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 ENGINEERING

Name of the Course: B.E.- IV (Sem. VII & VIII)

(Syllabus to be implemented from w.e.f. June 2019)

PAH SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF ENGINEERING & TECHNOLOGY
Electronics 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

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

C. Program Specific Outcomes

1. **Algorithms** : Graduate can design, realize and validate algorithms for different analog and digital electronic systems
2. **Systems**: Graduate can design, implement and test different analog and digital electronic systems
3. **Self Learning:** Graduate with his sound fundamentals is prepared to comprehend applications of the Electronics engineering through self learning mode

PAH SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Engineering & Technology (Revised from 2016-17)

Credit System structure of B.E. Electronics Engineering W.E.F. 2019-20 *Semester I*

Course Code	Theory Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ISE	ESE	ICA	Total
EN411	Power Electronics	4	_	_	4	30	70	--	100
EN412	Computer Networks	4	_	_	4	30	70	-	100
EN413	Mobile Technology	4	-	_	4	30	70	25	125
EN414	Internet of Things	3	1	_	4	30	70	_	100
EN415A to EN415D	Elective - I	3	1	_	4	30	70	25	125
Sub Total		18	2	_	20	150	350	50	550
Course Code	**Laboratory Course Name**								
							ESE		
							POE	OE	
EN411	Power Electronics	_	_	2	1	_	50	--	25	75
EN412	Computer Networks	_	_	2	1	_	_	25	25	50
EN414	Internet of Things	--	--	2	1	--	--	25	25	50
EN416	Project- I	_	_	4	2	_	_	_	50	50
EN417	Vocational Training	_	_	_	1	_	_	_	25	25
Sub Total		--	-	10	6		100		150	250
Grand Total		**18**	**2**	**10**	**26**	**150**	**450**		**200**	**800**

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

SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Engineering & Technology (Revised from 2016-17)

Credit System structure of B.E. Electronics Engineering W.E.F. 2019-20 *Semester II*

Course Code	Theory Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ISE	ESE	ICA	Total
EN421	Advanced Communication Engineering	4	_	_	4	30	70	-	100
EN422	Audio Video Systems	4	_	_	4	30	70	-	100
EN423	Electronic System Design	3	1	_	4	30	70	-	100
EN424A to EN424D	Elective – II	3	1	_	4	30	70	25	125
Sub Total		14	2	–	16	120	280	25	425
Course Code	**Laboratory Course Name**								
							ESE		
							POE	OE	
EN421	Advanced Communication Engineering	_	_	2	1	_	_	50	25	75
EN422	Audio Video Systems	_	_	2	1	_	_	_	25	25
EN423	Electronic System Design	_	_	2	1	_	--	50	25	75
EN425	Project- II	_	_	8	4	_	_	100	100	200
Sub Total		_		14	7	_	200		175	375
Grand Total		**14**	2	**14**	**23**	**120**	**480**		**200**	**800**

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

Elective I		*Elective II*	
Course Code	***Course***	***Course Code***	***Course***
EN415A	Biomedical Instrumentation	EN424A	Broadband Communication
EN415B	Mechatronics	EN424B	PLC and Industrial Controllers
EN415C	Image Processing	EN424C	Speech Processing
EN415D	Database Management Systems	EN424D	Data Analytics

- **Note** –

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining students exceeds 7, then a new batch shall be formed.
2. Vocational Training (evaluated at B.E. Part-I) 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
3. Appropriate Elective I & II Subjects may be added when required.
4. Project group for B.E. (Electronics) Part I and Part II shall not be of more than **three** students.
5. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable

PAH Solapur University, Solapur

B.E. (Electronics) Semester-I

EN411 POWER ELECTRONICS

Teaching Scheme
Lectures – 4 Hours/week, 4 Credits
Practical – 2 Hours/week, 1 Credit

Examination Scheme
ISE–30 Marks, **ESE**-70 Marks
ICA– 25 Marks
Practical & Oral exam – 50 Marks

Power electronics deals with the application of solid-state electronics for the control and conversion of electric power techniques, which require switching on and off of power devices. It provides analysis of power electronics applications such as three phase controlled rectifiers, choppers, inverters and cycloconverters. It also deals with application of power electronics converters like closed loop control of AC and DC drives and power factor controlling techniques.

Course Prerequisite:

Student shall have completed a comprehensive course covering basics of power devices and its applications for single phase conversion and shall have an ability to analyze circuits containing power devices. Student shall also have knowledge of Fourier series and AC and DC motors.

Course Objectives:

1. To make student understand switching behavior, design and analyze the three phase controlled rectifiers.
2. To make student understand the operation and analysis of choppers.
3. To make student analyze switching behavior of single phase and three phase cycloconverter.
4. To make student understand switching behavior and analysis of single phase and three phase voltage source inverters
5. To make student acquainted with the applications of power electronic converters in AC and DC drives.
6. To emphasis student with different power factor controlling techniques.

Course Outcomes:

1. Student can analyze and design the three phase controlled rectifiers.
2. Student can analyze different types of choppers.
3. Student can analyze single phase and three phase cycloconverters
4. Student can analyze single phase and three phase voltage source inverters.
5. Student can describe power electronics applications to control AC and DC drives.
6. Student can describe different power factor controlling techniques.

SECTION I

Unit 1- Three phase controlled rectifiers No of lectures-10

- **Prerequisite:** Concepts of single phase controlled rectifiers, Fourier expression

- **Objectives:**

1. To develop student with an understanding of the switching behavior and design of three phase controlled rectifiers.
2. To make student realize effect of source inductance on performance of three phase controlled rectifiers.
3. To make student understand operation of three phase dual converter.
4. To make student understand control scheme for three phase converters using microcontroller.

- **Outcomes:**

After completing this unit, student –

1. Can analyze and design three phase controlled rectifiers with different types of load.
2. Can analyze the effect of source inductance on performance of controlled rectifiers.
3. Can describe operation of three phase dual converter with energy saving conversion system.
4. Can explain importance and control schemes for three phase converters using suitable microcontroller.

- **Unit Content:**

Concepts of three phase, analysis of three phase half wave controlled rectifier with R and RL load, expressions for average output voltage, rms output voltage; bridge converters: analysis of three phase half controlled and full controlled converters with R and RL load, expressions for average output voltage, rms output voltage, effect of source inductance, three phase dual converters, microcontroller/DSP based firing scheme for three phase controlled rectifiers.

- **Content Delivery Methods:**

Chalk and talk, power point presentations, MATLAB simulation for three phase converters.

- **Assessment Methods:**

Questions based on mathematical expression for average and rms output voltage with different types of loads, different waveforms and numericals for different types of 3 phase rectifiers with advantages and limitations, dual converter, microcontroller/DSP based firing scheme for three phase controlled rectifiers

Unit 2 - Choppers: No of lectures – 10

- **Prerequisite** – Fundamentals of power devices.

- **Objectives –**

1. To make student understand operation and analysis of choppers.
2. To make student classify choppers in terms of their operating modes.
3. To make student understand chopper control using different control strategies.
4. To make student understand operation principles and circuit topologies of various chopper commutation circuits.
5. To make student understand operation of multiphase choppers.

- **Outcomes-**

After completing this unit, student –

1. Can analyze different types of choppers.
2. Can classify choppers in terms of their operating envelopes.
3. Can describe chopper control using different control strategies.
4. Can describe operation principles and circuit topologies of various chopper commutation circuits and select it for suitable application
5. Can describe operation of multiphase choppers.

- **Unit Content:**

Classification, principle of step-down and step-up chopper, control techniques of chopper (Numerical problems expected)
Chopper classification: single quadrant, two quadrants, four quadrants
Thyristor chopper circuits : voltage commutated chopper, current commutated chopper , load commutated chopper , single SCR chopper, Jones chopper and Morgan chopper.
Multiphase choppers, chopper circuit design.

- **Content Delivery Methods:**

Chalk and talk, power point presentation, MATLAB simulation for different choppers.

- **Assessment Methods:**

Questions based upon mathematical expression for different parameters, different types of load, different waveform, numerical problems for step-down and step-up chopper with their advantages and limitations and chopper control techniques, descriptive questions based upon circuit diagram and waveforms ensure understanding the operations of thyristor chopper circuits and multiphase choppers.

Unit 3 - Cycloconverter: No of lectures – 06

- **Prerequisite** – Concepts of controlled rectifiers and power devices.

- **Objectives –**

1. To make student understand need and operating principle of cycloconverter.
2. To make student analyze switching behavior of single phase and three phase cycloconverter.
3. To make student understand control scheme for cycloconverter using microcontroller.

- **Outcomes-**

After completing this unit, student –

1. Can describe need and operation of cycloconverter.
2. Can analyze single phase and three phase cycloconverters
3. Can explain control schemes for cycloconverters using suitable microcontroller.

- **Unit Content:**

Single phase to single phase cycloconverter:-mid-point and bridge type cycloconverter, three phase to single phase cycloconverter with R and RL load, three phase to three phase three pulse and six pulse converter, circulating and non circulating mode, expression for output voltage of cycloconverter, control scheme for cycloconverter

- **Content Delivery Methods:**

  Chalk and talk, power point presentations, MATLAB simulation for single phase and three phase cycloconverter

- **Assessment Methods:**

  Descriptive questions based upon circuit diagram and waveforms ensuring understanding of the operation of single phase and three phase cycloconverters, expression for output voltage and control scheme for cycloconverter.

SECTION II

Unit 4- Inverters No of lectures – 12

- **Prerequisite:** Fundamentals of controlled rectifiers and power devices, Fourier series.

- **Objectives:**

1. To make student understand switching behavior and analysis of single phase and three phase voltage source inverters
2. To make student analyze quality of inverters using different performance parameters
3. To emphasize student with different types of modulation techniques to control output voltage and eliminations of harmonics of inverters
4. To make student understand the series and parallel inverter.

- **Outcomes:**

  After completing this unit, student -

1. Can analyze single phase and three phase voltage source inverters
2. Can analyze quality of inverters using different performance parameters.

3. Can analyze output voltage control and elimination of harmonics by using different modulations techniques
4. Is able to explain the operation of the series and parallel inverter

- **Unit Content:**
  Classification of inverters, single phase voltage source inverter: half bridge & full bridge inverter with R and RL load; Fourier analysis of single phase inverter output voltage; quality of inverters, three phase bridge inverters – 120 & 180 degree conduction modes, voltage control in single phase inverters; PWM techniques-single, multiple and sinusoidal PWM; reduction of harmonics in inverter output voltage: PWM , transformer connection and stepped wave inverters; series inverters - basic series, modified series inverter, parallel inverter with R and RL load.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, MATLAB simulation for single phase and three phase inverters, series and parallel inverter

- **Assessment Methods:**
  Questions based upon mathematical expression for different parameters, load, and waveform; numerical for single phase and three phase inverters with their advantages and limitations, descriptive questions based upon circuit diagram and waveforms, operations of PWM and harmonics reduction techniques, series and parallel inverter.

Unit 5- Control of DC drive No of lectures – 04

- **Prerequisite:** Basics of DC motors, controlled rectifiers and choppers.

- **Objectives:**
  1. To make student understand the various schemes for DC motor speed control.
  2. To make student apply knowledge of controlled converters and choppers for controlling DC drives.
  3. To make student understand closed loop speed control system for DC drive using microcontroller.

- **Outcomes:**
  After completing this unit, student –
  1. Can describe the operation of various schemes for DC motor speed control.
  2. Can apply knowledge of controlled converters and choppers for controlling DC drives.
  3. Can describe importance and closed loop speed control system for DC drive using suitable microcontroller.

- **Unit Content:**
  Concept of electric drive, schemes for DC motor speed control, DC chopper drives; closed loop control of DC drive - phase locked loop control, voltage and current feedback with microcontroller /DSP controller, fuzzy logic control.

- **Content Delivery Methods:**

Chalk and talk; power point presentation and MATLAB simulation for closed loop control of DC drive

- **Assessment Methods:**
  Questions based upon different schemes for DC motor speed control, controlling DC drives using choppers, descriptive questions based upon microcontroller based closed loop control of DC drive and fuzzy logic control.

Unit 6- Control of AC drive No of lectures – 06

- **Prerequisite:** Basics of AC motors, inverters and cycloconverters

- **Objectives:**
  1. To emphasize student with different methods for AC motor speed control
  2. To apply knowledge of controlled converters, inverters and cycloconverters for controlling AC drives
  3. To make student understand closed loop speed control system for AC drive using microcontroller.

- **Outcomes:**
  After completing this unit, student –
  1. Can describe the operation of different methods for AC motor speed control.
  2. Can select appropriate converter to control AC drive.
  3. Can describe closed loop speed control system for AC drive using suitable microcontroller.

- **Unit Content:**
  Speed control of induction motor - stator voltage control, voltage source inverter, cycloconverter control, variable frequency drive; closed loop speed control of AC drive: single quadrant, four quadrant, speed control using microcontroller /DSP controller, fuzzy logic control

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Questions based upon different methods for AC motor speed control, controlling AC drives using inverters , cycloconverters and variable frequency drive descriptive questions based on microcontroller based closed loop control of AC drive.

Unit 7- Power factor improvement **No of lectures – 04**

- **Prerequisite:** Concepts of passive devices and power devices

- **Objectives:**
  1. To make student realize need and importance of power factor improvement.
  2. To make student understand different power factor controlling techniques.

- **Outcomes:**
  After completing this unit, student –
  1. Can describe need and importance of power factor improvement.
  2. Can describe different power factor controlling techniques

- **Unit Content:**
  Effect of poor power factor, methods of reactive power compensation, static VAR compensator (mathematical analysis is not expected)

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Questions based upon different power factor controlling techniques.
- **Internal Continuous Assessment (ICA) :**

  ICA shall consist of minimum ten experiments based upon-
  1. Three phase full controlled converter (feeding resistive and DC motor load)
  2. Step down chopper (feeding DC motor load)
  3. Step up chopper
  4. Jones chopper
  5. Morgan's chopper
  6. Single phase full bridge voltage source inverter
  7. Three phase inverter
  8. Series inverter.
  9. Parallel inverter
  10. Cycloconverter feeding resistive load.
  11. Power factor correction
  12. Simulation of three phase converter, chopper using MATLAB
  13. Simulation of PWM inverters using MATLAB
  14. Simulation of speed control of AC or DC drive

- **Text Books:**
  1. Power Electronics; M.H. Rashid; 3rd Edition; Pearson Education
  2. Power Electronics; M D Singh & K B Khanchandani; 2nd Edition; Tata McGraw Hill
  3. Power Electronics; Dr.P.S. Bimbra; Khanna Publishers

- **Reference Books:**
  1. Industrial and Power Electronics;Dr.Maneesha Gupta and G.K.Mithal;Khanna Publishers
  2. Power Electronics; P.C. Sen; Tata McGraw Hill
  3. Power Electronics; Vedam Subrahmanyam; New Age International Publishers

4. Power Electronics; Mohan, Undeland, Riobbins; 3rd Edition; Wiley
5. Power Electronics and its Applications; Alok Jain; Penram International Publishing Pvt Ltd.

PAH Solapur University, Solapur

B.E. (Electronics) Semester-I
EN412 COMPUTER NETWORKS

Teaching Scheme
Lectures – 4 Hours/week, 4 Credits
Practical- 2 Hours/week, 1 Credit

Examination Scheme
ISE– 30 Marks
ESE -70 Marks
ICA – 25 Marks
OE – 25 Marks

This course is to provide students with an overview of the concepts and fundamentals of data communication, computer networks design, engineering, and installation of networks to connect digital computers. The course will prepare students to plan and implement a network. Also includes peer-to-peer networks, the client-server model, network operating systems and an introduction to wide-area networks.

Course Prerequisite:
The knowledge of analog communication, modulation and channel capacity is required., awareness of different communication ports and hardware support in computers along with protocol stack to support the communication is useful.

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

1. Build and demonstrate fundamental concepts of computer networking.
2. Familiarize with the basic taxonomy and terminology of the computer networking area.
3. Understand network programming and associated services
4. Investigate the fundamental issues driving network design
5. Gain expertise in areas of networking such as the design and maintenance of individual networks

---

Course Outcomes:
After completing this course the student can demonstrate the knowledge and ability to:

1. Describe basic computer network technology.
2. Describe benefits of layered model approach and enumerate layers of the OSI and TCP/IP reference model, explain the function(s) of each layer.
3. Identify different types of network devices and their functions within a network
4. Establish IEEE 802.3 LAN and provide different services to the users.
5. Define subnetting and plan for routing mechanisms.
6. Describe basic protocols of computer networks, their implementation and techniques to enhance network performance

---

SECTION I

Unit 1- Data communication No of lectures – 08

- **Prerequisite:** Telephone networks, telephone network devices, maximum channel capacity, Shannon theorem, and effect of noise on data rate; network operating system, popular NOS used in practical.

