2. Datasheets of CPLDs and FPGAs.
3. CMOS digital integrated circuits, Analysis and Design, Sung-Mo Kang, Yusuf Leblebici, TATA McGRAW Hill
4. Principles of CMOS VLSI Design, Neil Weste, Kamran Eshraghian, Addison Wesley/Pearson Education
5. Modern VLSI Design, Wayne Wolf, 2nd Edition, Prentice Hall,1998
6. Essentials of VLSI Circuits and Systems, Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, PHI, EEE, 2005 Edition

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Final Year B.Tech (Electronics& Telecommunication Engineering)

Semester-I

ET414.1: Professional Elective

PLC and Industrial Controllers

Teaching Scheme:	**Examination Scheme:**
Lectures – 3Hours/week , 3 Credits	**ESE – 70Marks**
Tutorial – 1 Hours/week, 1 Credit	**ISE – 30 Marks**
	ICA –25 Marks

This course introduces to Programmable Logic Controller (PLC). As automation plays a very important role in industries. This is because of increasing demand of reliable production and activities in less time without human involvement. PLC plays a important role in achieving this. There is a large demand in the industry for trained programmers who can do custom based automation. This course will enable a engineer to acquire hardware and programing skills required for PLC.

Course Prerequisite:

Student shall have knowledge of Electronics, Electrical wiring, exposure to some kind of programing language, Drives.

Course Objectives:

1. To make students aware about modern PLC and its relevance in automation field.
2. To make student gain insights of PLC and its programing for automation.
3. To learn the details sensors, actuators and other parts required for PLC interfacing in detail.
4. To enable to do automation using programing of PLC.

Course Outcomes:

After successfully completing the course student will able to

1. Compare and contrast between conventional vehicles and the electric vehicles.
2. Select motor and sensors and appropriate PLC for given automation requirements.
3. Write PLC programs for particular application.

Section-I

Unit 1 -Introduction to PLC (06Hrs)

Introduction to PLC,History of PLC,The need of PLC, Types of PLC's, Comparison between relay logic and PLC, Advantages of PLC over relay panels, Leading companies in PLC's,Basic parts of PLC and their working block diagram,Selection parameters of PLCs.

Unit 2 - PLC Hardware **(08Hrs)**

PLC: Power supply for PLC, Digital and Analog I/O Modules for PLC, Concept of source and sink, Specifications of PLC, Selection of PLC for any application.

Unit3 – Sensors **(08Hrs)**

Classification of sensors**,** Industrial IR sensors, Potentiometer sensor, strain gauges,Piezo-electric sensors,Pressure sensors, Pneumatic sensors,Proximity switches- Inductive and capacitive, RTD-two and three wire, Thermocouple,specifications and selection criteria for above.

Section-II

Unit4 -I/O devices for PLC **(08Hrs)**

Pushbutton NO, Pushbutton NC, Emergency push button, limit switches, relays, solenoid valves, Stepper motor, D.C. Motor, A.C. motor, Servo motor, Specifications and selection criteria for above.

Unit5 - PLC Software **(10Hrs)**

Methods of Programming a PLC,PLC Software IDE, Ladder Diagrams, Ladder diagram for logic gates AND, OR, NOT,NAND, XOR, XNOR,Comparison,Use of timers and counters of PLC, Temperature control using PLC, PLC Ladder Programs for Washing machine, Garage Door, Bottle filling, Temperature controller using closed loop and a mini-application using PLC

Unit 6 - Industrial Controllers **(04Hrs)**

Industrial Controllers need, Specifications, key features, application areas.

Internal Continuous Assessment (ICA):

ICA shall include minimum **six tutorials** based on above syllabus.

Text Books:

1.W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering(6^{th} Edition), Pearson Publications, 2015

Reference Books:

1. PLC Manufacturer Datasheet
2. Swayam/Nptel Reference:
3. Mechatronics: IIT Roorkee July 2018

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Final Year B.Tech (Electronics& Telecommunication Engineering)
Semester-I

ET414.2: Professional Elective-II

Mobile Communication

Teaching Scheme:	**Examination Scheme:**
Lectures– 3 Hours/week, 3 Credits	**ESE -70 Marks**
Tutorial – 1 Hour/week, 1 Credit	**ISE - 30 Marks**
	ICA -25 Marks

This course introduces Advanced ideas, design principles, architectures and technology standardsused in advanced mobile communication systems.

Course Prerequisite:
Student shall have knowledge of basics of analog communication and digital communication.

Course Objectives:

1. To recognize cellular concept in mobile communication.
2. To examine the Mobile radio propagation, cellular system design, and to identify multipleaccess techniques used in mobile communication
3. To analyze mobile technologies like GSM
4. To categorize the mobile communication evolution of 2G to 5G technologies.
5. To describe overview of 4G & 5G next generation technology.

