Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2022
'B^{++}' Grade (CGPA 2.96)

Name of the Faculty: Science and Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: B.Tech. (Electronics Engineering)

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

(Syllabus to be implemented from July 2023)

P.A.H. SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF SCIENCE & TECHNOLOGY
Electronics Engineering

Program 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

P. A. H. SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Science & Technology (Revised from 2020 – 21)

Credit System structure of Final Year B.Tech. Electronics Engineering W.E.F. 2023 – 24

Semester I

Course Code	Theory Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ISE	ESE	ICA	Total
EN411	Advanced Communication Engineering	3	-	-	3	30	70	-	100
EN412	Power Electronics	3	-	-	3	30	70	-	100
EN413	Mobile Technology	3	1	-	4	30	70	25	125
EN414	Professional Elective – II	3	1	-	4	30	70	25	125
Sub Total		12	2	-	14	120	280	50	450
Course Code	**Laboratory Course Name**								
							ESE		
							POE	OE	
EN411	Advanced Communication Engineering	-	-	2	1	-	-	25	25	50
EN412	Power Electronics	-	-	2	1	-	25	-	25	50
EN414	Professional Elective – II	-	-	-	1	-	-	25	-	25
EN415	Seminar & Project Phase I	-	-	4	2	-	-	-	50	50
EN416	Vocational Training	-	-	-	1	-	-	-	25	25
Sub Total		-	-	08	6	-	75		125	175
Grand Total		**12**	2	**08**	**20**	**120**	**355**		**175**	**650**

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)

P. A. H. SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Science & Technology (Revised from 2020 – 21)

Credit System structure of Final Year B.Tech. Electronics Engineering W.E.F. 2023 – 24

Semester II

Course Code	***Theory Course Name***	***Hrs./week***			***Credits***	***Examination Scheme***			
		L	***T***	***P***		***ISE***	***ESE***	***ICA***	***Total***
EN421	Self-Learning II – Technical	-	-	-	2	-	50	-	50
EN422	Professional Elective – III	3	-	-	3	30	70	-	100
Sub Total		3	-	-	5	30	120	-	150
Course Code	***Laboratory Course Name***								
							ESE		
							POE	***OE***	
EN423	Project Phase II /Internship	-	-	10	10	-	-	100	150	250
Sub Total		-	-	10	10	-	100		150	250
Grand Total		**3**	**-**	**10**	**15**	**30**	**220**		**150**	**400**

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)

List of Professional Electives at TY II, B Tech I and B Tech II

Professional Elective I at TY II		*Professional Elective II at B Tech I*		*Professional Elective III at B Tech II*	
Course Code	*Course*	*Course Code*	*Course*	*Course Code*	*Course*
EN325A	Image Processing$	EN414A	CMOS VLSI Design	EN422A	Speech Processing
EN325B	Computer Organization	EN414B	PLC and Industrial Controllers	EN422B	Mechatronics
EN325C	Multimedia Systems	EN414C	Software Engineering	EN422C	Cloud Computing

List of Self Learning II - Technical

Course Code	*Self-Learning II – Technical Course*
EN421A	Electronic Instrumentation
EN421B	Biomedical Instrumentation
EN421C	Cyber Security
EN421D	Approved MOOC Course

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. Student has to complete a vocational training of minimum 15 days duration in any vacation after S.Y. Sem IV but before Final Year Sem VII report for which shall be submitted to the department at Final Year Sem VII for evaluation. Vocational training programmes arranged by the department or the MOOC course(s) recommended by the university, time to time, shall also be accepted as vocational training.
3. Student shall select one self Learning II Technical Course at Final Year Sem VIII Student can select a Self Learning Course from Course List given above and appear for its examination as and when conducted by the university.

   OR

   Student can enroll for MOOC course(s) recommended by the university and complete the necessary certification. The score of the student in this certification examination will be accepted for the credits of 'Self Learning Course' at Final Year Sem VIII

4. Internship – Student may complete an internship of minimum one month and maximum four month duration at industry during Final Year Sem II. Work done by the student at the industry and related report will be accepted as 'Project Phase II'
5. Appropriate Elective I, II & III Subjects may be added when required.
6. Project group for Final Year (Electronics) Part I and Part II shall not be of more than three students.
7. 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

P.A.H. Solapur University, Solapur

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

EN411 ADVANCED COMMUNICATION ENGINEERING

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

This course 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 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 with different modulation techniques and access techniques for wireless communications
6. To introduce to student optical communication system with its theory for implementation, types and devices with its application.