- **Objectives:**
  1. To explain student making use of already laid telephone network for data communication and its analysis.
  2. To introduce to student various issues related to data communication, concept of layered reference model, communication across the layers.
  3. To introduce to student serial communication support in PC.

- **Outcomes:**
  After completing this unit, student–
  1. Is able to analyze the performance of telephone network during data communication
  2. Is able to utilize serial communication facility in a PC.

- **Unit Content:**
  Uses of computer networks, network hardware , network software , layered model-communication between layers, ISO-OSI reference model, physical layer- band limited signals, maximum data rate of a channel, circuit switching & packet switching, EIA 232 serial interface standard.

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based upon issues in networking, layered reference model, channel capacity. Practical based on serial communication to assess concepts of serial standard EIA-232

Unit 2– Data link layer issues No of lectures – 08

- **Prerequisite:** Advantages of bundled data communication; different coding standards, errors in communication and BER

- **Objectives:**
  1. To make student understand parameters contributing to error-free communication.
  2. To introduce to student mechanism for data communication between two computers of different capacities.
  3. To make student understand sharing of a common bandwidth amongst multiple computers during data communication.

- **Outcomes:**
  After completing this unit, student

1. Is able to find error correcting and detection code for error free data communication
2. Is able to decide necessary parameters for data communication between two dissimilar computers.

- **Unit Content:**
  Frame making methods, error detection -parity, checksum, CRC, error correction- block parity, hamming code method; flow control - stop and wait mechanism, sliding window flow control mechanism–working principle, link utilization efficiency, go back N ARQ , selective repeat – ARQ, medium access control (MAC) – static and dynamic BW allocation, collision based & collision free protocols, CSMA, data link control protocol-HDLC

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based upon flow control, error control, bandwidth management and data link control protocols, numerical based on flow control, error control.

Unit 3– IEEE LAN standards No of lectures – 06

- **Prerequisite:** Hardware available in computer to support data communication, various important issues like priority in real time services.

- **Objectives:**
  1. To explain student selection of appropriate LAN standard for a particular application.
  2. To make student analyze LAN standard.

- **Outcomes:**
  After completing this unit, student -
  1. Is able to choose appropriate LAN standard based of physical shape of network, type of application.
  2. Is able to create LAN connection and analyze LANs performance for particular application.

- **Unit Content:**
  IEEE 802.3 CSMA/CD- working & performance analysis, megabit LAN, gigabit LAN, IEEE 802.4-token bus, IEEE 802.5-token ring, comparison of LANs

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based on various LAN standards and their performance analysis, practical can be considered for assessment.

Unit 4– Network devices No of lectures – 04

- **Prerequisite: V**arious components of computer networks and communication parameters.

- **Objectives:**
  1. To make student understand selection of appropriate network device for a particular network.

- **Outcomes:**
  After completing this unit, student –
  1. Is able to choose appropriate network device and install it in network.
  2. Is able to examine the traffic handled by these devices with the help of network sniffers.

- **Unit Content:**
  MODEM, switches, hub, bridges, router, gateway

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based on various network devices and their working principle can be considered for assessment

SECTION II

Unit 5– TCP/IP reference model No of lectures –08

- **Prerequisite:** Hardware like network interface card in computer, difference between packet and frame communication, need of protocols to accommodate various applications.

- **Objectives:**
  1. To explain student ways of providing internet services on available computer.
  2. To make student understand different addresses like IP and MAC during data communication

- **Outcomes:**
  After completing this unit, student –
  1. Is able to program IP address and other parameters to computer to avail internet services.
  2. Is able to use various networking commands and parameters in different types of communication protocols.

- **Unit Content:**
  TCP/IP protocol suit, TCP & IP header format, encapsulation, IPv4 addressing – sub netting & masking, user datagram protocol (UDP) – transmission control protocol (TCP) - three way handshake – congestion & its control

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based on various communication protocols, issues like congestion control.

Unit 6– Network layer No of lectures –10

- **Prerequisite:** Concepts of fairness and optimality in routing of data, issues like static & dynamic networks along with changing nature of data traffic on networks.

- **Objectives:**
  1. To explain student selection of appropriate routing protocol for a network.
  2. To make student understand performance analysis of selected routing protocol.

- **Outcomes:**
  After completing this unit, student –
  1. Is able to decide routing mechanism based on the nature of network and traffic flow.
  2. Is able to utilize protocol to assign dynamic IP address and supervise the network.

- **Unit Content:**
  Virtual circuit & datagram approach, routing protocols – shortest path, distance vector routing, link state, DHCP, ICMP. ARP

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based on various routing protocols, protocols like DHCP, ICMP.

Unit 7– Network programming No of lectures – 08

- **Prerequisite:** Client and server communication, multicast service.

- **Objectives:**
  1. To explain student use of socket to communicate between client and server.
  2. To make student understand client –server communication using standard communication protocol.

- **Outcomes:**
  After completing this unit, student –
  1. Is able to create simple TCP, UDP server and client and start the communication services.
  2. Is able to control multiple clients with the help of single server.

- **Unit Content:**

Socket, difference between TCP/IP, UDP/IP and multicast sockets, simple server, simple client, client –server communication over sockets, network analyzer

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based upon sockets, various services over sockets, practical on client-server communication using various protocols

---

- **Internal Continuous Assessment:**
  ICA shall consist of minimum eight experiments based upon above curriculum.

- **Text Books:**
  1. TCP/IP Protocol Suite; Behrouz A. Forouzan ; 4th Edition
  2. Computer Networks; Andrew S. Tanenbaum; 4th Edition; Prentice Hall
  3. Data Communication and Computer Networks; P. C. Gupta; Prentice Hall India publication
  4. Unix Network Programming- Networking APIs: Sockets & XTI; Richard Stevens; Prentice Hall India Publication

- **Reference Books:**
  1. Internetworking with TCP/IP Vol III; Client-Server Programming & Applications; Douglas E. Comer; 4th Edition; Prentice Hall
  2. Data and Computer Communications; William Stallings- Pearson Education Asia publication
  3. High Speed networks and Internets- Performance and Quality of service; William Stallings; Pearson Education Asia publication

PAH Solapur University, Solapur

B.E. (Electronics) Semester-I

EN413 MOBILE TECHNOLOGY

Teaching Scheme **Examination Scheme**

Lectures – 4 Hours/week, 4 Credits

ISE-30 Marks,
ESE-70 Marks
ICA – 25 Marks

The last decade of 20th century has witnessed a lot of activities in wireless and mobile communication and a convergence of communication technology and information technology. This fundamental course in mobile communication aims at triggering interest of students into two major fields of mobile communication. First section of this course covers cellular mobile communication with major focus on 3G GSM standard. The second section discusses topics related to mobile computing for digital data transfer.

Course Prerequisite:
Student shall boast basic knowledge of digital communication systems and wave propagation theory. Student shall also possess fundamental knowledge of internet and computer networks in general.

Course Objectives:

1. To make student realize effect and challenges for device portability and user mobility towards communication system design
2. To introduce to student cellular communication and frequency reuse concepts
3. To make student comprehend GSM system in detail and CDMA 95 as introductory
4. To introduce to student and to trigger their interest in the fast intensifying field of mobile computing for digital data transfer

Course Outcomes:

1. Student can give details for design challenges for wireless and mobile system development.
2. Student can describe frequency reuse concept and can apply different techniques for improving coverage and capacity
3. Student can describe GSM in detail with architecture, protocol, signal processing and security
4. Student can evaluate CDMA technique and can describe IS 95 block diagram and channels
5. Student can describe IEEE 802.11 and Bluetooth with architecture and protocol
6. Student can explain mobile TCP/IP

SECTION I

Unit 1- Fundamentals of mobile communication No of lectures -08

- **Prerequisite:** Fundamentals of digital communication, wave propagation, basics of data network

- **Objectives:**

1. To make student understand device portability and user mobility
2. To introduce to student different signal propagation effects
3. To make student realize why standard schemes from fixed network fails in wireless environment and how they are modified

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to classify devices depending upon mobility and wireless
  2. Can evaluate different signal propagation effects
  3. Can analyze few basic wireless MAC schemes

- **Unit Content:**
  Wireless and mobility, applications, mobile radio environment- signal propagation, path loss, fading, other signal propagation effects, frequency hopping spread spectrum, medium access control-hidden and exposed terminal, near and far terminals, MAC for mobile

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based upon analysis of signal propagation effects, wireless MAC, examples based upon FHSS

Unit 2- The cellular concepts No of lectures-06

- **Prerequisite:** Fundamentals of TDMA, FDMA, wave propagation

- **Objectives:**
  1. To make student understand fundamental cellular concepts of frequency reuse and handover
  2. To introduce to student different strategies adopted for improving coverage and capacity

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to evaluate frequency planning schemes
  2. Is able to derive for co channel reuse ratio and able to evaluate relation of cluster size, capacity and S/I
  3. Is able to solve numerical examples based on system capacity
  4. Can explain different handover strategies
  5. Can explain different strategies adopted for improving coverage and capacity

- **Unit Content:**
  Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**

Questions based upon derivation of channel reuse ratio, numerical examples on system capacity, analysis of channel reuse strategies, explanation of handover strategies and strategies for improving coverage and capacity

Unit 3- Digital cellular system- GSM & CDMA No of lectures-12

- **Prerequisite:** Fundamentals of digital modulation schemes, cellular concepts
- **Objectives:**
  1. To make student understand GSM system in detail
  2. To introduce to student salient features of GPRS and system architecture
  3. To introduce to student basics of DSSS
  4. To give student a overview of IS 95
- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to explain various aspects of GSM system in detail
  2. Can compile features of GPRS, EDGE & LTE
  3. Can express principles of DSSS
  4. Can give a general overview of IS 95
  5. Is motivated to compile information about evaluation of GSM and CDMA and their emerging standards

- **Unit Content:**
  GSM- system architecture, radio subsystem, channels, frame structure, signal processing, protocols, localization and calling, security, services, CDMA- direct sequence spread spectrum, processing gain, pseudorandom sequences, orthogonal codes, IS 95- frequency and channel specifications
  Introduction to GPRS- capacity, QOS, system architecture; EDGE, LTE

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based upon various aspects of GSM system, overview of GPRS and IS 95, numerical examples of DSSS

SECTION II

Unit 4- Mobile computing No of lectures-04

- **Prerequisite:** Basics of computer network and internet

- **Objectives:**
  1. To introduce to student general architecture for mobile computing and various applications and services associated

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to explain multi tier architecture for mobile computing application development and its significance

- **Unit Content:**
  Introduction, functions, devices, environment – middleware and gateways, architecture, applications and services

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study

- **Assessment Methods:**
  Questions based upon explanation of multi tier architecture for mobile computing

Unit 5- Wireless LAN- IEEE 802.11 No of lectures-08

- **Prerequisite:** Fundamentals of digital modulation schemes, cellular concepts

- **Objectives:**
  1. To make student understand WLAN 802.11 system in detail
  2. To give student a very short review of newer development of 802.11X standards
  3. To give student a very brief overview of Wi Max

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to explain various aspects of WLAN 802.11 system in detail
  2. Can compile features of newer development of 802.11X standards
  3. Can present a very brief overview of Wi Max
  4. Is motivated to compile information about evaluation of 802.1X and their emerging standards

- **Unit Content:**
  Advantages, infrastructure and ad hoc architectures, protocol, PHY layer, MAC layer, MAC frames, MAC management, mobility support, applications, brief overview of newer developments, introduction to Wi Max

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study

- **Assessment Methods:**
  Questions based upon various aspects of WLAN 802.11 system, overview of Wi Max

Unit 6- Wireless PAN – Bluetooth No of lectures-05

- **Prerequisite:** fundamentals of digital modulation schemes, cellular concepts

- **Objectives:**
  1. To make student understand Bluetooth system in detail

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to explain various aspects of Bluetooth system in detail

- **Unit Content:**
  User scenario, architecture, protocol stack, radio layer, baseband layer, physical links

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study

- **Assessment Methods:**
  Questions based upon various aspects of Bluetooth

Unit 7- Mobile TCP/IP No of lectures-09

- **Prerequisite:** TCP/IP protocol stack – functionality network layer and transport layer

- **Objectives:**
  1. To make student realize modifications required at network layer and transport layer to support mobility along with challenges
  2. To introduce to student in brief protocols and mechanism developed for the network layer to support mobility with mobile IP
  3. To introduce to student in brief protocols and mechanism developed for the transport layer to support mobility

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to analyze requirements for modifications at network layer and transport layer to support mobility
  2. Can explain protocols and mechanism developed for the network layer and transport layer to support mobility

- **Unit Content:**
  Mobile IP- entities, IP packet delivery, agent discovery and registration, tunneling and encapsulation, optimization, dynamic host configuration protocol; mobile TCP- indirect TCP, snooping TCP, mobile TCP

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study

- **Assessment Methods:**
  Questions based upon explanation of mobile network and transport layer protocols

- **Internal Continuous Assessment (ICA) :**
  ICA shall be based upon minimum five assignments completed by student based upon above curriculum. It is recommended that assignments shall induce student to compile, compare and evaluate various emerging technologies and standards in cellular communication, mobile computing and their convergence. Student is encouraged to explore various web resources for the same.

- **Text Books:**
  1. Mobile Communications; Jochen Schiller; 2nd edition; Pearson Education
  2. Wireless Communications: Principles and Practice; Theodore S. Rappaport; 2nd edition; PHI Learning Private Limited
  3. Mobile Computing; Asoke K Talukdar, Roopa R Yavagal; Tata McGraw Hill Publishing Company Limited,
  4. Introduction to Wireless & Mobile Systems; Dharma Prakash Agrawal, Qing-An Zeng; 3rd edition; Cengage Learning
  5. Wireless Communications, T L Singal, McGraw Hill Education (India) Private Limited

- **Reference Books:**
  1. Mobile Communication Design Fundamentals; William C. Y. Lee; 2nd edition; Wiley India
  2. Mobile Cellular Telecommunications: Analog and Digital Systems; William C. Y. Lee; 2nd edition; McGraw- Hill International Edition
  3. Third Generation CDMA Systems for Enhanced Data Services, Giridhar Mandyam, Jersey Lai, Elsevier- Academic Press

PAH Solapur University, Solapur

B.E. (Electronics) Semester-I
EN414 Internet of Things

Teaching Scheme	**Examination Scheme**
Lectures – 3 Hours/week, 3 Credits	**ESE** - 70 Marks
Tutorial – 1 Hour/week, 1 Credit	**ISE** - 30 Marks
Practical – 2 Hours/week, 1 Credit	**ICA** - 25 Marks
	OE - 25 Marks

The Internet of Things (IoT) refers to the systems in which different devices, equipped with sensors and signal processing, are connected through a network to communicate with each other with/without central servers. This course provides a thorough introduction to the different components of an IoT system. The course also introduces cloud platforms of IoT and different communication protocols. Introduction to Cortex M Series ARM architecture is also a part of this course.

Course Prerequisite:
Student has completed a course in microcontroller and interfacing and has an adept knowledge of assembly and C language programming, knowledge of interfacing techniques and working of different peripherals, student also has completed a course in computer network and has knowledge of TCP/IP, UDP networking protocols, OSI layers.

Course Objectives:

1. To make student aware of different components of an IoT System
2. To make student understand the architecture of ARM Cortex M3 series microcontroller.
3. To make student learn interfacing of different peripherals with microcontroller.
4. To make student learn different communication technologies used in IoT.
5. To make student learn different IoT application protocols.
6. To introduce to student different cloud platforms of IoT.

Course Outcomes:

1. Student can elaborate different components of an IoT system.
2. Student can describe the architecture of ARM Cortex M3 series microcontroller
3. Student can write interfacing program for different applications with microcontroller.
4. Student can describe different communication technologies used in IoT.
5. Student can illustrate MQTT & CoAP application protocols.
6. Student can elaborate different cloud platforms of IoT.

SECTION I

Unit 1 - Introduction to Internet of Things No of lectures – 05

- **Prerequisite:** Basics building blocks of microcontroller and computer networks.

- **Objectives:**
  1. To introduce IoT systems.
  2. To make student learn IoT systems architecture.
- **Outcomes:**
  After completing this unit student -
  1. Can illustrate IoT system architecture.
  2. Can describe different components of IoT systems architecture.

- **Unit Content:**
  Introduction to IoT, different components of an IoT system: embedded systems, sensors, communication systems, cloud, applications of IoT in various domains.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Questions based upon IoT system architecture.