Course Outcomes:

At the end of this course, Students will be able to,

1. Students will be able to define cellular systems, working and hand off strategies implemented inmobile communication.
2. Students will be able to analyze various losses in mobile radio propagations and define multipleaccess schemes sharing radio spectrum.
3. Students will be able to define GSM - architecture, frame structure, system capacity andservices provided.
4. Students will be able to describe mobile communication evolution of 2G to 5G technologies
5. Students will be able to analyze emerging technologies required for fourth generation mobilesystems such as Long Term Evolution(LTE) & 5G next generation technology.

Section I

Unit 1: Introduction (08Hrs)

Introduction to wireless communication systems

The Cellular Engineering Fundamentals : Introduction, Frequency Re-use, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of service, Co-channel Interference (CCI), Adjacent Channel Interference (ACI), Cell Splitting, Sectoring, Microcell Zone concept, Repeaters.

Unit 2: Mobile Radio Propagation (06Hrs)

Large scale path loss, Free space propagation model, ground reflection model (two ray model), Practical Link Budget using path loss model, Small scale fading and multipath small scale multipath propagation

Unit 3: Multiple Access Technique in Wireless Communications (08Hrs)

Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access (SSMA), Space Division Multiple Access (SDMA), Orthogonal Frequency Division Multiple Access (OFDMA)

Section II

Unit 4: GSM (08Hrs)

GSM Network architecture, signaling protocol architecture, identifiers, channels, Frame structure, speech coding, authentication and security, call procedure, handoff procedure, services and features.Mobile data networks, GPRS and higher data rates.

Unit 5: CDMA digital cellular standard (IS-95) & IMT – 2020 (06Hrs)

Frequency and channel specifications of IS-95, forward and reverse CDMA channel, packet and frame formats, mobility and radio resource management. IMT 2000 & IMT Advanced, IMT 2020,capabilities.

Unit 6: 4G (LTE) & 5G Next Generation Technology (08Hrs)

Introduction to 4G, LTE Architecture, Elements of LTE- EPS, LTE Radio / air interface- Modulation and features, LTE Channels, Introduction to 5G, 5G CN Architecture, Radio/air interface, features.

Internal Continuous Assessment (ICA):

- ICA shall include minimum **eight tutorials** based on above syllabus.

- One visit to the **Mobile base station** & submission of report.

Text Books:

1. Wireless Communications - Theodore S. Rappaport, Prentice Hall of India, PTR Publication.
2. Principles of Wireless Networks – Kaveh Pahlavan, Prashant Krishnamurthy, PHI.
3. Mobile Communication – G. K. Behera & Lopamudra Das, Scitech Publication.
4. Mobile Communications – Jochen Schiller, Pearson Education, Second Edition.

Reference Books:

1. Wireless Communication – Singhal, TMH.
2. Mobile and Personal Communication Systems and Services – Raj Pandya, Prentice Hall of India.
3. Wireless Communication – D. P. Agarwal, Thomnson learning 2007, Second Edition.
4. Wireless Communication and Network –Upena Dalal, OXFORD higher Education
5. 4 G Roadmap and Emerging Communication Technologies – Young Kyun Kim and RamjeePrasad –Artechhouse.
6. 5G NR: The Next Generation Wireless Access Technology- By Erik Dahlman, StefanParkvall, Johan Skold

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics& Telecommunication Engineering)
Semester-I

ET414.3: Professional Elective-II

DSP Processor & Application

Teaching Scheme:	**Examination Scheme:**
Lectures– 3 Hours/week, 3 Credits	**ESE -70 Marks**
Tutorial – 1 Hour/week, 1 Credit	**ISE - 30 Marks**
	ICA -25 Marks

Course Objectives:

1. Know fundamentals of DSP Processor
2. DevelopapplicationprogramsinC54X
3. StudythearchitectureandprogrammingofTMS320C5X,TMS320C3X Processors for real time applications.

Course Outcomes:
After successfully completing the course students will be able to

1. Use fundamentals of Programmable DSP Processors for different applications
2. Demonstrate their ability to program DSP Processors.
3. Discuss and compare the architecture and programming of TMS320C5X, TMS320C3X Processors for real time applications.

Section–I

Unit1: Numeric Presentation and arithmetic: (04Hrs)
Number formats for signals and coefficients in DSP systems, Dynamic Range and precision, Sources of Error in DSP implementations, A/D conversion errors, DSP computational errors, D/A conversion errors.

Unit 2:Fundamentals of programmable DSPs: (09Hrs)
Introduction to Programmable DSPs, Architectural Features of PDSPs: Multiplier and multiplier accumulator, modified bus structure and memory access in P-DSPs, multiply access memory, multi-ported memory, VLIW architecture, pipelining, special addressing modes in PDSPs, on-chip peripherals, computational accuracy in DSP processors.

Unit 3:TMS320C5X Processors (09Hrs)

Architecture, Assembly Language Syntax, Addressing Modes Assembly Language Instruction, Pipeline Structure, Operation Block Diagram of DSP Starter Kit, Application Program for Processing Real Time Signals.