Course Outcomes:

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

1. Derive different parameters of microwave devices by applying its working principle and applications.
2. Characterize microwave devices in terms of the directionality of Communication.
3. Apply microwave fundamentals for evaluation of radar systems
4. Apply microwave fundamentals for evaluation of satellite communication systems and design radio link models and analyze link budget for satellite.
5. Apply ray theory to identify components of an optical communications system

SECTION I

Unit 1 – Introduction to Microwave Techniques No of lectures – 08

- **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 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 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, introduction to wave guides, passive microwave components - 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 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.

- **Outcomes:**
  After completing this unit, student –
  1. Can express working of microwave devices: amplifier and oscillator.
  2. Can explain use of solid state devices for different applications
  3. Can derive equation for various parameter related to microwave devices.

- **Unit Content:**
  Klystrons, reflex klystrons, TWTs, magnetrons, microwave solid state devices –MESFET, varactor diode, PIN diode; tunnel microwave, TED, and avalanche transit time devices

- **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 – 05

- **Prerequisite:** concepts 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 will be able to–
  1. Derive radar range equation.
  2. Describe different types of radar system.

- **Unit Content**
  Radar fundamentals, radar principle, radar range equation, types of radar pulsed radar system, , FMCW radar, Doppler radar ,MTI, radar beacons

- **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 analyze different controlling parameter related to each subsystem and explain working of each block of satellite 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 – 08

- **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 derive uplink frequency and downlink frequency equation
  2. To make student understand modulation and multiplexing techniques used in satellite communication.
  3. To make student understand working of earth station
  4. 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 – 05

- **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 analyze and compare optical devices: light sources, fibers and detectors from both physical and system point of view.

3. 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 compare the structural characteristics of different optical fibers and the different fabrication processes of optical fiber cables
3. 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) :**
  ICA shall consists of minimum ten lab sessions based on above curriculum and covering below-
  1. Tutorial on microwave frequency measurement
  2. Tutorial on calculation of refection coefficient and VSWR
  3. Tutorial on power dividing using H,E,E-H plane Tee junction
  4. Tutorial on isolator and circulator
  5. Tutorial on measurement of coupling factor, isolation and directivity of Directional coupler
  6. Tutorial on reflex Klystron
  7. Tutorial on Gunn diode
  8. Tutorial on Radar communication
  9. Tutorial on Satellite communication
  10. Tutorial on optical communication

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. Microwave and Radar Engineering Dr. M. Kulkarni Umesh Publications.
  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

P. A. H. Solapur University, Solapur
Final Year B. Tech. (Electronics Engineering) Semester-I

EN412 POWER ELECTRONICS

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits
Practical – 2 Hours/week, 1 Credit

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks
ICA – 25 Marks
POE – 25 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 single phase & 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.

Course Prerequisite:

Student has completed a comprehensive course in electronic circuit analysis & design and shall have an understanding and the ability to analyze circuits containing semiconductor devices. Student also has knowledge of network theory and analysis, differential equations and linear algebra.

Course Objectives:

1. To make student understand construction, characteristics of thyristor and different types of protection and commutation circuits for power devices.
2. To make student analyze switching behavior of the single phase and three phase controlled rectifiers.
3. To make student understand the operation and analysis of choppers.
4. To make student analyze switching behavior of single phase and three phase cycloconverter.
5. To make student understand switching behavior and analysis of single phase and three phase voltage source inverters
6. To make student acquainted with the applications of power electronic converters in AC and DC drives.

Course Outcomes:

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

1. Illustrate the characteristics of thyristor and analyze different types of protection & commutation circuits.
2. Design and analyze single phase and three phase controlled rectifiers.
3. Design and analyze different types of choppers.
4. Analyze single phase and three phase cycloconverters
5. Analyze single phase and three phase voltage source inverters.
6. Evaluate power electronics applications to control AC and DC drives.