Unit 2 – Embedded Systems for IoT No of lectures – 07

- **Prerequisite:** Basics of microcontroller based systems.

- **Objectives:**
  1. To make student understand Linux based embedded system.
  2. To make student understand role of embedded systems in IoT.

- **Outcomes:**
  After completing this unit student -
  1. Can illustrate Linux based embedded system.
  2. Can elaborate role of embedded systems in IoT.

- **Unit Content:**
  Introduction to embedded systems, different components of an embedded system, and basics of microcontroller based embedded systems; basics of Linux based embedded systems, role of embedded systems in IoT.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Questions based upon microcontroller and Linux based embedded systems.

Unit 3 – Introduction to ARM Cortex Microcontroller No of lectures – 10

- **Prerequisite:** Basics of microcontroller architectures, C and assembly programming.

- **Objectives:**
  1. To make student understand architecture of ARM Cortex-M3 core.
  2. To make student understand the use of instruction set of ARM Cortex-M3 core and write programs in assembly language for different tasks.
  3. To make student to learn architecture of ARM Cortex-M3 core based microcontroller, working of on chip peripherals and interfacing different peripherals.

- **Outcomes:**
  After completing this unit student -
  1. Can describe architecture of ARM Cortex-M3 core.
  2. Can able to write a program using assembly language by making use of ARM Cortex-M3 core instruction set for different tasks.
  3. Can describe architecture of ARM Cortex-M3 core based microcontroller, working of on chip peripherals and interface different peripherals.

- **Unit Content:**
  Introduction to ARM architecture, cortex series classification (A, R, M series), ARM Cortex-M series family, ARM Cortex-M3 processor overview, block diagram, registers, memory map, instruction set: data accessing, processing, arithmetic, program flow control etc., exception handling, low-power features, requirements, sleep mode, development of low-power applications, basic embedded C programs for on-chip peripherals, interfacing I/O devices like led's, switch's etc., serial communication, analog interfacing and data acquisition, concepts of application programming interface (API).

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, simulation software

- **Assessment Methods:**
  Questions based upon architecture of ARM Cortex-M3 core, and programming by using the instruction set, architecture of ARM Cortex-M3 core based microcontroller, working of on chip peripherals, interfacing of different peripherals, and programming on interfacing.

SECTION II

Unit 4 – Communication Technologies for IoT No of lectures – 08

- **Prerequisite:** Basics of computer networks, TCP/IP protocols

- **Objectives:**
  1. To make students understand basics of communication technologies
  2. To make students understand architecture, characteristics of different communication technologies.

- **Outcomes:**

After completing this unit student –

1. Can describe basics of communication technologies
2. Can illustrate architecture, characteristics of different communication technologies.

- **Unit Content:**
  Basics of the communication technologies like Bluetooth Low Energy (BLE), Zigbee, Wifi, RFID, their architecture, characteristics, limitation, power consumption parameters and applications

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, simulation software

- **Assessment Methods:**
  Questions based upon architectures, characteristics etc. of different communication technologies.

Unit 5 - Application Protocols for IoT No of lectures – 07

- **Prerequisite:** Basics of TCP/IP/UDP network protocols, OSI layers

- **Objectives:**
  1. To make students learn architectures of different IoT application protocols
  2. To make students understand implementations and applications of application protocols

- **Outcomes:**
  After completing this unit student –
  1. Can illustrate architectures of different IoT application protocols
  2. Can describe implementations and applications of application protocols

- **Unit Content:**
  Basics of application protocols like MQTT and CoAP, their features, framework, message formats, implementations and applications

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, simulation software

- **Assessment Methods:**
  Questions based upon architectures of different IoT application protocols, their features, frameworks, message format etc.

Unit 6 - Cloud Platforms for IoT No of lectures – 07

- **Prerequisite:** Basics of programming language, API's

- **Objectives:**
  1. To make students learn different cloud architectures for IoT, their coasting structures, performance metrics etc.
- **Outcomes:**
  After completing this unit student –
  1. Can demonstrate different cloud architectures for IoT, their coasting structures, performance metrics etc.
- **Unit Content:**
  Cloud architecture for IoT, concept of APIs, survey of various IoT cloud platforms, understanding the costing structure of cloud for IoT services, performance metrics for cloud platforms in IoT
- **Content Delivery Methods:**
  Chalk and talk, power point presentation, simulation software
- **Assessment Methods:**
  Questions based upon architectures of different IoT cloud platforms, their coasting structures, performance metrics etc.

- **Internal Continuous Assessment (ICA) :**
  ICA consists of minimum 6 tutorials and minimum 8 practical based on curriculum.
  Recommended tutorial and practical:
  1. Interfacing general purpose I/O devices like LED's, switches
  2. Interfacing motors
  3. Reading sensor values and plotting them on the PC through UART
  4. Interfacing BLE/Wifi modules with ARM based platforms
  5. Sending sensor data to the cloud using Wifi
  6. Sending sensor data to cell phone using BLE.
  7. Implement an interrupt handler to illustrate low power feature
  8. Implement Bluetooth Low Energy connection between the microcontroller kit and smart devices.

- **Text Books**
  1. Internet of Things by Raj Kamal
  2. The Definitive Guide to the ARM Cortex-M3 by Joseph Yiu
  3. Internet of Things for Architects by Perry Lea
  4. Analytics for the Internet of Things (IoT) by Andrew Minteer
  5. Enterprise Internet of Things Handbook by Arvind Ravulavaru

- **Reference Books**
  1. Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies by Dimitrios Serpanos, Marilyn Wolf
  2. MQTT Essentials - A Lightweight IoT Protocol by Gaston C. Hillar
  3. Learning Internet of Things by Peter Waher.

4. Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed by Perry Xiao

PAH Solapur University, Solapur

B.E. (Electronics) Semester-I

ELECTIVE-I

EN415A BIOMEDICAL INSTRUMENTATION

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

This course aims at developing an understanding of the measurement principles of medical instrumentation, including biochemical sensors, bio-potential amplifiers, bioelectrical signals (ECG, EEG and EMG), and measurement of parameters related to respiratory function, blood pressure and blood flow.

Course Prerequisite:

The student shall have knowledge of different transducers used for physical parameters measurement along with its signal conditioning. Student shall also have basic knowledge of different systems of human body and their working.

Course Objectives:

1. To make student understand electrical activities of human body parts.
2. To introduce to student various biomedical transducers and signal conditioning essential in medical instruments.
3. To introduce to student different biomedical instruments used in diagnosis.
4. To make student aware to human safety against electrical shock hazards.

Course Outcomes:

1. Student can analyze bio electrical signals from various parts of body
2. Student can decide appropriate sensor and necessary instrumentation for physiological parameter measurement
3. Student can identify common signal artifacts, their sources and formulate strategies for their suppression
4. Student can outline the design of instrumentation amplifier, cardiac pacemakers and defibrillators
5. Student is able to explain working of basic medical equipments
6. Student is able to plan for protection to biomedical instrument against electrical shocks.

SECTION I

Unit 1 – The Origin of Bio-potentials No of lectures – 04

- **Prerequisite:** Physiological system of human, transducers for various physical measurements

- **Objectives:**
  1. To introduce to student human anatomy and physiological system.
  2. To introduce to student cell potential and its propagation
  3. To make student understand source and characteristics of different electrical signals generated by human body.

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to explain concept of resting and action potential
  2. Is able to explain working of human heart and cardiovascular system
  3. Is able to describe characteristics of ECG, EMG and EEG signals

- **Unit Content:**
  Electrical activity of excitable cells-resting potential, active state, function of the heart, electrical behavior of cardiac cells, normal and abnormal cardiac rhythms, ECG, EEG, EMG

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos and models.

- **Assessment Methods:**
  Questions based upon cardiovascular system, various electrical signals generated by cells, brain, and muscle activities

Unit 2 – Bio-potential Electrodes, Sensors and Transducers No of lectures – 08

- **Prerequisite:** Characteristics of ECG, EMG and EEG signals, basics of transducers, signal conditioning

- **Objectives:**
  1. To introduce to student electrode theory
  2. To make student select sensor for specific body parameter.

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to find appropriate electrode specific to physiological parameter measurement.
  2. Is able to choose transducer for the physiological parameter measurement.

- **Unit Content:**

Need of electrode, electrode and electrolyte interface, polarization, electrode circuit model, body surface recording electrodes- metal plate electrodes, suction electrodes, floating electrodes, internal electrodes, microelectrodes, electric properties of microelectrodes, design specification of bio medical instruments, transducer for biomedical applications, factors governing the selection of transducer, pressure, temperature, flow, biomedical ultrasonic transducer

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based upon electrode theory, different types of electrodes, transducers selection, types of transducers.

Unit 3 – Instrumentation in Diagnostic Cardiology No of lectures – 09

- **Prerequisite:** Human cardiovascular system, Einthoven triangle, characteristics of ECG

- **Objectives:**
  1. To make student understand techniques for blood pressure measurement
  2. To make student understand operational working of ECG machine
  3. To make student make out different ECG lead combinations

- **Outcomes:**
  Upon completion of this unit, student –
  1. Can explain different blood pressure measurement techniques
  2. Can explain functionality of ECG machine
  3. Can demonstrate different ECG lead combinations

- **Unit Content:**
  ECG lead, electrocardiograph machine, ECG signal- various distortion, artifacts from electric transients, interference from other electric devices, transient protection, cardio tachometer, cardiac monitors, radio telemetry system for ECG , blood pressure: systolic, diastolic, direct measurements of blood pressure: extravascular system, intravascular system , indirect measurements of blood pressure-typical indirect blood pressure measurement system, ultrasonic determination of blood pressure, oscillometric method

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations.

- **Assessment Methods:**
  Questions based on ECG measurement, ECG machine, blood pressure measurement and three channel telemetry.

SECTION II

Unit 4 - Instrumentation for Blood Circulation and Respiration No of lectures – 05

- **Prerequisite:** Functioning of cardiovascular system, invasive & non invasive methods of blood flow measurement.

- **Objectives:**
  - To introduce to student indirect methods of measurement of blood flow and blood volume in a blood pipe
  - To make student understand respiratory system, various gases and their proportion and various techniques for their measurement

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to select appropriate electrode and instrumentation for measurement of blood flow and blood volume measurement.
  2. Is able to choose specific sensor and required signal processing for respiratory measurements.

- **Unit Content:**
  Blood flow and blood volume measurement: indicator dilution, thermo dilution method electromagnetic and ultrasound blood flow measurement, blood flow volume , measurement-photoplethysmography, respiratory system-measurable variables in respiratory system, measurement of respiratory pressure, measurement of gas flow rate.

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations and visit to medical laboratory.

- **Assessment Methods:**
  Questions based on dilution, magnetic & ultrasound methods of blood flow measurement

Unit 5 – Medical Imaging Systems No of lectures – 08

- **Prerequisite:** Human anatomy, basics of instrumentation

- **Objectives:**
  1. To make student realize need of non invasive imaging techniques
  2. To make student understand working principle and functionality of different imaging systems like X ray, CT , ultrasound and MRI

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to describe basic principle and functionality of different imaging systems like X ray, CT , ultrasound and MRI
  2. Is able to make out different parts / basic measurement settings of these instruments

- **Unit Content:**

Information content of an image: resolution, image noise, modulation transfer function; radiography generation, measurement and background radiation of X-ray; X-ray machine, computed tomography, CT scanner, magnetic resolution imaging, ultrasonography

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations. a visit to medical radiology lab is highly recommended

- **Assessment Methods:**
  Questions based on principle and parameters of images, x-ray machine, CT scan machine and magnetic imaging.

Unit 6 - Therapeutic and Prosthetic Instruments No of lectures – 05

- **Prerequisite:** Human anatomy, basics of instrumentation, a very preliminary knowledge about different irregularities in heart system, cardiac arrest and problems of new born babies.

- **Objectives:**
  1. To make student understand causes of irregularity in signals at SA & AV nodes and corrections essential to regularize them
  2. To make student recognize various infant physiological parameters and its importance in infant health care
  3. To make student understand working principle and functionality of defibrillators, cardioverters, ventilators, infant incubators

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to analyze electrical signals from various triggering points in heart system and instrumentation related to re-correct the abnormality.
  2. Is able to analyze infant related parameters and essential instrumentation in infant care systems.

- **Unit Content:**
  Cardiac pacemakers- synchronous and asynchronous pacemakers, defibrillators, cardioverters, ventilators, infant incubators

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos; a visit to hospital with these facilities is highly recommended

- **Assessment Methods:**
  Questions based on various internal and external pacemakers, defibrillator and ventilator, infant incubators

Unit 7 – Electrical Safety No of lectures – 03

- **Prerequisite:** Human anatomy, basics of electrical engineering, preliminary knowledge of electrical safety codes and standards

- **Objectives:**
  1. To emphasize to student need of electrical safety of biomedical instruments
  2. To introduce to student hazards due to electric shocks
  3. To make student cognizant to various electrical safety standards and safety codes

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to plan for proper grounding and shielding in medical instruments to guarantee patient's safety.
  2. Is able to recognize safe medical equipments according to electrical safety norms.

- **Unit Content:**
  Physiological effect of electricity, important of susceptibility parameters, distribution of electric power, micro-shock hazards, electric safety codes and standards

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentation; use of electrical standards and code book is highly recommended.

- **Assessment Methods:**
  Questions based on electric shock hazards, safety norms, patient's isolation, grounding and shielding

---

- **Internal Continuous Assessment:**

  ICA shall be based on minimum six tutorials covering above curriculum. Below activities are recommended for tutorials-

  1. Case study of different medical instruments
  2. Evaluation / comparison of an instrument by different vendors
  3. Analysis of specifications of an instrument through brochure
  4. Actual usage / parameter setting of an instrument and preparing a report for the same
  5. Visit to medical facilities mentioned and report for the same
  6. Compiling a report on state of the art in medical instruments / techniques through information gathered from internet

---

- **Text Books:**
  1. Medical Instrumentation- Application and design; John G Webster; Wiley Students Edition; 3rd edition; Wiley Publication
  2. Handbook of Biomedical Instrumentation; R. S. Khandpur; Tata McGraw Hill Publication
  3. Biomedical Instrumentation & Measurement; Leaslie Cromwell; PHI Publication

- **Reference Books:**
  1. Biomedical Instrumentation system; Shakti Chattarjee; Aubart Miller; Cengage Publication

---

PAH Solapur University, Solapur

B.E. (Electronics) Semester-I

ELECTIVE-I

EN415B MECHATRONICS

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ISE - 30 Marks
ESE - 70 Marks
ICA - 25 Marks

Mechatronics is a multidisciplinary application of engineering that includes a combination of mechanical engineering, electrical engineering and electronics engineering. This course aims at providing an overview of the basics of mechatronic systems including the components and characteristics typical for such systems. This course covers detailed aspects of controlling of mechanical systems with sophisticated electronic controllers.

Course Prerequisite:
Student shall have an adept knowledge of basic electrical circuit theory, power devices, digital logic, microcontroller hardware design and interfacing of electrical parts with microcontroller. He shall also possess knowledge about basic mechanical systems

---

Course Objectives:

1. To introduce to student the basic concept and key elements of mechatronics system.
2. To introduce to student working of different sensors and transducers & their selection.
3. To introduce to student pneumatic and hydraulic actuation system.
4. To introduce to student mechanical actuation system.
5. To make student acquainted with the MEMS, micro sensors and micro actuators.
6. To introduce to student mechatronic system case studies.

Course Outcomes:

1. Student can elaborate basic concept and analyze key elements of mechatronics system.
2. Student can explain principles of different sensors and transducers.
3. Student can illustrate pneumatic and hydraulic actuation system.
4. Student can describe mechanical actuation system.
5. Student can illustrate the operation, principle and characteristics of MEMS.
6. Student can analyze the mechatronic system as a whole.