Section–II

Unit 4: Programmable Digital Signal Processors (10Hrs)

Data Addressing Modes of TMS320C54XX DSPs, Data Addressing Modes of TMS320C54XX Processors, Memory Space of TMS320C54XX Processors, Program Control, On-Chip, Peripherals, Interrupts of TMS320C54XX Processors, Pipeline Structure of TMS320C54XX Processors

Unit 5:Application programs in C54X: (06Hrs)

Pipeline operation, Code composer studio, overview of the 'C5402-Based DSK', Introduction to C54X Assembly language programming, and Applications programs in C54X.

Unit 6: Advanced Processors: (06Hrs)

Code composer studio-Architecture of TMS320C6X, Architecture of Motorola DSP563XX, Comparison of the features of DSP family processors.

Internal Continuous Assessment (ICA):

Minimum six tutorials should be conducted based on above topic.

Textbooks:

1. Digital Signal Processors, Architecture, Programming-B. Venkata Ramaniand, M. Bhaskar TMH, 2004.
2. DSP Implementation using DSP microprocessor with Examples from TMS32C54XX– AvatarSingh,S.Srinivasan-Thamson 2004
3. Digital signal processing- Salivahanan, Ganapriya- TMH, second Edition

Reference Books:

1. DSP Processor Fundamentals, Architectures &Features– Lapsleyetal. S. Chand & Co, 2000.
2. Digital Signal Processing-S. K .Mitra-Tata McGraw-Hill Publication,2001
3. User guides Texas Instruments, Analog Devices and NXP.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics& Telecommunication Engineering)
Semester-I

ET 415: Research Methodology

Teaching Scheme:
Lectures – 3 Hours/week , 3 Credits

Examination Scheme:
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks

Course Objectives:

1. To make students aware about basics of research methodology and research problem formulation.
2. To do analysis of research-related information using various methods.
3. To learn scientific report writing using different steps.
4. To acquaint students with issues related to ethics in research.
5. To learn different data analysis strategies using different methods.
6. To learn different research design and sampling design

Course Outcomes:

After successfully completing the course student will able to

1: Understand research problem formulation.
2: Analyze research related information.
3: Recognize the importance of Report writing.
4: Understand the research ethics.
5: Understand data analysis strategies.
6. Explain different research design and sampling design.

Section-I

Unit-I – Introduction to Research: (05 Hrs)

Motivation and objectives, Research methods *vs* Methodology, Types of research – Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, Conceptual *vs.* Empirical. Research process, Criterion for good research

Unit-II - Research Formulation: (08 Hrs)

Defining and formulating the research problem, selecting the problem, Necessity of defining the problem, Importance of literature review in defining a problem, Identifying gap areas from literature review, Development of working hypothesis.

Unit-III - Research Design and Methods: (09 Hrs)

Research design – Basic Principles, Need of research design, Features of good design, important concepts relating to research design, different research design, basic principles of experimental design, steps in sampling design, criterion for selecting sampling procedure, strategic for good sample design, different types of sampling.

Section-II

Unit-IV - Data Collection and Analysis: (09 Hrs)

Execution of the research, Observation and Collection of data, Methods of data collection, Sampling Methods, Data Processing and Analysis strategies using Chi-Square, ANOVA.

Unit-V - Reporting and Thesis writing: (08 Hrs)

Structure and components of scientific reports, Types of report, Technical reports and thesis, Significance, Different steps in the preparation – Layout, structure and Language of typical reports/thesis, Illustrations and tables, Bibliography, referencing and footnotes, Plagiarism, Citation and acknowledgement.

Unit-VI –Ethics of Research: (05 Hrs)

Research and publication ethics, Basic principles of ethics, components of ethics including honestly, objectivity, efficiency, and accuracy of research, Environmental impacts on research ethics, ethical issues and ethical committees.

Internal Continuous Assessment (ICA)

ICA shall be based upon minimum six assignment based upon above curriculum.

Text Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.

2. Kothari, C.R., 1990. *Research Methodology: Methods and Techniques*. New Age International. 418p.

3. Sinha, S.C. and Dhiman, A.K., 2002. *Research Methodology*, EssEssPublications.2 volumes.

4. Trochim, W.M.K., 2005. *Research Methods: the concise knowledge base*, Atomic Dog Publishing. 270p. 5. Wadehra, B.L. 2000. *Law relating to patents, trademarks, copyright designs and geographical indications*. Universal Law Publishing.

Reference Books:

1. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. *Research Methods: A Process of Inquiry*, Allyn and Bacon.