SECTION I

Unit 1 - Introduction to Mechatronics No of lectures – 08

- **Prerequisite: C**ontrol system theory, basics of microcontrollers
- **Objectives:**
  1. To make student understand key elements and design process of mechatronics.
  2. To introduce to student role of control system in mechatronics
  3. To introduce to student the microprocessor based controllers
- **Outcomes:**
  After completing this unit, student -
  1. Can analyze the elements and design process of mechatronics.
  2. Can comprehend different elements of control system and microprocessor based controllers.
- **Unit Content:**
  Introduction to mechatronics, mechatronics key elements, mechatronics design process, closed loop controllers - proportional/integral/differential/PID controllers, digital controller, adaptive control system, and microprocessor based controllers.
- **Content Delivery Methods:**
  Chalk and talk, power point presentation, assignments as a home work
- **Assessment Methods:**
  Questions based upon control system, microprocessor based controllers

Unit 2 – Sensors and transducers No of lectures – 08

- **Prerequisite:** Basics of active and passive components
- **Objectives:**
  1. To introduce to student the principle and working of sensors and transducers
  2. To make student understand performance of commonly used sensors
- **Outcomes:**
  After completing this unit, student –
  1. Can analyze the working of sensors and transducers.
  2. Can select the sensors according to the requirement of application.
- **Unit Content:**
  Sensors and transducers, performance terminology; displacement, position and proximity; velocity and motion; force, fluid pressure, liquid flow, liquid level, temperature, light sensor, selection of sensors
- **Content Delivery Methods:**
  Chalk and talk, power point presentation, animation
- **Assessment Methods:**
  Descriptive questions based upon working principal of different sensors and transducers.

Unit 3– Pneumatic and Hydraulic Actuation System No of lectures – 05

- **Prerequisite:** Basic concepts of mechanical systems

- **Objectives:**
  1. To make student understand various types of actuation systems
  2. To make student understand actuators and their sub systems

- **Outcomes:**
  After completing this unit, student –
  1. Can describe the various types of actuation systems
  2. Can explain working of actuators and their sub systems

- **Unit Content:**
  Actuation systems, pneumatic and hydraulic systems, directional control valves, pressure control valves, cylinders, process control valves, rotary actuators

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, animation

- **Assessment Methods:**
  Descriptive questions based upon pneumatic and hydraulic actuating systems, rotary actuator.

SECTION II

Unit 4– Mechanical Actuation System No of lectures – 06

- **Prerequisite:** Basic concepts of mechanical systems

- **Objectives:**
  1. To make student understand various types of mechanical actuation systems
  2. To make student understand mechanical actuators

- **Outcomes:**
  After completing this unit, student –
  1. Can describe the various types of actuation systems
  2. Can explain working of actuators and their sub systems

- **Unit Content:**
  Mechanical systems, types of motions, kinematic chain, cams, gear trains, ratchet and pawl, belt and chain drives, bearings, mechanical aspects of motor selection

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, animation

- **Assessment Methods:**
  Descriptive questions based upon mechanical actuating systems, bearings and motor selection.

Unit 5 – MEMS No of lectures – 07

- **Prerequisite:** Electronic devices, basics concepts of mechanical systems

- **Objectives:**
  1. To emphasize student with MEMS & micro system
  2. To make student understand working principles of micro sensors and micro actuators.
  3. To introduce to student manufacturing process of micro systems

- **Outcomes:**
  After completing this unit, student –
  1. Can describe the operation and working of micro sensors and micro actuators
  2. Student can illustrate manufacturing process of micro systems

- **Unit Content:**
  Overview of MEMS & microsystems, typical MEMS & micro system, products and applications, micro sensors and micro actuators: phototransistors, pressure sensors, thermal sensors, micro grippers, micro motors, micro valves, micro pumps, micro manufacturing: bulk manufacturing, surface manufacturing, LIGA process.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, animation

- **Assessment Methods:**
  Questions based upon MEMS and microsystems, descriptive questions on micro manufacturing process

Unit 6 –Mechatronic Systems No of lectures – 07

- **Prerequisite:** Basic concepts of conventional, mechatronics systems and system components

- **Objectives:**
  1. To make student realize difference between a conventional system and mechatronic system
  2. To make student aware to mechatronic system design requirements and process with the help of case studies

- **Outcomes:**
  After completing this unit, student –
  1. Can describe difference between conventional system design and mechatronic system design process
  2. Can describe and sketch a mechatronic system
  3. Can list mechatronic systems

- **Unit Content:**
  Traditional and mechatronic designs, possible mechatronics design solutions, case studies of mechatronics systems like piece counting system, pick and place manipulator, automatic car parking system etc.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, animation, case studies

- **Assessment Methods:**
  Questions based upon mechatronic design process and its different case studies

---

- **Internal Continuous Assessment:**
  ICA *shall consist of minimum eight tutorials based upon above curriculum as listed below.*
  1. Interfacing and control of DC servo motor with microcontroller for position, speed and direction control
  2. Open loop, closed loop control system
  3. PLC programming in ladder, FBD, structured text for simple applications.
  4. Pneumatic and hydraulic actuators
  5. Case studies of mechatronics systems
  6. Literature survey, specification analysis and comparative study of various commercially available mechatronic sub systems, PLCs and MEMS sub systems

---

- **Text Books:**
  1. Mechatronics: Electronic control systems in mechanical and electrical engineering; W. Bolton; Addison Wesley, 2nd edition
  2. Mechatronics Principles, Concepts and Applications; N.P. Mahalik; Tata McGraw-Hill
  3. Mechatronics Integrated Mechanical Electronic Systems; K.P. Ramachandran, G. K. Vijayaraghavan, M.S. Balsundaram; Wiley India Pvt. Limited
  4. Mechatronics System Design; Devdas Shetty, Richard A. Kolk, Cengage Learning

- **Reference Books:**
  1. Computer Control of Manufacturing Systems; Yoram Koren; McGraw Hill
  2. MEMS and Microsystems Design and Manufacture; Tai, Ran Hsu; McGraw-Hill
  3. Mechatronics Principles and Applications; Godfrey Onwubolu, Elsevier Butterworth-Heinemann

---

PAH Solapur University, Solapur

B.E. (Electronics Engineering) Semester-I

ELECTIVE-I
EN415C IMAGE PROCESSING

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

Following the explosion of internet during 1970s and 1980s, the last three decades were characterized by a maturing of the field image processing which has reflected into significant growth of active applications in the areas of biometrics, biomedical imaging, remote sensing, technical diagnostics, autonomous vehicle guidance and image analytics. This basic course is designed to provide a thorough grounding and provides necessary basics to the beginner. It also allows a more interested student to take further courses/projects in this area. This course focuses more on the conceptual understanding of the lower level image processing operations and do not cover computer vision fundamentals

---

Course Prerequisite:
Student shall boast basic knowledge of digital signal processing, matrix theory and operations.

Course Objectives:

1. To make student realize different areas and applications of image processing
2. To introduce to student low level image processing operations in spatial and frequency domain
3. To introduce to student preliminary methods for image analysis and description
4. To make student understand the necessity of image compression and its related techniques
5. To activate student's interest in computer vision and video processing applications

---

Course Outcomes:

1. Student is able to enlist various application areas and applications of image processing
2. Student is able to express low level operations in spatial and frequency domain
3. Student is able to describe and derive for image analysis operations
4. Student is able to differentiate between image representation & description operations
5. Student is able to illustrate advantages of transform-domain processing over spatial domain
6. Student is able to compare different image compression techniques

---

SECTION - I

Unit 1: Fundamentals of digital image processing No of lectures – 08

- **Prerequisite**: matrix theory, transforms in digital signal processing
- **Objective**:

1. To introduce to student fundamental steps in image processing
2. To make student aware of various image processing areas and applications
3. To make student understand concept of digital image in spatial domain and transform domain

- **Outcomes:**

After completing this unit, student is able to –

1. describe various image processing areas and applications
2. explain basic framework for image processing
3. compare image processing in spatial and transform domain
4. write a MATLAB program for basic operations in spatial and transform domain

- **Unit Content:**

Fields of use of digital image processing, fundamental steps in digital image processing, sampling & quantization, representation, spatial & intensity resolution, neighborhood, connectivity of pixels, distance measurement, matrix operations, spatial operations, and basics of transform domain, color image fundamentals, color models & conversion

- **Content Delivery Methods:** Chalk and talk, power point presentations, MATLAB® tutorials
- **Assessment Methods:**

Questions based upon applications, framework and operations in spatial & transform domain, numerical questions based on operations in spatial & transform domain

Unit 2: Image preprocessing No of lectures – 08

- **Prerequisite**: Matrix theory, spatial operations
- **Objective**:
  1. To make student understand lower level image processing operations in spatial and frequency domain
  2. To make student understand image enhancement operations
  3. To make student understand image restoration operations
- **Outcomes**:

  After completing this unit, student is able to –
  1. explain various image preprocessing, restoration and enhancement operations
  2. select appropriate preprocessing operation for various image processing tasks
  3. write MATLAB® programs for few basic image preprocessing operations in spatial and frequency domain.
- **Unit Content**:

Basic intensity transformation functions, histogram processing, preprocessing in spatial domain, preprocessing in frequency domain, image smoothing and sharpening using spatial and frequency domain filters, image restoration in spatial domain & frequency domain, geometric transformations

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, MATLAB® tutorials

- **Assessment Methods:**
  Questions based upon various preprocessing, enhancement and restoration operations, numerical examples on spatial operations and geometric transformations

Unit 3: Image analysis No of lectures – 08

- **Prerequisite**: Matrix theory, spatial operations

- **Objective**:

  1. To introduce to student detection of discontinuity in an image
  2. To make student understand detection of similarities in an image
  3. To make student understand fundamental techniques for edge based segmentation
  4. To make student understand fundamental techniques for region based segmentation

- **Outcomes**:

  After completing this unit, student is able to –
  1. analyze and compare various image discontinuity and similarity techniques
  2. explain and compare different fundamental segmentation techniques
  3. write MATLAB® programs for few basic image discontinuity and similarity techniques

- **Unit content**:

Edge detection, line detection, corner detection, boundary detection, Hough transform, thresholding, edge-based segmentation, region-based segmentation, template matching

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, MATLAB® tutorials

- **Assessment Methods:**

Questions based upon various detection and segmentation operations, analysis of detection of discontinuity and similarity techniques

SECTION – II

Unit 4: Image representation & description No of lectures – 08

- **Prerequisite**: Matrix theory, spatial operations, image transforms, image analysis techniques

- **Objectives**:

1. To make student realize necessity of image representation and description as an important
2. step for image understanding through examples
3. 2.To make student understand basic techniques for image representation using external and
4. internal characteristics of an image
5. To make student understand use of texture as a region descriptor

- **Outcome**:
  After completing this unit, student is able to –
  1. select suitable image representation and description technique for various applications
  2. compare different image descriptor techniques
  3. explain texture and its use as a region descriptor

- **Unit Content:**
  Chain code, polygon approximation, signature, skeleton, shape number, Fourier descriptor, regional descriptors, texture and statistical texture description

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study

- **Assessment Methods:**
  Questions based upon various image representation and description techniques, numerical questions based on simple descriptors

Unit 5: Image transforms No of lectures – 06

- **Prerequisite:** matrix theory, transforms in digital signal processing

- **Objectives:**
  1. To make student understand advantages of linear image transforms
  2. To introduce student techniques of singular value decomposition and principle component analysis applied to an image

- **Outcome:**
  After completing this unit, student is able to –
  1.compare image processing operation in spatial domain and transformed domain
  2.explain significance of singular value decomposition and principle component analysis for image processing

- **Unit Content:**

Discrete Fourier transform, discrete cosine transform, wavelet transform, singular value decomposition, principle component analysis.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**

Questions based upon mathematical preliminaries of transforms, wavelet transform, singular value decomposition, principle component analysis and their significance

Unit 6: Image compression No of lectures – 06

- **Prerequisite**: matrix theory, spatial operations, image transforms

- **Objectives:**
  1.To make student recognize need of image compression techniques
  2.To make student understand predictive and progressive compression techniques
  3.To present to student a brief overview of JPEG and MPEG

- **Outcome:**
  After completing this unit, student is able to –
  1.express need of image compression techniques and can select an appropriate technique for various applications
  2.explain various predictive and progressive compression techniques
  3.present a brief overview of JPEG and MPEG

- **Unit Content:**

Transforms for image compressions, predictive compression, vector quantization, hierarchical & progressive compression, coding, JPEG & MPEG

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study

- **Assessment Methods:**
  Questions based upon various compression techniques, overview of JPEG and MPEG

- **Internal Continuous Assessment (ICA):**
  ICA shall be based on tutorials covering MATLAB® implementation of above concepts

---

- **Text Books:**
  1. Digital Image Processing; R.C. Gonzalez, R.E. Woods; 2nd Edition; Pearson Education – Chapter 3, 4, 5
  2. Digital Image Processing; R.C. Gonzalez, R.E. Woods; 2nd Edition; Pearson Education – Chapter 1

3. Digital Image Processing & Computer Vision; Milan Sonka, Vaclav Hlavac, Roger Boyle; Cengage Learning – Chapter 2, 3, 4, 5, 6

- **Reference Books:**

1 Fundamentals of Digital Image Processing – Anil K. Jain; 2nd Edition; Prentice Hall, Englewood cliffs, NJ

2. Image Processing: The Fundamentals – Maria Petrou; 2nd Edition; John Wiley

PAH Solapur University, Solapur
B.E. (Electronics Engineering) Semester-I

ELECTIVE-I
EN415D DATABASE MANAGEMENT SYSTEMS

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Tutorial – 1 Hour/week, 1 Credit

Examination Scheme
ESE -- 70 Marks
ISE -- 30 Marks
ICA- 25 Marks

Database management has evolved from a specialized computer application to a central component of a modern computing environment, and, as a result, knowledge about database systems has become an essential part of an education in almost every domain of engineering. This basic course is designed to provide the fundamental concepts of database management and provides necessary basics to the beginner. This course focuses on the fundamentals of database modeling and design, the languages and models provided by the database management systems.

Course Prerequisite:
Student shall have adept knowledge of basic data structures, computer organization, and a high-level programming language such as C, C++ or Java.

Course Objectives:
1. To introduce to student the concept of computerized database and database management systems (DBMS)
2. To introduce to student database system concepts and related architecture
3. To make student understand the data modeling using the Entity–Relationship (ER) model and the relational data model
4. To make student understand the basics of structured query language (SQL)
5. To introduce to student advanced database systems

Course Outcomes:
1. Student is able to enlist various advantages of using database management systems.
2. Student is able to define a data model, distinguish its categories and describe three schema architecture
3. Student is able to describe classification of database management systems.
4. Student is able to differentiate between model & relational data model
5. Student is able to illustrate basic retrieval queries used in SQL
6. Student is able to describe distributed database systems and their types

SECTION - I

Unit 1: Databases and Database Users No of lectures – 04

- **Prerequisite**: Basics of data structures and computer organization
- **Objective**:
  1. To introduce to student concept of computerized databases and DBMS
  2. To make student understand the advantages of using DBMS approach
  3. To make student understand capabilities that should be provided by the DBMS software
- **Outcomes:**

After completing this unit, student is able to –

1. define the terms *data, database, DBMS, database system*
2. describe main characteristics of the database approach
3. differentiate between the database approach and traditional file systems
4. enlist and describe different types of database end users
5. differentiate between database systems and information retrieval systems

- **Unit Content:**

Introduction, an example, characteristics of the database approach, actors on the scene, workers behind the scene, advantages of using the DBMS approach, a brief history of database applications, when not to use a DBMS.

- **Content Delivery Methods:** Chalk and talk, power point presentations
- **Assessment Methods:**

Questions based upon characteristics of the database approach, capabilities that should be provided by a DBMS, database end users.

Unit 2: Database System Concepts and Architecture No of lectures – 06

- **Prerequisite**: basics of data structures and computer organization
- **Objective**:
  1. To introduce to student main concepts involved in database systems
  2. To make student understand three schema DBMS architecture
  3. To make student understand centralized and client/server architectures for database management systems
- **Outcomes**:

After completing this unit, student is able to–

1. discuss the main categories of the data models
2. differentiate between a database schema and a database state
3. describe the three-schema architecture
4. differentiate between logical data independence and physical data independence

- **Unit Content**:

Data models, schemas, and instances, three-schema architecture and data independence, database languages and interfaces, the database system environment, centralized and client/server architectures for DBMSs, classification of database management systems.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based on database system concepts, three schema DBMS architecture, data independence, and classification of database management systems

Unit 3: Data Modeling Using the Entity–Relationship (ER) Model No of lectures – 10

- **Prerequisite**: basics of data structures and computer organization

- **Objective**:

  1. To make student understand the basic ER model conceptsof entities and their attributes.
  2. To make student understand ER model concepts at the schema level
  3. To introduce to student ER modeling concepts

- **Outcomes**:

After completing this unit, student is able to –

1. discuss the role of a high-level data model in the database design process
2. enlist the various cases where use of a NULL value would be appropriate
3. define and differentiate between an entity, an entity type, and an entity set
4. define and differentiate between an instance, a relationship type, and a relationship set
5. describe the naming conventions used for ER schema diagrams

- **Unit content**:

Using high-level conceptual data models for database design, a sample database application entity types, entity sets, attributes, and keys, relationship types, relationship sets, roles, and structural constraints, weak entity types, ER diagrams, naming conventions, and design issues, examples.

- **Content Delivery Methods:**

Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based upon use of high-level data models for database design, entity/relationship types and sets,structural constraints, and ER diagrams

SECTION – II

Unit 4: The Relational Data Model SQL No of lectures – 12

- **Prerequisite**: basics of data structures, computer organization and knowledge of higher level programming language such as Java, C++.

- **Objectives**:
  1. To introduce to student modeling concepts, data structures, and constraints provided by the relational model of data
  2. To introduce to student the SQL database language.

- **Outcome**:
  After completing this unit, student is able to –
  1. differentiate between a key and a superkey
  2. describe characteristics of relations that make them different from ordinary tables and files
  3. describe the various reasons that lead to the occurrence of NULL values in relations
  4. enlist the data types that are allowed for SQL attributes
  5. describe basic retrieval queries used in SQL i.e., INSERT, DELETE and UPDATE

- **Unit Content:**
  Relational model concepts, relational model constraints and relational database schemas, update operations, transactions, and dealing with constraint violations. SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, additional features of SQL, schema change statements in SQL.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, programming demo

- **Assessment Methods:**
  Questions based upon relational model concepts, relational model constraints, relational database schemas, SQL data definition, data types and basic retrieval queries in SQL

Unit 5: Indexing Structures for Files and Physical Database Design No of lectures – 06

- **Prerequisite:** Basics of data structures and computer organization

- **Objectives:**
  1. To introduce to student file organizations that involve additional access structure namely *indexes*
  2. To introduce to student how multilevel indexes can be implemented as B-trees and B+ trees
  3. To give student an overview of benefits of using indexing.
  4. To introduce to student the concept of a logical index and compared it with the physical indexes

- **Outcome:**
  After completing this unit, student is able to –
  1. differentiate among primary, secondary, and clustering indexes

2. illustrate the use of multilevel indexing to improve the efficiency of searching an index file
3. describe the structure of B-tree and B+ tree nodes
4. illustrate general issues concerning indexing
5. describe the factors that influence physical database design

- **Unit Content:**

Types of single-level ordered indexes, multilevel indexes, dynamic multilevel indexes using B trees and B+ trees, indexes on multiple keys, other types of indexes, some general issues concerning indexing, physical database design in relational databases.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**

Questions on single and multilevel indexes, structures of B, B+ trees, multiple keys and issues related to physical database design in relational databases

Unit 6: Advanced Database Systems No of lectures – 04

- **Prerequisite**: Basics of data structures and computer organization

- **Objectives:**
  1. To introduce to student distributed database concepts
  2. To introduce to student various types of distributed database systems

- **Outcome:**
  After completing this unit, student is able to –
  1. illustrate potential advantages of using distributed database systems
  2. recognize need of NOSQL systems
  3. define big data
  4. describe the MapReduce model.
  5. describe the architecture of Hadoop

- **Unit Content:**

Distributed database concepts, types of distributed database systems, introduction to NOSQL systems, the CAP theorem, document-based NOSQL systems and MongoDB, NOSQL graph databases and Neo4j, what is big data?, introduction to MapReduce and Hadoop

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**

Questions based on distributed database concepts, NOSQL systems, MongoDB, and big data

- **Internal Continuous Assessment (ICA):**
  ICA shall be based on tutorials covering all six units

—

- **Text Book :**
  1. Fundamentals of Database Systems (7th Edition) by Ramez Elmasri ,Shamkant B. Navathe. Publisher: Pearson

- **Reference Book:**
  1. Database System Concepts by Silberschatz, Korth and Sudarshan (6th Edition) Publisher: Tata McGraw Hill Education

PAH Solapur University, Solapur
B.E. (Electronics) Semester-I
EN416 PROJECT

Teaching Scheme	**Examination Scheme**
Practical – 4 Hours/week, 2 Credits	**ICA–** 50 Marks

Project based learning is a paradigm which is becoming time-honored now a days. To keep abreast with this, Project course is included in the curriculum which is spread over both semesters of final year. For this course students carry out a project as a team that allows them to demonstrate their abilities and to develop skills within their chosen area of interest. Hardware realization as well software simulation projects with focus on design and research aspects are accepted. Also communicating effectively, both in oral and written form is an important skill for engineering graduates in many different contexts. This course also aims to foster these skills

Course Prerequisite:

Student shall have technical competency as well as behavioral facet to carry project as a part of a team. He shall have an adept 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

Course Objectives:

1. To expose student to different project life cycle phases for software or/and hardware projects
2. To impart on student hands on experience for design & development of project
3. To enhance amongst student team working and leadership skills
4. To enhance amongst student presentation and technical documentation skills

Course Outcomes:

1. Student can select a suitable project based upon requirement analysis and literature survey
2. Student can plan for management and financial aspects of the project
3. Student can design hardware and software architecture of the project
4. Student can apply design concepts for detail design of project
5. Student can validate the results and can also analyze them
6. Student demonstrates leadership and team working behavioral skills
7. Student can write synopsis and project report
8. Student demonstrates presentation skills
9. Student can use programming / simulation software and presentation, word processing software at various stages of project

The project work is carried out in two semesters of B.E. (Electronics). The practical batch for the project will be of 15 students. The batch will be divided into groups each consisting of not more than 3 students.

In semester –I, group will select a project with the approval of guide and submit the synopsis of the project. The group is expected to complete detail system design, high level design and low level design of project in first semester as a part of ICA.

Each student shall deliver a seminar (presentation) preferably on the topic related to project area.

EN4517 VOCATIONAL TRAINING

Teaching Scheme

Examination Scheme
ICA – 25 Marks

After graduation, an engineer will be serving society and country by adopting a suitable profession or a career. Although, the formal education at college prepares him for this, it is also necessary for him to get an exposure to industrial/organizational environment while he is in college. This is accomplished by a minimum 15 days vocational training / apprenticeship student has to undertake. This vocational training completed in any industry/software development house/any engineering organization will give a student a flavor of tangible industrial environment as well will sharpen his soft skills.

Course Prerequisite:
Student shall have technical competency to understand work process at the industry/ organization of his vocational training. He shall also possess necessary technical report writing skills, presentation skills and shall have proficiency in office software for word processing and presentation

---

Course Objectives:

1. To expose student to industrial/ organizational environment & different industrial / organizational practices
2. To cultivate basic management skills
3. To enhance team working skills and other soft skills
4. To enhance technical documentation skills.

Course Outcomes:

1. Student undertakes suitable project based on the learning in vocational training and successfully completes it.
2. Student can write vocational training report
3. Student demonstrates presentation skills
4. Student can use programming / simulation software and presentation , word processing software at various stages of project

---

Each student must complete minimum 15 days vocational training in any industry / organization / software development house in any vacation after S.E. Part II but before B.E. Part I and the report prepared and submitted by the student will be evaluated in B.E. Part I. This report evaluation will be done by the respective project guide of the student. Report shall include – certification from the industry / organization about completion of the training, profile of the industry / organization, details of the training, technical skills / soft skills gained, learning from training.

PAH Solapur University, Solapur

B.E. (Electronics) Semester-II

EN421 ADVANCED COMMUNICATION ENGINEERING

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ISE-**30 Marks
Practical – 2 Hours/week, 1 Credit	**ESE-**70 Marks
	ICA – 25 Marks
	POE – 50 Marks

This course aims at providing student with an overview of contemporary communication systems such as microwave, radar, satellite communications and optical communication. The basic and under-lying technical concepts, which are essential for the design, implementation, and introductory hands on in the communication systems, are presented in an easy way to understand with discussion on practical examples and solutions to some real-world problems.

Course Prerequisite:

Student shall have completed a course in analog and digital communication and shall have an adept knowledge of various communication techniques. Student shall also possess knowledge about basics of optics, electromagnetic engineering, electric field theory and electronic circuit design.

Course Objectives:

1. To introduce to students with concept of microwave communication with its need, frequency and microwave components.
2. To introduce to students with concept of microwave devices with its working principle and applications.
3. To introduce to student radar communication system with it working principle and implementation techniques.
4. To introduce to student satellite communication system with it concepts, working principle and implementation techniques.
5. To introduce to student satellite communication system is able to apply different modulation techniques and access techniques for wireless communications
6. To introduce to student optical communication system with it theory for implementation, types and devices with its application.

Course Outcomes:

1. Student is able to compare radio frequency and microwave frequency communication with respect to devices, working principle and applications.
2. Student is able describe microwave devices with its working principle, mathematical analysis and its applications.
3. Student is able to explain different radar systems.
4. Student is able to describe satellite subsystem and earth station block diagram with their working principle.

5. Student is able to apply different modulation techniques and access techniques for wireless communications
6. Student is able to deign radio link models and analyze link budget for satellite.
7. Student is able to apply ray theory for optical communication.

SECTION I

Unit 1 – Introduction to Microwave Techniques

No of lectures – 10

- **Prerequisite:** concepts of circuits and network, communication and electromagnetic engineering

- **Objectives:**
  1. To introduce to student microwave frequency ranges and their applications
  2. To make student understand electrical characteristics of waveguides and transmission lines through electromagnetic field
  3. To make student compare different transmission lines and waveguides.
  4. To introduce to student microwave components and circuits and scattering parameters.

- **Outcomes:**
  After completing this unit, student –
  1. Can compare different microwave applications based on frequencies
  2. Can evaluate various parameter related to waveguide and transmission line.
  3. Can evaluate equations for different modes for waveguide and can solve related problems
  4. Can compare wave guide and transmission lines
  5. Can derive scattering parameter for various microwave components.

- **Unit Content:**
  Introduction to microwave fundamentals, microwave frequencies and microwave devices, microwave transmission lines- reflection coefficient and transmission coefficient, standing waves , wave guides, rectangular wave guides, TE mode wave, power transmission in wave guide, power losses, excitation of modes in wave guide, microwave components ,microwave cavities, microwave hybrid circuits (E,H.EH plane Tee), directional coupler, circulators and isolators.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Questions based upon microwave fundamentals, derivations related to wave guide and transmission line, derivation of scattering parameters for microwave hybrid circuits (E, H, EH plane Tee) and directional coupler, question based on construction and working of directional coupler, circulators and isolators.

Unit 2 – Microwave Devices and Antennas No of lectures – 08

- **Prerequisite:** concepts of electric field theory and electronics circuit design

- **Objectives** :
  1. To make student understand high frequency limitations on conventional devices.
  2. To make students understand difference between conventional devices and microwave devices.
  3. To make student understand construction, working principle and mathematical analysis of various microwave devices based on stability, bandwidth, gain, noise figure criteria and efficiency.
  4. To make student understand construction, working principle and mathematical analysis of various microwave solid state devices.
  5. To introduce to students different microwave antennas and it's working.
  6. To make student understand the function, design, and integration of the major components in a wireless transceiver: oscillator, modulator, power amplifier, antenna, low-noise amplifier, filter, and mixer.

- **Outcomes:**
  After completing this unit, student –
  1. Can analyze limitations of conventional devices for high frequency and can compare conventional devices and microwave devices.
  2. Can express working of microwave devices: amplifier and oscillator.
  3. Can explain use of solid state devices for different applications
  4. Can derive equation for various parameter related to microwave devices.
  5. Can describe different antennas used at microwave frequency.
  6. Can describe integration of the major components in a wireless transceiver: oscillator, modulator, power amplifier, antenna, low-noise amplifier, filter, and mixer.

- **Unit Content:**
  Klystrons, reflex klystrons, TWTs, magnetrons, microwave solid state devices –MESFET, varactor diode, PIN diode; tunnel microwave, TED, and avalanche transit time devices, microwave antenna-horn, parabolic reflector slots, and lens and micro strip antennas.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, animation

- **Assessment Methods:**
  Questions based limitation of conventional devices, construction, working and derivation on Klystrons, reflex klystrons, TWTs, magnetrons, construction and working on –MESFET, varactor diode. PIN diode; tunnel microwave, TED, and avalanche transit time devices, microwave antenna-horn, parabolic reflector slots, and lens and micro strip antennas.

Unit 3 - Radar No of lectures – 08

- **Prerequisite: c**oncepts of microwave techniques and devices, sensitivity, dynamic range, jamming and communication links.

- **Objectives** :
  1. To introduce to student basic mathematical concepts: dB values and equations.
  2. To make student understand radar systems and classification
  3. To make student understand different types of radar systems.

- **Outcomes:**
  After completing this unit, student –
  1. Is able to describe the principle of operation of radar systems.
  2. Is able to derive radar range equation.
  3. Is able to describe different types of radar system.

- **Unit Content**
  Radar fundamentals, radar principle, radar range equation, types of radar pulsed radar system, MTI, radar beacons, FMCW radar, Doppler radar, phased array radar, plane array radar and antenna.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Questions based on derivation of radar range equation, related numerical, block diagram and descriptive questions based on different types of radar system

SECTION II

Unit 4- Satellite Communication: No of lectures – 08

- **Prerequisite:** basics of analog and digital communication, mobile communication

- **Objectives :**
  1. To make student understand the basics of orbital mechanics, the types of satellite orbits, the look angles from ground stations to the satellite.
  2. To make student understand satellite subsystems and working of each subsystem

- **Outcomes:**
  After completing this unit, student –
  1. Can solve problems related to orbital mechanics and look angles.
  2. Can explain working of each block of satellite subsystem
  3. Can analyze different controlling parameter related to each subsystem.

- **Unit Content**
  Introduction, orbital mechanics, Types of orbits, look angle determination, satellite subsystem.

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, animation

- **Assessment Methods:**
  Questions based on derivation and definition related to orbital mechanics and looks angle determination, block diagram of satellite subsystem, descriptive questions based on different subsystem

Unit 5 – Satellite Link Design No of lectures – 09

- **Prerequisite:** concepts of microwave techniques and devices, signals and systems descriptions in time and frequency domains, analog and digital modulation, receiver noise calculations, signal to noise ratio and bit error rate calculations.

- **Objective :**
  1. To make student design uplink frequency and downlink frequency equation
  2. To make student derive C/I equation and discuss related parameter.
  3. To make student understand modulation and multiplexing techniques used in satellite communication.
  4. To make student understand working of earth station
  5. To make student list and explain different applications of satellite.

- **Outcomes:**
  After completing this unit, student –
  1. Can solve numerical problems related to design of downlink, link budget and design of uplink
  2. Can evaluate different modulation and multiplex techniques used.
  3. Can explain working and controlling of satellite system in different application.

- **Unit Content:**
  Design of downlink, link budget, design of uplink, modulation techniques, multiplex techniques, earth station, application overview-Radio and satellite navigation, GPS position location, DHS-TV

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, visit to satellite earth station/TV station/radio station is highly recommended

- **Assessment Methods:**
  Questions based on derivation and definition related to downlink, link budget, design of uplink, modulation techniques, multiplex techniques satellite subsystem; questions based upon block diagram on modulation techniques, multiplex techniques satellite subsystem; descriptive questions based on different subsystem.

Unit 6 - Optical Communication No of lectures – 09

- **Prerequisite:** Ray theory and related laws

- **Objectives:**

1. To make student understand basic operating principles of single mode, multimode fibers, light sources, detectors, amplifiers and passive optical devices.
2. To make student design a simple optical communication link.
3. To make student analyze and compare optical devices: light sources, fibers and detectors from both physical and system point of view.
4. To make student understand compare the structural characteristics of different optical fibers and the different fabrication processes of optical fiber cables
5. To make student interpret the optical losses characteristic in optical fiber such as dispersion, scattering, absorption, nonlinear effects, fiber alignment and splicing that affect the performance of transmission systems.

- **Outcomes:**

After completing this unit, student –

1. Can explain operating principles of single mode, multimode fibers, light sources, detectors, amplifiers and passive optical devices.
2. Can design a simple optical communication link
3. Can analyze and compare optical devices: light sources, fibers and detectors from both physical and system point of view.
4. Can compare the structural characteristics of different optical fibers and the different fabrication processes of optical fiber cables.
5. Can interpret the optical losses characteristic in optical fiber such as dispersion, scattering, absorption, nonlinear effects, fiber alignment and splicing that affect the performance of transmission systems.

- **Unit Content:**

Introduction to optical communication, advantages and application, nature of light, ray theory, acceptance cone, numerical aperture, optical fiber modes and types, operation of optical source and optical detector

- **Content Delivery Methods:**

Chalk and talk, power point presentation, animation

- **Assessment Methods:**

Questions based on derivation and numerical problems related to ray theory, acceptance cone, and numerical aperture, descriptive questions on operation of optical source and optical detector, optical communication system, advantages and application.