2. Carlos, C.M., 2000. *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*. Zed Books, New York.
3. Coley, S.M. and Scheinberg, C. A., 1990, *"Proposal Writing"*, Sage Publications.
4. Day, R.A., 1992.*How to Write and Publish a Scientific Paper*, Cambridge University Press.
5. Fink, A., 2009. *Conducting Research Literature Reviews: From the Internet to Paper*. Sage Publications
6. Leedy, P.D. and Ormrod, J.E., 2004 *Practical Research: Planning and Design*, Prentice Hall. 7. Satarkar, S.V., 2000. *Intellectual property rights and Copy right*. EssEss Publications.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics& Telecommunication Engineering)

Semester-I

ET416 : Project – I

Teaching Scheme: **Examination Scheme:**
Practical: 4 Hours /week, 2 credits **ICA– 25 Marks**

Course Objectives:

1. To guide students to explore research areas and to undertake literature survey.
2. To identify & formulate a realistic problem statement.
3. To follow an appropriate designing technique for further development of project.
4. To prepare to work in a team and to understand importance of teamwork.
5. To develop soft skills including presentation, writing & convincing.

Course Outcomes: At the end of the course students will be able to

1. Explore research areas, conduct literature survey and formulate a problem statement catering societal/professional need.
2. Select an appropriate design with due consideration for society.
3. Carry out impact analysis for environment and sustainability concern.
4. Prepare Software requirement specification (SRS) & design document using software engineering techniques and modern tools.
5. Engage in team work and communicate effectively while observing professional ethics.
6. Inculcate habit of self study to become a lifelong learner.

Guidelines:

1. Student will finalize the project after the approval of guide and submit a synopsis with presentation.
2. Student should prepare the project design.
3. Project synopsis should preferably contain abstract, literature survey, problem definition, proposed system & design.
4. Student will have to give a seminar on the design of the project.
5. Project will be assessed by project guide and the panel appointed by the university.

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics& Telecommunication Engineering)

Semester-I

ET417 : Vocational Training

Credits: 1 credit

Examination Scheme:
ICA – 25 Marks

Course Objectives:

1. To get acquainted with the industry environment.
2. To acquire in-depth knowledge of software/hardware development tools and technique to solve real world problems.
3. To study to exhibit professional & ethical responsibilities.

Course Outcomes: At the end of the course students will be able to

1. Use hardware and software development tools and techniques for real world problem.
2. Effectively communicate a vocational training report in writing and oral presentation.
3. Exhibit professional & ethical responsibilities.
4. Assimilate knowledge, skills and professional practices.

Guidelines:

1. Vocational Training of minimum 15 days shall be completed in any vacation after S.E. Part-II but before B.E. Part-I & the report shall be submitted and evaluated in B.E. Part-I.
2. Following are the options available to complete minimum 15 days vocational training
   a. Students can opt for online internships of minimum 15 days.
   b. Students can do an online course of minimum two weeks duration through any MOOC Platform (NPTEL / Coursera / TCSiON / Headstart / EdX / any other) and submit certificate to the institute. But this course should be separate than the 2/3 credit course done as a 'Self Learning' through any of the suggested MOOC Course.
   c. students can opt for Internships offered by institute if any.
3. Training will be done individually.
4. Project based on training will be completed at industry or followed by training at institute.
5. Vocational report should be submitted along with completion certificate to the institute.

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Final Year B.Tech. (Electronics and Telecommunication Engineering)

Semester - II

ET421.1: Professional Elective-III

Wireless Sensor Networks

Teaching Scheme: **Examination Scheme:**

Self Learning, 2 credits **ESE: 50 Marks**

Course Objectives:

1. To understand the basics of Wireless Sensor Networks with its architecture, infrastructure, associated protocols and IEEE standards.
2. To study applications of WSN in various fields

Course Outcomes:

At the end of this course, the student will be able to

1. Know Wireless Sensor scenario with its challenges, architecture and protocols.
2. Apply their knowledge for the implementation of the Wireless Sensor Network in various applications

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Section– I

Unit 1: Introduction to Wireless Sensor Network (07Hrs)

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, Applications of WSN and Mobile adhoc networks and wireless sensor networks.

Unit 2: Architectures of WSN (08Hrs)

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

Section-II

Unit 3 – QoS , Energy Management and Security Threats in WSN (08Hrs)

Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes. **Security threats**-Malware, Types of Malwares, Malicious

node, Malware analysis (behavioural, Code and Memory),False data injection (FDI) attack

Unit 4 – Applications of RFID in WSN (07Hrs)

Physics and Geometry of RFID, Backscatter Communication, Antenna Directivity and Gain, Aspects of EMC, Electrical Dimensions Applications of RFID: Identification and data capture, Health care and Massive incidents.