- **Internal Continuous Assessment:**

  ICA shall consists of minimum ten lab sessions based on above curriculum and covering below-

  1. Lab session on microwave frequency measurement
  2. Lab session on calculation of refection coefficient and VSWR
  3. Lab session on power dividing using H,E,E-H plane Tee junction
  4. Lab session on isolator and circulator
  5. Lab session on measurement of coupling factor, isolation and directivity of Directional coupler
  6. Lab session on reflex Klystron
  7. Lab session on Gunn diode
  8. Lab session on Radar communication
  9. Lab session on Satellite communication
  10. Lab session on optical communication
  11. Simulation of microwave, radar, satellite communications and optical communication building blocks

  ✓ It is also desirable for a student to visit satellite earth station / TV station / radio station and prepare a visit report

---

- **Text Books:**

1. Microwave Devices and Circuits; Liao Samuel Y., Liao; Prentice Hall Publisher.
2. Microwave and Radar Engineering; M.L. Sisodia; 1st Edition; New Age International Publishers
3. Satellite Communication; Timothy Pratt; 2nd Edition; Wiley India Pvt. Limited
4. Optical Fiber Communication; Gerd Keiser; McGraw Hill International.

- **Reference Books:**

  1. Fundamentals of Microwave Engineering; Peter A. Rizzi; Prentice hall of India.
  2. Radar Principles, Technology; Application -EDDE-LPE
  3. Optical fiber communications: principles and practice; John M. Senior; Prentice Hall International
  4. Communication Electronics principle and application; Louis E. Frenzel; 3rd Edition; Tata McGraw Hill

---

PAH Solapur University, Solapur
B.E. (Electronics) Semester-II
EN422 AUDIO VIDEO SYSTEMS

Teaching Scheme	**Examination Scheme**
Lectures – 4 Hours/week, 4 Credits	**ESE-** 70 Marks**,**
Practical – 2 Hours/week, 1 Credit	**ISE-**30 Marks
	ICA – 25 Marks

This course aims at a introducing to students multimedia field covering three main domains- devices, systems and applications. It includes basic concepts for processing of audio, video and image. It also includes media demand compression and coding methods. This course also covers basic TV principles in depth and gives detailed insight of colour TV systems and standards. It includes chroma processing sub-systems and various receiver designing blocks. It also includes schematic explanation of equipments, devices, circuits involved in modern television systems.

Course Prerequisite:

A course in analog and digital communication is mandatory. Student shall also have knowledge of analog and digital electronics circuit design and digital signal processing

Course Objectives:

1. To introduce to student fundamentals, need and applications of multimedia.
2. To make student understand essential components of multimedia
3. To introduce to student concepts of audio and video systems in monochrome and colour television.
4. To make student understand working of NTSC, PAL and SECAM TV systems.
5. To make student understand working principle of digital television, high definition television, satellite television and cable television systems.

Course Outcomes:

1. Student can describe basic components of multimedia.
2. Student can explain and relate audio-video standards based on different applications.
3. Student can identify and analyze various elements of composite video signal.
4. Student can analyze amplitude and frequency of colour composite video signal such as burst cycles, spectrum of bar pattern, etc.
5. Student can explain block diagram of NTSC, PAL and SECAM TV systems.
6. Student can design receiver antenna section of a TV system.
7. Student can describe functional blocks of digital television, high definition television, satellite television and cable television systems.

SECTION I

Unit 1- Fundamentals of Audio Systems No of lectures-05

- **Prerequisite:** transducers and measurements, optics
- **Objectives:**
  1. To introduce to student various measuring units of sound
  2. To explain student concepts of acoustics and its effect
  3. To make student understand various parameters of reverberation
  4. To introduce to student working of optical recording and reproduction systems
- **Outcomes:**
  At the end of this unit, student
  1. Can select and convert sound units as per application
  2. Can calculate an absorption coefficient, reverberation time for efficient acoustic effect
  3. Can design acoustic of auditorium and meeting hall
  4. Can compare film and compact disc recording
- **Unit content:**
  Sound waves and its various measuring units; acoustics – reverberation, absorption coefficient, growth and decay of sound, acoustics of auditoriums and studios; optical recording and reproduction of sound – on film and on compact disc
- **Content Delivery Methods:**
  Chalk and talk, power point presentations, animations, demonstrations
- **Assessment Methods:**
  Descriptive questions based on sound, acoustics, optical systems; analytical questions based on audio measurements, reverberation parameters

Unit 2- Fundamentals of Television System No of lectures-06

- **Prerequisite:** fundamentals of audio & video systems, analog & digital communication, electronic circuit design concepts
- **Objectives:**
  1. To introduce to student scanning process for picture transmission
  2. To make student understand composite video signal and its components
  3. To make student understand types and working of camera pick up devices
  4. To make student understand various transmission systems for TV
- **Outcomes:**
  At the end of this unit, student

1. Can explain scanning process and calculate Kell factor for various video systems
2. Can identify and measure different components of composite video signal
3. Can explain functions of video standard pulses and intercarrier system
4. Can compare various types of camera pick up devices
5. Can design antenna system for different TV channels

- **Unit content:**
  Introduction to picture transmission; colour mixing, aspect ratio, persistence of vision, flicker, vertical resolution, horizontal resolution, Kell factor, video bandwidth, composite video signal, digital TV camera, modulation of audio and video, terrestrial signal transmission, video displays: LCD vs LED.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, demonstrations

- **Assessment Methods:**
  Descriptive questions based on scanning, standard video signals, TV transmission system

Unit 3 - Colour Television Standards No of lectures-06

- **Prerequisite:** monochrome television system

- **Objectives:**
  1. Introduce student to colour system
  2. Introduce student to different colour TV standards
  3. To make student understand principle of scanning process.

- **Outcomes:**
  At the end of this unit, student
1. Can measure and analyze colour spectrum of chrominance signal
2. Can define & describe the standards NTSC, PAL, SECAM.
3. Can compare and illustrate the different scanning process.

- **Unit content:**
  Standards: NTSC, PAL, SECAM colour system, generalized colour TV receiver block diagram, study of functionality of each block, alignment issues, sampling of video signal, colour sub sampling, composite vs component video, interlace vs progressive scan.

Unit 4 - Digital TV No of lectures-08

- **Prerequisite:** monochrome and colour television working**,** analog and digital communication, electronic circuit design concepts

- **Objectives:**
  1. To introduce to student modification in standard TV systems
  2. To make student understand block diagrams of satellite, digital and cable TV system
  3. To explain student television sub-systems required for transponder communication
  4. To make student understand cable TV concept and their distribution system

- **Outcomes:**
  At the end of this unit, student
1. Can explain need of modern television systems
2. Can explain working principle of satellite, digital and cable TV system
3. Can analyze transceiver sub-systems for satellite communication
4. Can compare and explain working principle of CCTV, MATV and CATV

- **Unit Content:**
  Satellite television – elements, communication sub-systems, transponder, block diagram of TV broadcast system; DTH communication; digital television – block diagram of audio transmitter, video production and reproduction, TV receiver; non-radiating system – CCTV, MATV, CATV, cable channels

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Descriptive questions based on radiating and non-radiating TV systems

SECTION II

Unit 5- Multimedia Components No of lectures-08

- **Prerequisite:** Fundamentals of analog and digital communication

- **Objectives:**
  1. To make student understand building blocks of multimedia.
  2. To explain student audio and video capture process
  3. To introduce to student concept of animation

- **Outcomes:**
  At the end of this unit, student
  1. Can compare between multimedia and hypermedia
  2. Can select appropriate audio and video systems for various applications
  3. Can classify and differentiate between different file formats of images
  4. Can compare between 2D, 2.5D and 3D types of animation

- **Unit content:**
  Introduction to basic components; multimedia and hypermedia; digital audio capture, levels of digitization, MIDI; image data types and its file formats; digital video capture; animation – principle, types – 2D, 2.5D, 3D, kinematics;

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, demonstrations

- **Assessment Methods:**
  Descriptive questions based on multimedia components, audio and video capture, image and animation

Unit 6- Data Coding and Compression Techniques No of lectures-10

- **Prerequisite:** basics of multimedia, digital signal processing transforms

- **Objectives:**
  1. To introduce to student coding methods for audio and video
  2. To make student understand working principle of MPEG compression algorithms
  3. To present student a brief review of JPEG

- **Outcomes:**
  At the end of this unit, student
  1. Can classify and select proper coding technique for a given audio & video application
  2. Can analyze compression algorithms for audio and video systems
  3. Can compare various MPEG series
  4. Can differentiate and explain lossy and lossless JPEG modes

- **Unit content:**
  Coding requirements, classification of coding techniques, data storage space; MPEG audio – block diagrams of layers, strategy, basic compression algorithm – block diagram of MPEG audio encoder and decoder, bit allocation; MPEG video – MPEG-1 – motion compensation, video bit stream; MPEG-2 – interlaced video, scalabilities, major difference from MPEG-1; JPEG – block diagram of encoder, JPEG modes – lossy sequential DCT, expanded lossy DCT, lossless, hierarchical;

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, demonstrations

- **Assessment Methods:**
  Descriptive questions based on coding techniques, MPEG and JPEG systems; analytical questions based on compression algorithms and JPEG modes

Unit 7- Multimedia Applications No of lectures-07

- **Prerequisite:** basics of multimedia, coding and compression, basics of transducers and measurements, electronic circuit design concepts

- **Objectives:**
  1. To explain student different applications of multimedia
  2. To explain student working of audio input and output devices
  3. To make student understand working principle of PA system, facsimile and Xerography machine
- **Outcomes:**
  At the end of this unit, student
1. Can list applications of multimedia in various fields
2. Can compare between headphones and headsets
3. Can explain working of PA system, facsimile and Xerography machine

- **Unit content:**
  Headphones, headsets and hearing aids; PA system for public meeting, auditorium and stadium; virtual reality: concept, Forms of VR, VR applications, VR devices: hand gloves, head mounted tracking system, VR chair, CCD, VCR, 3D sound system, head mounted display, introduction to multimedia in Android.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, animations, demonstrations

- **Assessment Methods:**
  Descriptive questions based on audio systems, Fax and Xerography

- **Internal Continuous Assessment (ICA):**

ICA shall consist of minimum eight experiments based upon-

1. Optical reproduction system
2. PA system
3. Analysis of audio signal using equalizers, sequencers
4. Designing of SMPS for TV set
5. Analysis of composite video signal
6. Voltage and waveform analysis of colour TV signal
7. Measurement of blanking and synchronizing pulses
8. Designing antenna systems for TV
9. Satellite TV transmission and reception system

- **Text Books:**

1. Fundamentals of Multimedia; Ze-Nian Li, Mark S. Drew; Prentice Hall of India Pvt. Ltd.
2. Multimedia: computing, communications & applications; Ralf Steinmetz, Klara Nahrstedt; Pearson Education
3. Television and video engineering; A.M. Dhake; Tata McGraw Hill publication
4. Consumer Electronics; S.P. Bali; Pearson Publication

- **Reference Books:**

1. Multimedia-making it work; Tay Vaughan; 6th Edition; Tata McGraw Hill Publication
2. Television Engineering and Video Systems; R.G. Gupta;2nd Edition, Tata McGraw Hill Publication
3. Monochrome and Colour Television; R.R. Gulati, Revised 2nd Edition, New Age International Publication
4. Basic Television and Video Systems; Bernord Grob, 6th Edition, Tata McGraw Hill Publication

PAH Solapur University, Solapur
B.E. (Electronics Engineering) Semester-II
EN423 ELECTRONIC SYSTEM DESIGN

Teaching Scheme	**Examination Scheme**
Lectures – 3 Hours/week, 3 Credits	**ESE –** 70 Marks
Tutorial – 1 Hour/week, 1 Credit	**ISE –** 30 Marks
Practical– 2 Hour/week, 1 Credit	**ICA-** 25 Marks
	OE - 50 Marks

This aims at objective to make student realize electronic system design and product design process. This includes power supply design and its management along with signal preprocessing. It also includes hardware and software design and testing. PCB design, documentation and reporting are an integral part of industrial process. This course underlines it as well.

Course Prerequisite:

Student shall have an adept knowledge of analog and digital design. He shall also have a sound basis for microcontrollers and interfacing. Student shall also have basic technical report writing skills.

Course Objectives:

1. To make student design various power supply like DC power supply, SMPS, emitter follower regulator etc.
2. To make student design different multivibrator circuits using IC555, ON/OFF, PI, and PID controllers.
3. To make student use sensors, serial bus protocols like RS232, RS485, sequential circuits for system design with a practical approach.
4. To make student realize industrial product design requirements and then make him aware of product development process accordingly.
5. To introduce to student various documentations associated with electronic products.
6. To make student design the PCB for electronic circuits.

Course Outcomes:

1. Student can design various power supply like DC power supply, SMPS, emitter follower regulator etc.
2. Student can design different multivibrator circuits using IC555, ON/OFF, PI, and PID controllers.
3. Student can use sensors, serial bus protocols like RS232, RS485, sequential circuits for system design with a practical approach.
4. Student can analyze and design analog and digital circuits which constitutes to final system design of an electronic product.
5. Student can implement software design, testing and debugging process for final year project.
6. Student can develop various technical documents for final year project.
7. Student can design the PCB for electronic circuits.

SECTION I

Unit 1 – Design of Power Supply System: No of lectures – 07

- **Prerequisite:** rectifiers, filters and regulators basics of power supply design.
- **Objectives:**
  1. To make student understand various issues in power supply design according to the system's requirement.
  2. To make student realize the efficient management of the power amongst the various system parts and necessary protections.
- **Outcome:**
  After completing this unit, student –
  1. Can analyze the power requirements of the system and its distribution and management across the system.
  2. Can decide and implement different protections required in power supply for safe operation.
- **Unit Content:**
  Unregulated DC power supply system with rectifiers and filters, design of emitter follower regulator, series regulators, overload protection circuits for regulators, design of SMPS for Step up and step down.
- **Content Delivery Methods:**
  Chalk and talk, power point presentation
- **Assessment Methods:**
  Questions based on DC power supply system design, series regulators, design of SMPS, overload protection circuits

Unit 2 – Analog Circuit Design No of lectures – 07

- **Prerequisite:** Concepts of op-amp, flip flop and transistor.
- **Objectives:**
  1. To make student understand internal block diagram of IC555, working and function of each pin.
  2. To introduce the student different application of astable, bistable, monostable multivibrators and Schmitt trigger using IC555.
  3. To make student understand a practical approach of design of ON/OFF controller and proportional controller.
  4. To make student understand working principle of PLL.
- **Outcomes:**
  After completing this unit, student –
  1. Can describe internal block diagram of IC555, working and function of each pin.
  2. Can develop astable, bistable, monostable multivibrators and Schmitt trigger using IC555.
  3. Can design ON/OFF controller and proportional controller.
  4. Can describe working principle of PLL.

- **Unit Content:**
  Design of astable multivibrator, monostable multivibrator, bistable multivibrator, Schmitt trigger using IC555, design of analog ON/OFF controller and proportional controller for controlling process, PLL-working principle, design consideration

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, PROTEUS simulation

- **Assessment Methods:**
  Questions based on design of multivibrators, ON/OFF controller and proportional controller, and PLL-working principle

Unit 3 – Digital Circuit Design No of lectures – 07

- **Prerequisite:** Working of basic digital devices and serial communication

- **Objectives:**
  1. To make student understand the sensor interfacing technique.
  2. To develop student to interface serial protocols like RS232 and RS485.
  3. To make student to design sequential circuits.

- **Outcome:**
  After completing this unit, student –
  1. Can interface different sensors like temperature, pressure, and humidity.
  2. Can interface serial protocols like RS232 and RS485.
  3. Can design sequential circuits.

- **Unit Content:**
  Sensors (temperature, pressure, humidity) and interfacing techniques, analog interfacing and data acquisition, interfacing of serial bus protocols like RS232, RS485, sequential circuit design: binary counter, sequence detector.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations,
- **Assessment Methods:**
  Questions based on sensor interfacing, serial bus protocols and sequential circuit.

SECTION II

Unit 4 – Hardware Design and Testing: No of lectures – 07

- **Prerequisite:** concept of hardware test points and limits in the circuit, basics of CRO

- **Objectives:**
  1. To make student understand electronic product development stages.
  2. To make student recognize importance of modern test and measurement equipments used in debugging the hardware.
  3. To make student know various issues related to EMI and EMC.

- **Outcomes:**
  After completing this unit, student –
  1.Can describe various electronic product development stages.
  2.Can select appropriate equipment for debugging the hardware.
  3.Can select appropriate EMI and EMC related testing.