Text Books:

1. Protocols and Architectures for Wireless Sensor Networks -Holger Karl & Andreas Willig -John Wiley, 2005.
2. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education – 2008

Reference Books:

1. Wireless Sensor Networks- Technology, Protocols, and Applications - Kazem Sohraby, Daniel Minoli, & Taieb Znati - John Wiley, 2007.
2. Wireless Sensor Network Designs - Anna Hac - John Wiley, 2003.
3. Ian F. Akyildiz and Mehmet Can Vuran, Wireless Sensor Networks, A John Wiley and Sons, Ltd,Publication, 2010.
4. Fundamentals of Wireless Sensor Networks- Theory and Practice, Waltenegus Dargie, Chrstian Poellabauer, Wiley
5. Networking Wireless Sensors, Bhaskar Krishnamachari, Cambridge University Press

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Final Year B. Tech. (Electronics and Telecommunication Engineering)

Semester-II

ET421.2 : Professional Elective III

Satellite Communication

Teaching Scheme: **Examination Scheme:**

Self-Learning, 2 Credits **ESE: 50 Marks**

Course Prerequisite:

The student shall have exposure to Analog Communication & Digital Communication.

Course Objectives:

1. To understand the basics of satellite communications and different satellite communication orbits
2. To study Geostationary Orbit & Wave Propagation for Satellite Communication
3. To understand the Space Segment of the Satellite
4. To understand the Earth Segment & Space Link of Satellites

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Course Outcomes:

At the end of this course, the student will be able to

1. Understand basic concepts of Satellite Communication, satellite orbits, and orbital parameters.
2. Understand Geostationary Orbit & Wave Propagation for Satellite Communication
3. Understand the Space Segment of the Satellite.
4. Understand the Earth Segment & Space Link of Satellite.

Section– I

Unit 1: Overview of Satellite Systems, Orbits. (08Hrs)

Introduction – Frequency Allocation for Satellite services – Intelsat – US Domsats – Polar-orbiting Satellite - Kepler's laws, Definitions of terms for Earth-orbiting Satellites – Orbital Elements – Apogee & Perigee Heights – Orbital Perturbations - Effect of nonspherical earth – Atmospheric Drag – Inclined Orbits – Sun Synchronous Orbits- Problems.'

Unit 2: Geostationary Orbit & Radio Wave Propagation. (07Hrs)

Introduction – Antenna Look Angles – The Polar Mount Antenna – Limits of Visibility – Near Geostationary Orbits – Earth Eclipse of Satellite – Sun Transit Outage – Launching Orbits.

Radio Wave Propagation – Introduction – Atmospheric Losses – Ionospheric Effects – Rain Attenuation – Other Propagation Impairments.

Section– II

Unit 3: The Space Segment. (07Hrs)

Introduction – The Power Supply – Altitude Control - Spinning Satellite Stabilization, Momentum Wheel Stabilization – Station Keeping – Thermal Control – TT&C Subsystem – Transponders -The Wideband Receiver, The Input Demultiplexer, The Power Amplifier - The Antenna Subsystem.

Unit 4: The Earth Segment & Space Link. (08Hrs)

The Earth Segment: Introduction – Receive- Only Home TV Systems – Master Antenna TV System – Community Antenna TV System – Transmit-Receive Earth Stations.

Space Link: Introduction – Equivalent Isotropic Radiated Power – Transmission Losses – The Link-Power Budget Equation – System Noise – Carrier-to-Noise Ratio – The Uplink – Downlink – Effects of Rain – Combined Uplink & Downlink C/N Ratio – Inter-Satellite Links.

Text Books:

1. Dennis Roddy, ―Satellite Communications‖, 4th Ed., Mc. Graw-Hill International Ed. 2009.
2. Timothy Pratt, Charles Bostian, and Jeremy Allmuti, ―Satellite Communications‖, John Willy & Sons (Asia) Pvt. Ltd. 2004

Reference Books:

1. R. N. Mutangi, ― Satellite Communication‖, Oxford university press, 2016.
2. Gerard Maral and Michel Bousquet, ―Satellite Communication Systems‖, 4th Edition Wiley Publication
3. Wilbur L. Pritchard, Henri G. Suyderehoud, and Robert A. Nelson, Satellite Communication Systems Engineering, Pearson Publication

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.Tech. (Electronics and Telecommunication Engineering)

Semester - II

ET421.3 : Professional Elective-III

Software Defined Radio

Teaching Scheme: **Examination Scheme:**

Self Learning, 2 credits **ESE: 50 Marks**

Course Objectives:

1. To familiarize the concept of software defined radio
2. To describe different software radio platforms
3. To introduce case studies of software defined radio

Course Outcomes:

At the end of this course, the student will be able to

1. Explain the need and benefits of software defined radio
2. Describe different architectures and software radio platforms.
3. Explain case studies of software defined radio.

Section– I

Unit 1: Introduction to Software Defined Radio (07Hrs)

Need for Software Defined Radio, Benefits of Software Defined Radio, Design Principles of Software Defined Radio, Software Defined Radio Forum, Software Defined Radio Block Diagram, Worldwide frequency band plans.