- **Unit Content:**
  Electronic product development basics, product development stages, identification of customer requirement, designing the product/prototype- design of data acquisition system, Techno-commercial feasibility-case studies, product testing for temperature, EMI and EMC

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based on product development stages, design of data acquisition, product testing for temperature, EMI and EMC

Unit 5 – Software Design and Testing: No of lectures – 07

- **Prerequisite:** basics of structured high level programming language, microcontroller programming

- **Objectives:**
  1. To make student understand different phases of software design.
  2. To make student understand software testing and debugging process.

- **Outcomes:**
  After completing this unit, student –
  1. Can describe different phases of software design
  2. Can implement software design, testing and debugging process for final year project

- **Unit Content:**
  Software design phases, goals of software design, design of structured program, testing and debugging of program, software documentation, selection of language for software development, types of compilers, simulation tools, case studies of processor based product

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Questions based on software design phases, testing and debugging and case studies of processor based product

Unit 6 – PCB Design No of lectures – 07

- **Prerequisite:** working of electronic components/devices especially transistors, diodes, opamps, flip-flops, registers, counter etc.

- **Objectives:**
  1. To make student analyze the fabrication processes of printed circuit boards.
  2. To make student understand the chemical and mechanical processes by using negative/positive masks.
  3. To make student use software PCB design tools and also complete various processes for developing PCB in the lab. (drilling, etching , masking etc).
- **Outcomes:**
  After completing this unit, student –
  1. Able to analyze the fabrication processes of printed circuit boards.
  2. Can perform the chemical and mechanical processes by using negative/positive masks
  3. Student can design PCB using appropriate software PCB design tools and can develop it in the lab completing all the necessary processes.
- **Unit Content:**
  PCB design rules: power and ground traces routing, PCB design rules for digital circuits, noise due to ground and supply line, grounds, returns, shields, PCB design rules for analog circuits, case study: any practical analog and design circuits
- **Content Delivery Methods:**
  Chalk and talk, power point presentation
- **Assessment Methods:**
  Questions based on analysis and design of PCB for analog and digital circuits.

- **Internal Continuous Assessment (ICA):**

  ICA shall consist of tutorials and practical based upon –
  1. Design of DC power supply and SMPS
  2. Design and simulation of multivibrator using IC555.
  3. Application of PLL.
  4. Interfacing of sensors like temperature, pressure etc.
  5. Serial data communication using RS232 and RS485
  6. Data acquisition systems
  7. Design of Sequential circuits
  8. Simulation of processor based products
  9. PCB artwork, layout and schematic design

- **Text and Reference Books:**
  1. Electronic Circuit Design-From concept to implementation; Nihal Kulratna; CRC Press
  2. Electronic Product Designing; R.G. Kaduskar, V.B. Baru; 2nd Edition
  3. Introduction to System Design Using Integrated Circuits by B. S. Sonde, NewAge International Publishers, 2nd Edition.
  4. Integrated Circuits by K. R. Botkar, Khanna publishers, 10th Edition.
  5. Programmable Logic Controllers by Job Den Otter, Prentice Hall International Editions.
  6. Printed Circuit Boards, Design and Technology, by Walter C Bosshart, Tata Mc-Graw Hill publication.

PAH Solapur University, Solapur
B.E. (Electronics) Semester-II
ELECTIVE-II
EN424A BROADBAND COMMUNICATION

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

This course is brought in with an objective to realize requirements of high speed networks for broadband applications and services. This course also includes the selection of appropriate network interface to different applications available at the campus over digital network. The course also covers fixed and flexible interface standard for wireless communication

Course Prerequisite:

The student shall have the knowledge of telephone network, control signaling in circuit switching networks, behavior of packet networks and limitations of packet networks during high speed communication. Student also shall also have basic knowledge of analog communication, digital communication, synchronous & asynchronous communication

Course Objectives:

1. To make student realize issues affecting speed of communication and limitations of present technologies.
2. To make student aware to contemporary technologies available for high speed communication.
3. To introduce to student combined interface to accommodate applications requiring information communication.
4. To introduce to student modern broadband applications and requirements to support these for communication.

Course Outcomes:

On completion of this course student is able to -

1. Analyze appropriate data communication network architecture for given application
2. Illustrate different techniques to supports narrowband and broadband services
3. Define broadband services and specify their applications in modern communication networks
4. Reveal broadband packet switching technologies and networks
5. Describe different protocols to utilize available networks with high efficiency.
6. Interpret ATM switching mechanisms for broadband networks

SECTION I

Unit 1 – Ccommunication Networks No of lectures – 06

- **Prerequisite:** concept of circuit, frame and packet switching & their comparison, control and data handling in circuit switched network

- **Objectives:**
  1. To make student aware of parameters affecting speed of communication in computer networks.
  2. To make student aware of issues like switching and multiplexing in computer networks.

- **Outcomes:**
  After completing this unit, student –
  1. Can analyze the communication parameters affecting the speed of communication.
  2. Can apply concept of switching and multiplexing to form intelligent digital networks.

- **Unit Content:**
  Circuit switching- routing and control signaling**,** packet switching- basic operation, packet switched network interface protocol X.25- internal operations and external services, packet formats, comparison between circuit and packet switching, digital networks- advantages of digital communication over analog communication, intelligent digital networks (IDN)

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based upon various switching technologies, evolution of switching spectrum, performance parameters and multiplexing in intelligent digital networks.

Unit 2 – High Speed Networks No of lectures – 05

- **Prerequisite:** concepts of managing of data at various network components in communication network, packet processing time and high level data link level protocol.

- **Objectives:**
  1. To make student understand frame communication technique over reliable networks.
  2. To introduce to student t protocols influencing speed and quality of communication.

- **Outcomes:**
  After completing this unit, student –
  1. Can analyze the frame parameters and their processing at routers to enhance the speed of communication.
  2. Can select the protocol according to need of quality and cost of communication.

- **Unit Content:**
  Need for speed and quality of service, frame relay- frame relay operation, frame mode protocol architecture-frame mode bearer services, frame relay, frame switching, call control protocol, link layer core parameters, link layer control parameters, LAPF core protocol, LAPF control protocol.

- **Content delivery method:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power presentations, videos and simulations

- **Assessment Method:**
  Questions based upon issues handled in frame communication to enhance the speed of communication, core & control parameter selection in protocol for quality control.

Unit 3 – ISDN and BISDN No of lectures – 10

- **Prerequisite:** Need of multiplexed interface for integration of various devices requiring communication

- **Objectives:**
  1. To make student understand various protocols and interfaces to connect different devices over communication network.
  2. To make student aware of standards and specifications for application management on the networks
  3. To introduce student high data rate applications

- **Outcomes:**
  After completing this unit, student –
  1. Can plan for practical implementation of ISDN for campus connectivity
  2. Is able access different services over digital networks

- **Unit Content:**
  ISDN- principles, services, architecture, user network interface, access configuration, protocol architecture, virtual call setup, addressing, interworking, physical layer, frame format for basic rate access, multi-frame structure, contention resolution,
  BISDN- broadband services, BISDN architecture, physical layer- SONET/SDH

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos and visit to local BSNL office.
- **Assessment Methods:**
  Questions based upon ISDN standard, ISDN user network interface, various reference points and equipment for providing integrated access to different applications at campus

SECTION II

Unit 4 - Asynchronous Transfer Mode No of lectures – 08

- **Prerequisite:** basics of synchronous & asynchrones data transfert, benefits of small size cell communication

- **Objectives:**
  1. To introduce to student concept of fixed size cell communication to support high speed
  2. To make student understand different protocols for guaranteed QOS ATM communication.
  3. To make student understand transmission of ATM traffic over available networks

- **Outcomes:**
  After completing this unit, student –
  1. Can utilize various ATM parameters to guaranteed QoS communication.
  2. Is able to select the appropriate transport mechanism according to available network for the communication

- **Unit Content:**
  Virtual channel, virtual path, call establishment over virtual path, ATM cell formats, generic flow control, HEC operation, transmission of ATM cells- cell based physical layer & SDH based physical layer, ATM adaptation layer- AAL services & protocols

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, simulations.

- **Assessment Methods:**
  Questions based upon ATM cell structure, various parameters in cell providing quality in service and those parameters setting, various protocols at transmitter & receiver, different ATM service protocols for guarantee of quality of service.

Unit 5 – Traffic and Congestion Control in ATM Networks No of lectures - 08

- **Prerequisite:** concepts of physical layer in ATM, performance paramètres in the network, basics of congestion and effect of congestion

- **Objectives:**
  1. To make student realize effect of delay on the quality of communication
  2. To make student understand various ATM network management parameters.

- **Outcomes:**
  After completing this unit, student –
  1. Can plan for guaranteed QoS
  2. Can select for appropriate admission control mechanism to control congestion on ATM network.

- **Unit Content:**
  Latency effect, cell delay variation at UNI, ATM service categories, ATM traffic related attributes, traffic management- frame work, connection admission control, PCR algorithm

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based upon ATM network management parameters, admission control and congestion control algorithm to obtain better quality of service.

Unit 6 – ATM Switching No of lectures - 08

- **Prerequisite:** concepts ATM network, network components, need of switches for routing of applications

- **Objectives:**
  1. To introduce to student ATM switches and its statistical abilities.
  2. To make student appreciate importance of buffer and its management in the ATM switches

- **Outcomes:**
  After completing this unit, student –
  1. Can analyze the statistics maintained by ATM switch to ensure quality of communication
  2. Can select appropriate buffer size and location for quality requirements.

- **Unit Content:**
  ATM switching building blocks, ATM cell processing in a switch, matrix type switch, input, output buffering, central buffering, performance aspects of buffering switching networks.

- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.

- **Assessment Methods:**
  Questions based upon ATM switch elements, switching parameters, types of ATM switches & performance of switching, importance of buffers and its placement for fast high speed communication.

- **Internal Continuous Assessment**
  ICA shall be based on minimum six tutorials covering above curriculum.

- **Text Books:**
  1. ISDN and Broadband ISDN with Frame Relay and ATM- William Stallings, 4th Edition- Pearson Publication
  2. High Speed Networks and Internets- Performance and Quality of Services- Pearson Education Asia publication
  3. Broadband Communications -Balajikumar, Mac-Graw Hill

- **Reference Books:**
  1. Wireless Communications and Networks- William Stallings, Pearson Education Publication
  2. Introduction to Wireless and Mobile Systems- Dharma Agrawal, Quing An Zeng- Cengage Publication.

PAH Solapur University, Solapur
B.E. (Electronics) Semester-II
ELECTIVE-II
EN424B PLC & INDUSTRIAL CONTROLLERS

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

A programmable logic controller, PLC or programmable controller is a digital computer used for automation of typically industrial electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. It is also useful for domestic appliances like Washing machine, Elevator systems and machine shop with computer numerical control etc. The objective of this course is to introduce to student functions, interfacing and programming of the PLC. This course also provides a comprehensive theoretical and applied foundation for industrial process control.

Course Prerequisite:
Student preferably shall have completed a comprehensive course in Mechatronics and shall have an understanding and the ability to analyze electronic circuits and design of signal conditioning circuits and power systems.

Course Objectives:
1. To introduce to student the purpose, functions and operations of the PLC in industrial applications
2. To make student understand hardware architecture of PLC
3. To introduce to student PLC ladder logic and basic programming concepts
4. To make student understand interfacing with PLC & troubleshooting controllers with PLC
5. To make student acquainted with the process control, different types of controllers, its tuning and implementation.
6. To introduce to student different types of sensors and actuators for electromechanical applications
7. To emphasis student with different signal conditioning networks required for interfacing sensors and actuators

Course Outcomes:
1. Student can identify applications for PLC
2. Student can identify the basic components of the PLC and explain how they function
3. Student able to write and debug ladder diagrams for PLC applications
4. Student can establish communication through interfacing with PLC
5. Student can explain PID controllers with necessary mathematical background and can also describe its tuning control

6. Student can describe the operation principle and characteristics of various sensors and actuating systems for electromechanical applications
7. Student can design signal conditioning circuits for interfacing various sensors and actuating systems

---

SECTION I

Unit 1 – Introduction to Programmable Controllers

No of lectures – 07

- **Prerequisite:** basics of analog and digital electronics, microcontrollers
- **Objectives:**
  1. To introduce to student purpose, functions, and operations of the PLC in industrial applications.
  2. To introduce to student hardware architecture of PLC.
  3. To make student understand PLC ladder logic and basic programming concepts.
- **Outcomes:**
  After completing this unit, student –
  1. Can describe purpose, functions, and operations of the PLC in industrial applications.
  2. Can identify and describe various hardware components of PLC.
  3. Able to build ladder diagram for various operations.
  4. Can describe operation of PLC programming unit and data addresses to I/O modules.
- **Unit Content:**
  Controllers, microprocessor based controllers, PLC controllers, typical PLC system, internal architecture of PLC, PLC ladder diagrams, ladder symbols
- **Content Delivery Methods:**
  Chalk and talk, power point presentation
- **Assessment Methods:**
  Questions based upon hardware architecture of PLC, designing the ladder diagram

Unit 2 – Ladder and Functional Block Programming

No of lectures – 07

- **Prerequisite:** PLC architecture and concepts of ladder diagram
- **Objectives:**
  1. To make student understand a practical approach of PLC program design
  2. To introduce to student relay logic, timer and data manipulation instructions.
  3. To make student write the PLC programs for simple applications.
- **Outcomes:**
  After completing this chapter, student –
  1. Can describe relay logic, timer and data manipulation instructions.
  2. Can write PLC programs for simple applications.

- **Unit Content:**
  PLC ladder programming, Logic functions- AND, OR, NOT, NAND, NOR, XOR, latching, multiple outputs, programming examples, programming methods, internal relays, jump and call, timers, counters.

- **Content Delivery Methods:**
  Chalk and Board, power point presentation, home work assignments for programming

- **Assessment Methods:**
  Questions based upon writing programs making efficient use of different instructions for simple applications

Unit 3 – PLC advanced programming and interfacing No of lectures – 07

- **Prerequisite** – Concepts of PLC hardware, programming, interfacing analog and digital devices with microcontroller

- **Objectives** –
  1. To make student understand concept of 'loop' in programming.
  2. To make student safely and correctly wire input and output devices to the PLC.
  3. To make student to design PLC systems like temperature controllers, valve sequencing, and conveyor belt control.

- **Outcomes-**
  After completing this chapter, student –
  1. Can write efficient programs making use of 'loop'.
  2. Can interface analog and digital devices with PLC.
  3. Can design PLC systems like temperature controllers, valve sequencing, and conveyor belt control.

- **Unit Content:**
  Loop commands, shift registers, data manipulations, PLC system designing like temperature controller, valve sequencing, and conveyor belt control.

- **Content Delivery Methods:**
  Chalk and Board, power point presentation, animation, case studies

- **Assessment Methods:**
  Questions based upon advanced programming concepts, interfacing analog and digital devices with PLC and its troubleshooting

SECTION II

Unit 4 - Fundamentals of Process Control No of lectures – 08

- **Prerequisite** – basics of feedback control systems
- **Objectives-**
  1. To introduce to student mathematical background of on/off and PID controller.
  2. To develop student with the designing concept of on/off proportional controller.
  3. To make student understand the PID controllers with its tuning and implementation.
- **Outcomes-**
  After completing this unit, student –
  1. Can describe mathematical concepts for on/off and PID controller.
  2. Can design on/off and proportional controllers.
  3. Can tune PID controller for its implementation.
- **Unit Content:**
  Introduction to process control, on/off, proportional controller, PI & PD controllers, PID controller, tuning and implementation
- **Content Delivery Methods:**
  Chalk and board, power point presentations, simulation
- **Assessment Methods:**
  Questions based upon mathematical foundation of controllers, designing of on/off controllers, PI & PD controllers, tuning of PID controllers

Unit 5 – Sensors and Actuators No of lectures – 08

- **Prerequisite**: basics of sensors
- **Objectives:**
  1. To make student understand working of different sensors required in industrial process.
  2. To make student understand actuators required in industrial process.
- **Outcomes:**
  After completing this unit, student -
  1. Can describe the operation of various types of sensors required in industrial process.
  2. Is able to select appropriate sensors in different industrial applications.
  3. Can describe components of hydraulic and pneumatic actuating system.