Unit 2: Software Defined Radio Architecture and Components (08Hrs)

Traditional Hardware Radio Architecture, An Ideal Software Defined Radio Architecture, Von Neumann Memory Architecture, Havard Memory Architecture, Hybrid Radio Architecture, Software standards for software radio, JTRS software communication Architecture, SDRF Distributed object computing software radio Architecture, Common Object Request Broker Architecture (CORBA), A COTS implementation of the basic architecture.

Section-II

Unit 3 – Software Radio Platforms (07Hrs)

Platform requirements, System architecture, System interfaces, System design, Functional design, Low level implementation details, Potential applications, EDA tools for software radio development.

Unit 4 – Case Studies in Software Defined Radio Design (08Hrs)

Architectural characteristics of practical software radios, SPEAKeasy - Phase I & II, JTRS - Goals of SCA, Attributes of SCA, SCA Architectural details, Wireless Information Transfer System - Architecture goals and overview, Software architecture, Hardware architecture, SpectrumWare - system description, programming environment, Layered Radio Architecture implementation example.

Text Books:

1. Jeffrey.H.Reed ,Software Radio : A Modern Approach to Radio Engineering , Pearson
2. Paul Burns : Software Defined Radio for 3G, Artech House, Boston, London

Reference Books:

1. Dillinger, Madani, Alonistioti (Eds.): Software Defined Radio, Architectures, Systems and Functions, Wiley 2003
2. Bard, Kovarik: Software Defined Radio, The Software Communications Architecture, Wiley 2007

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.Tech. (Electronics and Telecommunication Engineering)

Semester - II

SLM41.1 : Self Learning Module-II (Professional Course)

Electrical Vehicles

Teaching Scheme:
Self Learning, 2 credits

Examination Scheme:
ESE: 50 Marks

Course Prerequisite:

Student shall have knowledge of Power Electronics, electric motor working principles, Embedded systems.

Course Objectives:

1. To make students aware about electric vehicles technology and its relevance in today's era.
2. To make student gain insights of motor and controller for the electric vehicles.
3. To learn the details of battery and related charger technology for use in electric vehicles
4. To acquaint students about the current rules, regulations and norms associated with electric vehicles.

Course Outcomes:

At the end of this course, the student will be able to

1. Compare and contrast between conventional vehicles and the electric vehicles.
2. Select motor and appropriate controller for given specifications.
3. Choose suitable battery and charger technology for given specifications.
4. Value the rules and regulations and associated laws for electric vehicle technology.

Section– I

Unit 1– Introduction to Electric Vehicles (05Hrs)

The need of EV's, Types of EV's, Introduction to EV's in India, Comparison between an petrol/diesel vehicle and the electric vehicles, Advantages of EV's over conventional vehicles, Leading companies in two and four wheeler, Basic parts of EV and their working, Government role in promoting EV, Predicted market growth of EV's in next few years.

Unit 2–EV Motor and Controllers (10Hrs)

Motors for EV: Brushless DC Electric Motor (BLDC), Permanent magnet synchronous Motors (PMSM), Induction Motor, Synchronous Reluctance (SynR) Motors, their technical

specifications, construction, working , characteristics, selection criteria of motors for EV's and drives technology (controller) used for these motors.

.

Section-II

Unit 3–Batter & Chargers (10Hrs)

Batteries for EV: Lead-acid, Lithium ion, Lithium Ion Battery Management Systems, Sodium ion, Aluminum Air Battery, technical specifications, characteristics, selection criteria of batteries for EV's and charger technology used for these batteries.

Unit 4–Electric Vehicles Rules Regulations and Case study (05Hrs)

Safety, Testing, Regulations, Charging stations and additional requirements, Standards of Electric vehicle's, Case Study of electric vehicle, Selection criteria for EV's.

Text Books:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003
2. D. A. J. Rand, R. Woods, and R. M. Dell, "Batteries for Electric Vehicles," Society of Automotive Engineers," Warrendale PA, 2003.
3. Energy Storage by Robert A. Huggins, Springer Publication
4. Energy Management Handbook, Wayne C. Turner, The Fairmont Press Inc., 5th Edition, Georgia.

Reference Books:

1. Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication.

Swayam/Nptel Reference :

Electric Vehicles and Renewable Energy by Prof. Ashok Jhunjhunwala, Prof. Kaushal Jha, Prof. L Kannan, Prof. Prabhjot Kaur | IIT Madras

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final year B.Tech (Electronics & Telecommunication Engineering)

Semester-II

SLM41.2 : Self Learning Module-II (Professional Course)

Mechatronics

Teaching Scheme:
Self Learning , 2 credits

Examination Scheme:
ESE- 50 Marks

This Course is introduction course aim at designing mechatronics system, which required integration of the mechanical, electrical, electronics and computing engineering disciplines within a unified framework.

Course Objectives

1. Understand what makeup a mechatronics systems
2. Understand how to model a mechatronics systems
3. Learn what is a PLCs and how to program it using ladder logic
4. Understand the concept of Micro-electro Mechanical systems

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Course Outcomes

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

1. Explain the types and applications of sensors and actuators in Mechatronics systems
2. Program PLC using ladder logic
3. Explain MEMS and its applications

Section-I

Unit 1- Mechatronics systems and devices (07Hrs)

Basic definition, key elements of Mechatronics, historical perspective, Examples of Mechatronics systems: Car Engine managements, Automatic camera, white goods and domestic appliances, various systems in a modern automobiles (ABS, TCS,DAS), Modern HVACs, CNC machines and factory automation, IOT, Industry 4.0.

Unit 2- PLCs & MEMS (08Hrs)

PLC Architecture, I/O Processing, NPN/PNP Sourcing and sinking, Ladder diagrams, PLC vs PC based systems.

History of Micro-Electro-Mechanical Systems (MEMS), Market for MEMS, Introduction to MEMS simulation and design tools, Lumped element modeling and design, Electrostatic Actuators, Electromagnetic Actuators, Linear and nonlinear system dynamics.

Section II

Unit 3- Sensors and Actuators (10Hrs)

Sensors: Classification, Principle of operation & Characteristic, Linear and rotational sensors, acceleration sensors, Force sensors, Torque sensors, Flow sensors, Temperature sensors, Distance sensors, optical sensors, ultrasonic sensors, micro-sensors, Selection criteria.

Actuators: Classification of Actuators, Hydraulic and pneumatic actuators, DC motors, Servomotors, Stepper motors, AC Motors switches, solenoids, Piezoelectric actuators, Variable Frequency drive motors (VFDs), Micro actuators

Unit 4 - Application case studies: **(05Hrs)**

Gyroscope, Digital Micro-mirror Devices (DMD), Capacitive Micro-machined Ultrasonic Transducers (CMUT).

Text Books

1. W. Bolton, Mechatronics, Pearson Publications, 4th edition
2. Shetty & Kolk, Mechatronics systems design, Cengage Learning, 2nd Edition
3. Nadim Maluf, An Introduction to Microelectromechanical Systems Engineering, Artech House, 3 rd edition, 2000.

Reference Books

1. Bishop et. al. Handbook of Mechatronics, CRC press 2nd edition
2. W. Bolton, Programmble Logic Controllers, Pearson Publications 3rd Edition
3. Mahalik Nitaigour Premchand, MEMS, McGraw-Hill, 2007

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.Tech. (Electronics and Telecommunication Engineering)

Semester - II

SLM41.3 : Self Learning Module II (Professional Course)

Biomedical Instrumentation

Teaching Scheme: **Examination Scheme:**

Self Learning, 2 credits **ESE: 50 Marks**

Course Objectives:

1. To know specific engineering and instrumentation principles
2. To understand how biomedical signals are generated through various medical instruments

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Course Outcomes:

At the end of this course, the student will be able to

1. Explain the anatomy and physiology of the human body, also the role of engineers in healthcare
2. Describe about generation and processing of signals using various medical instruments

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Section– I

Unit 1: Fundamentals of Medical Instruments (07Hrs)

Introduction to medical instruments, its basic components and their classifications. Anatomical and Physiological mechanisms of the human body - Biological neurons and different biological systems: auditory, visual, respiratory, nervous and cardiovascular. Challenges involved in measuring a living system and the role of engineers in healthcare facilities.

Unit 2: Removal of artifacts/Event detection of the biomedical signals/images (08Hrs)

Biomedical signal processing: The case studies of various biomedical signals for removal of artifacts/ feature extraction. Image-related biomedical signal processing: The case studies of various biomedical images for removal of artifacts/ feature extraction.

Section-II

Unit 3 – Data acquisition of biomedical signals/images (10Hrs)

Transducers and electrode placement for recording the biomedical signals/images. Clinical laboratory instruments for biomedical signals/images. 1D biomedical signals: Electrocardiogram (ECG), Electroencephalogram (EEG), Electroneurogram (ENG), Electromyogram (EMG), Electroretinography (ERG), Electrooculography (EOG), Event-related Potentials(ERPs), Action

potential, Electrogastrogram (EGG), Phonocardiogram (PCG), Speech production and recognition, sensory and Otoacoustic emission signals. 2D biomedical signals (or images): X-Ray, Magnetic resonance imaging (FMRI), Ultrasonic images, CT scans, and PET.

Unit 4 – Clinical Relevance **(05Hrs)**

Therapeutic and prosthetic devices, rehabilitation, Patient monitoring systems.