- **Unit Content:**
  Flow sensors, pressure sensors, temperature sensors, semiconductor sensors, actuators: control valves, directional control valves, switches & gauges, hydraulic actuation system, pneumatic actuators

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Descriptive questions based upon sensors and actuating systems and their applications

Unit 6 – Signal Conditional Networks No of lectures – 05

- **Prerequisite:** basic concepts of data acquisition systems, op amp, electronic circuit design

- **Objectives:**
  1. To emphasis student with V to I and I to V converters.
  2. To make student apply knowledge of these converters in floating load and grounded load applications.
  3. To make student design DAS using microcontroller.

- **Outcomes:**
  After completing this unit, student -
  1. Can describe the operation of V to I and I to V converters for floating load and grounded load.
  2. Student can design simple DAS using microcontroller.

- **Unit Content:**
  I to V, V to I for floating load and grounded load, data acquisition system using microcontroller

- **Content Delivery Methods:**
  Chalk and talk, power point presentation

- **Assessment Methods:**
  Descriptive / design questions based upon V to I and I to V, microcontroller based DAS

- **Internal Continuous Assessment (ICA):**

  ICA shall consist of minimum eight tutorials based upon above curriculum. Suggested list of few tutorials is as below-

1. PLC ladder diagram and programming
2. Pneumatic and hydraulic actuators
3. Case studies of electromechanical system like CNC machine
4. Analog on/off controller
5. PI Controller, PD & PID
6. Signal conditioning network.
7. Literature survey, specification analysis and comparative study of various commercially available PLCs

---

- **Text Books:**

1. Programmable Logic Controllers; Bolton, Elsevier-Newnes; 3rd Edition
2. Programmable Logic Controllers Programming Methods and Applications; John R. Hack Worth , Frederick D. Hackworth, Jr.; Prentice Hall India
3. Industrial & Process Control, C.D. Johnson, John Wiley & Sons Inc, Eight Edition
4. Industrial Electronics: Circuits, instruments and control techniques, Terry Bartelt ,
5. Delmar Learning India Pvt

- **Reference Books:**

1. Programmable Logic Controllers and applications; John W Webb Ronald A. Reis, PHI Learning
2. Programmable Logic Controllers, Frank Petruzella, McGraw-Hill Higher Education
3. Programmable Logic Controllers Gray Durming, Third Edition

Solapur University, Solapur
B.E. (Electronics) Semester-II
ELECTIVE-II
EN424C SPEECH PROCESSING

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

Speech and music are the most basic means of adult communication. With the advancement of technology more sophisticated techniques have became available to use with speech & music signals. With the proliferation of multimedia systems like DTH, speech processing has gained importance now a days. This course is designed to introduce the basic speech processing techniques including speech synthesis and recognition.

Course Prerequisite:

Student shall have basic knowledge of core mathematical concepts like differential equations, probability functions etc. Student shall also have an adept knowledge of digital signal processing.

Course Objectives:

1. To introduce to student need and applications of speech processing
2. To present to student basic principles of speech analysis and speech recognition in time and transformed domain
3. To make student understand speech enhancement, speech coding and speech recognition

Course Outcomes:

1. Can describe need of different speech processing operations and can list applications for each
2. Student can express the speech signal in terms of its time and frequency domain representations and the different ways in which it can be modeled.
3. Student can analyze simple features used in speech classification applications.
4. Student can implement simple speech processing operations like speaker recognition using MATLAB®

SECTION I

Unit 1- Introduction to speech processing No of lectures-05

- **Prerequisite:** representation of signal in time and frequency domain

- **Objectives:**
  1. To make student familiar with need and applications of speech processing
  2. To make student understand process of human speech production
  3. To introduce to student fundamental steps in speech processing

- **Outcomes:**
  Upon completion of this unit, student –
  1. Can describe various speech processing areas and applications
  2. Can explain basic steps for speech processing
  3. Can explain the process of human speech production.

- **Unit Content:**
  Speech signal, speech processing, digital speech processing, speech synthesis, recognition, applications, sampling, basics of process of human speech production

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, animation for human speech production system

- **Assessment Methods:**
  Questions based upon applications and basics of speech processing.

Unit 2 - Time domain models No of lectures-08

- **Prerequisite:** speech processing basics.

- **Objectives:**
  1. To make student understand the general framework of time domain speech processing.
  2. To introduce to student techniques of silent discrimination and pitch period estimation.

- **Outcomes:**
  Upon completion of this unit, student is –
  1. Able to explain the time domain processing of speech signals.
  2. Able to explain different measurement used in the time domain processing.
  3. Able to explain the techniques for silence discrimination & pitch period detection.

- **Unit Content:**
  Energy, magnitude, zero crossing, silence discrimination, pitch period estimation, autocorrelation, smoothing

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based upon mathematical background of different measurements of time domain processing, techniques for silence discrimination, pitch period estimation. Numerical questions on energy computation & autocorrelation.

Unit 3 - Harmonic speech processing No of lectures-08

- **Prerequisite:** LTI systems, Z transform short time Fourier analysis.

- **Objectives:**
  1. To introduce to student concept and mathematical background of homomorphic systems for convolution
  2. To make student understand complex cepstrum of speech.
  3. To make student understand pitch detection based on homomorphic processing.

- **Outcomes:**
  Upon completion of this unit, student –
  1. Can explain homomorphic systems for speech processing
  2. Can explain pitch detection based on homomorphic processing
  3. Can explain homomorphic vocoder, cepstrum computation

- **Unit Content:**
  Homomorphic systems for convolution, complex cepstrum of speech, pitch detection, formant estimation, homomorphic vocoder

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based upon homomorphic systems, pitch detection, formant estimation, & homomorphic vocoder, numerical questions on cepstrum computation.

SECTION II

Unit 4 - Linear predictive coding No of lectures-09

- **Prerequisite:** Speech production model

- **Objectives:**
  1. To introduce to student linear predictive methods for speech analysis.
  2. To make student understand evaluation of LPC parameters
  3. To make student understand relation between various speech parameters
  4. To make student understand speech synthesis technique using LPC

- **Outcomes:**
  Upon completion of this unit, student –

1. Is able to compare different methods of linear predictive coding for speech analysis
2. Can evaluate the LPC parameters.
3. Can explain the relation between different speech parameters
4. Can explain the LPC based speech synthesis technique

- **Unit Content:**
  Linear predictive analysis by different methods, prediction error signal, evaluation of LPC parameters, interpretation, selective linear prediction, relation between various speech parameters, speech synthesis using LPC, other applications

- **Content Delivery Methods:**
  Chalk and talk, power point presentations.

- **Assessment Methods:**
  Questions based upon different predictive methods, speech parameters, speech synthesis. Numerical questions on LPC parameters evaluations.

Unit 5 - Speech recognition No of lectures-06

- **Prerequisite:** basics of speech signal and elementary mathematics

- **Objectives:**
  1. To make student evaluate the common speech features required for speech recognition
  2. To make student comprehend basics of isolated word recognition & connected word recognition.

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to explain and compare different features of speech useful for speech recognition.
  2. Can differentiate the isolated word detection & connected word detection.

- **Unit Content:**
  Common features, dynamic features, robustness, basics of isolated word recognition & connected word recognition

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, simulation models

- **Assessment Methods:**
  Questions based upon speech features & speech recognition techniques.

Unit 6- Speech synthesis No of lectures-06

- **Prerequisite:** Speech signal representation in time and frequency domain, human speech production model

- **Objectives:**
  1. To make student understand different techniques for speech synthesis

- **Outcomes:**
  Upon completion of this unit, student –
  1. Is able to explain and compare different speech synthesis techniques.

- **Unit Content:**
  Formant synthesizer, filter synthesizer, concatenative methods

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, simulation models

- **Assessment Methods:**
  Questions based upon different synthesizers & concanative methods.

- **Internal Continuous Assessment (ICA) :**
  ICA shall be based on tutorials covering MATLAB® implementation of above concepts.

- **Text & Reference Books**:

  1. Digital Processing of Speech Signals , L.R. Rabiner & R.W. Schafer , Pearson Education
  2. Speech & Audio Signal Processing, Ben Gold & Nelson Morgan, Wiley India
  3. Speech and Audio Processing, Shaila D. Apte, Wiley India

---

PAH Solapur University, Solapur
B.E. (Electronics Engineering) Semester-II

ELECTIVE-II

EN424D DATA ANALYTICS

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

The information in the world doubles every 20 months. Important data sources are business and industrial processes, text and structured data bases, image and biomedical data. Many applications show that data analytics can provide huge benefits. We need models and algorithms to collect, preprocess, analyze, and evaluate data, from various fields such as statistics, system theory, machine learning, pattern recognition, or computational intelligence. This basic course is designed to provide the most important methods and algorithms for data analytics. This course focuses on the understanding of the basic concepts of data analytics, which will allow student to keep pace and to actively contribute to the advancement of the growing field of data analytics.

Course Prerequisite:

Student shall have adept knowledge of algorithms and data structures, database management systems (DBMS) and a high-level programming language preferably Python or R.

Course Objectives:

1. To introduce to student the concepts that are helpful in understanding data preprocessing
2. To make student understand how the data can be preprocessed in order to improve the quality of the data.
3. To make student understand the important steps used in the data preparation phase
4. To introduce to student the concepts used in data reduction and transformation
5. To make student understand the need of data warehousing for analyzing the data

Course Outcomes:

1. Student is able to illustrate various attribute types and basic statistical measures used to describe the central tendency and dispersion (spread) of attribute data.
2. Student is able to analyze the methods used for *data* cleaning, integration, reduction and transformation
3. Student is able to describe the role of feature extraction and data type portability for data preparation.
4. Student is able to list out the strategies used for data reduction and data transformation
5. Student is able to describe dimensionality reduction using axis rotation and type transformation
6. Student is able to illustrate data cube and OLAP concepts of data warehouse modeling

SECTION - I

Unit 1: Getting to know your data No of lectures – 04

- **Prerequisite**: basics of data structures and DBMS
- **Objective**:
  1. To introduce to student concept of data object and it's attribute types
  2. To introduce to student three areas of basic statistical descriptions of data
  3. To make student understand how the data can be conveyed to users effectively
- **Outcomes:**
  After completing this unit, student is able to –
  1. differentiate between various attribute types used to describe a data object
  2. calculate different measures used to quantify central measures of the data
  3. calculate different measures used to quantify dispersion of the data
  4. illustrate various data visualization techniques and sketch the same
  5. compute values of various measures used for measuring data similarity and dissimilarity
- **Unit Content:**

Data objects and attribute types, basic statistical descriptions of data, data visualization, measuring data similarity and dissimilarity

- **Content Delivery Methods:** Chalk and talk, power point presentations
- **Assessment Methods:**

Questions based upon attribute types used to describe data objects, numerical to calculate different measures used for quantifying the data, data similarity and dissimilarity

Unit 2: The Basic Data Types, Data Preprocessing No of lectures – 06

- **Prerequisite**: basics of data structures and DBMS
- **Objective**:
  1. To introduce to student the basic concepts of data preprocessing
  2. To make student understand data cleaning
  3. To make student understand data integration
  4. To make student understand data transformation and discretization
- **Outcomes**:
  After completing this unit, student is able to –
  1. illustrate the need for data preprocessing
  2. describe basic methods used for data cleaning
  3. describe the need for data integration and ways to achieve the same
  4. enlist data transformation strategies

- **Unit Content**:

  Data preprocessing: an overview, data cleaning, data integration, data transformation and data discretization

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based on overview of data preprocessing, data cleaning, data integration, data transformation and discretization

Unit 3: Feature Extraction and Portability No of lectures – 6

- **Prerequisite**: basics of data structures and DBMS

- **Objective**:

  1. To make student understand the need of data preparation phase
  2. To make student understand the concept of feature extraction
  3. To introduce to student the concept of data type portability

- **Outcomes**:

  After completing this unit, student is able to –
  1. discuss feature extraction phase of data along with domain of origin
  2. describe methods for conversion of data formats between various data types
  3. describe important aspects and steps involved in data cleaning

- **Unit content**:

  Feature extraction, data type portability, data cleaning

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based on the concepts of feature extraction, data type portability and data cleaning

SECTION – II

Unit 4: Data Reduction and Transformation No of lectures – 8

- **Prerequisite**: basics of data structures and DBMS

- **Objectives**:
  1. To introduce to student data reduction techniques
  2. To introduce to student data transformation techniques.

- **Outcome**:
  After completing this unit, student is able to –
  1. illustrate the goal of data reduction
  2. Enlist various types of data reduction techniques
  3. describe the concept of *sampling* in the context of data reduction
  4. describe feature subset selection
  5. describe dimensionality reduction using axis rotation and type transformation

- **Unit Content:**
  Sampling, feature subset selection, dimensionality reduction with axis rotation, dimensionality reduction with type transformation

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, programming demo

- **Assessment Methods:**
  Questions based upon sampling in the context of data reduction, feature subset selection, data dimensionality reduction techniques

Unit 5: Data Warehousing and Online Analytical Process No of lectures – 06

- **Prerequisite:** basics of data structures, DBMS, Python

- **Objectives:**
  1. To introduce to student basic concepts of data warehousing
  2. To introduce to student the concept of multidimensional data mining

- **Outcome:**
  After completing this unit, student is able to –
  1. Explain key features of a data warehouse
  2. differentiate between operational database systems and data warehouses
  3. describe three-tier data warehousing architecture.
  4. illustrate data warehouse modeling concepts
  5. describe data warehouse design process
  6. differentiate between the three main types of data warehouse usage
  7. Explain online analytical processing (OLAP) operations

- **Unit Content:**

Basic concepts, data warehouse modelling: data cube and OLAP, data warehouse design and usage, data warehouse implementation

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**

Questions based upon basic concepts of data warehousing, modeling, design, usage and implementation

Unit 6: The Major Building Blocks of Data Analysis No of lectures – 06

- **Prerequisite**: basics of data structures, DBMS, Python

- **Objectives:**
  1. To introduce to student the relationships between data items
  2. To make student understand the scalability issues
  3. To introduce to student some application scenarios of data mining

- **Outcome:**
  After completing this unit, student is able to –
  1. describe data classification in the context of data mining
  2. describe data clustering in the context of data mining
  3. illustrate outlier detection in the context of data mining

- **Unit Content:**

A bird's eye view, scalability issues and the streaming scenario, a stroll through some application scenarios

- **Content Delivery Methods:**
  Chalk and talk, power point presentations

- **Assessment Methods:**

Questions based upon the major building blocks of data mining, scalability issues and applications in the related context.

- **Internal Continuous Assessment (ICA):**

ICA shall be based on tutorial questions covering all six units.

- **Text Books:**

1. Data Mining: Concepts and Techniques, The Morgan Kaufmann Series in Data Management Systems by Jiawei Han, Micheline Kamber and Jian Pei, Morgan Kaufmann Publishers, 3rd edition.
2. Data Mining: The Textbook by Charu C. Aggarwal, Springer Publisher, 2015 Edition.

- **Reference Book:**

1. Data Mining and Analysis: Fundamental Concepts and Algorithms by Mohammed J. Zaki and Wagner Meira, Cambridge University Press

PAH Solapur University, Solapur
B.E. (Electronics) Semester-II
PROJECT

Teaching Scheme
Practical – 8 Hours/week, 4 Credits

Examination Scheme
ICA – 100 Marks
Oral exam – 100 Marks

Project based learning is a paradigm which is becoming time-honored now a days. To keep abreast with this, Project course is included in the curriculum which is spread over both semesters of final year. For this course students carry out a project as a team that allows them to demonstrate their abilities and to develop skills within their chosen area of interest. Hardware realization as well software simulation projects with focus on design and research aspects are accepted. Also communicating effectively, both in oral and written form is an important skill for engineering graduates in many different contexts. This course also aims to foster these skills

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

Course Objectives:
1. To expose student to different project life cycle phases for software or/and hardware projects
2. To impart on student hands on experience for design & development of project
3. To enhance amongst student team working and leadership skills
4. To enhance amongst student presentation and technical documentation skills.

Course Outcomes:
1. Student can select a suitable project based upon requirement analysis and literature survey
2. Student can plan for management and financial aspects of the project
3. Student can design hardware and software architecture of the project
4. Student can apply design concepts for detail design of project
5. Student can validate the results and can also analyze them
6. Student demonstrates leadership and team working behavioral skills
7. Student can write synopsis and project report
8. Student demonstrates presentation skills
9. Student can use programming / simulation software and presentation, word processing software at various stages of project

The project work is carried out in two semesters of B.E. (Electronics). The practical batch for the project will be of 15 students. The batch will be divided into groups each consisting of not more than 3 students.

In semester –I, group will select a project with the approval of guide and submit the synopsis of the project. The group is expected to complete detail system design, high level design and low level design of project in first semester as a part of ICA.

Each student shall deliver a seminar (presentation) preferably on the topic related to project area.