Text Books:

1. Cromwell: Biomedical Instrumentation and Measurements; PHI, New Delhi, 2nd Ed. 2015.

Reference Books:

1. R. S. Khandpur, Handbook of biomedical instrumentation, Tata McGraw-Hill.
2. R. M. Rangayyan, Biomedical Signal Analysis: A Case-Study Approach, John Wiley & Sons.
3. John G Webster, Medical Instrumentation: Application and Design, John Wiley & Sons

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics& Telecommunication Engineering)
Semester-II

ET 421: Project – II (Capstone Project)

Teaching Scheme:
Practical: 20 Hours /week, 10 credits

Examination Scheme:
ICA– 100 Marks
OE – 100 Marks

Course Pre-requisite:

Student shall have technical competency as well as behavioral facet to carry project as a part of a team. He/She shall have an adequate knowledge of hardware and software architecture and associated programming skills. He shall also possess necessary technical report writing skills, presentation skills and shall have proficiency in office software for word processing and presentation

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Course Objectives:

1 To make student apply design concept, prepare detailed planning to solve problem undertaken
2. To make student to evaluate and analyze performance of the proposed solution to the problem undertaken
3. To make student aware of his responsibilities working in a team to provide time bound solutions to the problem
4. To make student write technical specifications, project document over problem undertaken.
5. To make student demonstrate a sound technical presentation of their selected project topic.
6. To make student aware of different software tools and soft-skills required to practice at various stages of project execution

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Course Outcomes:

At the end of the course students will be able to
1 Apply different design concepts to plan solution to the problem undertaken
2. Evaluate performance and detailed analysis of outcome of the proposed solution for problem undertaken
3. Work in project group following work ethics
4. Communicate with engineers and the community at large in written and oral forms
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.
6. Select and use proper programming solution, simulator and necessary soft skills to provide solution to problem undertaken.

The objective of Project- II is to enable the student to extend further the investigative study taken up under Project-I, either fully practical or involving both theoretical and practical work, under the guidance of a supervisor from the department alone or jointly with a Supervisor drawn from

R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment normally includes:

1. In depth study of the topic assigned in the light of the report prepared under project-I

2. Review and finalization of the approach to the problem relating to the assigned topic

3. Preparing an action plan for conducting the investigation, including team work;

4. Detailed analysis/modeling/simulation/design/problem solving/experiment as needed

5. Final development of product/process, testing, results, conclusions and future directions

6. Preparing a paper for conference presentation/publication in journals, if possible

7. Preparing a project document in the standard format for being evaluated by the department.

8. Final seminar presentation before a departmental committee

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Final Year B.Tech (Electronics& Telecommunication Engineering)

Semester-II

ET 421 : Project – II (Internship)

Teaching Scheme:
Credit : 10 credits

Examination Scheme:
ICA– 100 Marks
OE – 100 Marks

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales.

Course Objectives:

1 To give exposure for technical students of industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry
2. To Provide possible opportunities to learn, understand and sharpen the real time technical / managerial skills required at the job
3. To Familiarize with various materials, processes, products, softwares and their applications along with relevant aspects of quality control
4. To expose students to the engineer's responsibilities and ethics
5. To Understand the social, economic and administrative considerations that influence the working environment of industrial organizations
6. To understand the psychology of the workers and their habits, attitudes and approach to problem solving

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Course Outcomes:

At the end of the course students will be able to

1. Develop professional competence through internship.
2. Apply academic knowledge in a personal and professional environment.
3. Build the professional network and expose students to future employees.
4. Apply professional and societal ethics in their day to day life.
5. Become a responsible professional having social, economic and administrative considerations
6. Make own career goals and personal aspirations.

Engineering internships are intended to provide students with an opportunity to apply theoretical knowledge from academics to the realities of the field work/training. The following guidelines

are proposed to give academic credit for the internship undergone as a part of the Final Year Engineering curriculum.

1. Students may undergo internship with Small/ Medium / Large scale industries to make themselves ready for the industry.
2. Students should be available in the industry for the period of 12 to 14 weeks of the semester.
3. The evaluation of internship activities carried out shall be done by Program Head / Cell Incharge / Project Coordinator / Project Guide / Faculty mentor.
4. Every intern shall send weekly report to their internal guide without fail. Interns shall have at least fortnightly communication with the internal guide without fail.
5. Students shall maintain Internship Diary/ Internship Workbook. The students should record in the daily training diary account of the observations, impressions, information gathered and suggestions given, if any.
6. Student will give a seminar based on his training report every month, before an expert committee constituted by the concerned department as per norms of the institute.
7. The Internship report shall be presented covering following recommended fields but not limited to:
   - ➢ Title/Cover Page
   - ➢ Internship completion certificate.
   - ➢ Internship Place Details- Company background-organization and activities/Scope and object of the study / personal observation.
   - ➢ Index/Table of Contents
   - ➢ Introduction
   - ➢ Title/Problem statement/objectives
   - ➢ Motivation/Scope and rationale of the study
   - ➢ Methodological details
   - ➢ Results / Analysis /inferences and conclusion
   - ➢ Suggestions / Recommendations for improvement to industry, if any
   - ➢ Attendance Record
   - ➢ List of reference (Library books, magazines and other sources)
8. The report submitted by student will be accepted and considered for final evaluation only if student continuously reports their work to the project guide and periodically evaluated by the internal examiners at college level.