SECTION I

Unit 1 – Thyristor: Principles and Characteristics: No of lectures – 08

- **Prerequisite:** Concepts of diodes and transistors, RLC circuits and resonance

- **Objectives:**
  1. To make student understand – construction, two transistor analogy, switching characteristics of thyristor.
  2. To make student understand turn on and turn off mechanism of thyristor.
  3. To introduce different types of protection and commutation circuits.
  4. To introduce the student a practical approach of snubber circuit with a systematic design procedure.
  5. To establish thyristor rating and selection of thyristors according to application.

- **Outcome:**

  After completing this unit, student -
  1. Can illustrate construction, two transistor analogy and switching characteristics of Thyristor.
  2. Can describe turn on and turn off mechanism of Thyristor.
  3. Able to analyze protection and commutation circuits for Thyristor.
  4. Able to explain importance of snubber circuits and design with a systematic design procedure.
  5. Can select Thyristor according to need of application.

- **Unit Content:**

  Construction, V-I Characteristics, two transistor analogy, switching characteristics, turn on methods of Thyristor, Thyristor protection circuit: dv/dt, di/dt, over voltage and over current protection circuit, gate protection, design of snubber circuit and di/dt inductance. Thyristor commutation techniques- Class A, Class B, Class C, Class D, Class E & Class F

- **Content Delivery Methods:**

  Chalk and talk, power point presentations, MATLAB simulation for commutation techniques

- **Assessment Methods:**

  Questions based upon two transistor analogy, switching characteristics, turn on methods of thyristor, thyristor protection circuit, design of snubber circuit, protection circuits, and commutation techniques with output waveforms

Unit 2 – Single Phase Controlled Rectifier No of lectures –06

- **Prerequisite:** Uncontrolled rectifiers and its different parameters

- **Objectives:**
  1. To make student analyze switching behavior of the single-phase controlled rectifiers.
  2. To make student understand effect of source inductance on performance of controlled rectifiers.
  3. To make student understand operation of dual converter
  4. To develop control scheme for single phase converters using microcontroller.

- **Outcomes:**
  After completing this unit, student –
  1. Can design and analyze single phase-controlled rectifiers.
  2. Can analyze the effect of source inductance on performance of controlled rectifiers.
  3. Can describe operation of dual converter with energy saving conversion system.
  4. Can design control schemes for single phase converters using suitable microcontroller.

- **Unit Contents:**
  Half wave and full wave-controlled rectifiers; half controlled and fully controlled bridge rectifiers with R, R-L load, effect of source inductance on performance of controlled rectifier, design of controlled rectifiers, dual converter, microcontroller/DSP based firing scheme for single phase-controlled rectifiers

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, MATLAB simulation for single phase converters.

- **Assessment Methods:**
  Questions based upon mathematical expression for different parameters, different types of load, different waveform for different types of controlled rectifiers their advantages and limitations, numerical based on different types of controlled rectifiers and design of controlled rectifiers, microcontroller based firing scheme for converters.

Unit 3 – Three Phase Controlled Rectifiers No of lectures-06

- **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 control scheme for three phase converters using microcontroller.

- **Outcomes:**

  After completing this unit, student –

  1. Can design and analyze three phase controlled rectifiers with different types of load.
  2. Can analyze the effect of source inductance on performance of controlled rectifiers.
  3. Can design control schemes for three phase converters using suitable microcontroller.

- **Unit Content:**

  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; design of three phase controlled rectifiers, 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 upon mathematical expression for different parameters, different types of load, different waveform for different types of three phase controlled rectifiers their advantages and limitations, numerical based on different types of controlled rectifiers and design of three phase controlled rectifiers, microcontroller/DSP based firing scheme for converters.

SECTION II

Unit 4 – Choppers No of lectures – 07

- **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 design and 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 illustrate operation principles and circuit topologies of various chopper commutation circuits and select it for suitable application
5. Can analyze operation of multiphase choppers.

- **Unit Content**:

  Principle of step-down and step-up chopper, design of MOSFET based choppers, control techniques of chopper, chopper classification: single quadrant, two quadrants, four quadrants Thyristor chopper circuits: voltage commutated chopper, current commutated chopper, load commutated chopper, Jones chopper and Morgan chopper, multiphase choppers.

- **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 design of MOSFET based choppers, chopper control techniques, descriptive questions based upon circuit diagram and waveforms ensure understanding the operations of Thyristor chopper circuits and multiphase choppers.

Unit 5 – Cycloconverter No of lectures – 04

- **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 load, three phase to three phase three pulse and six pulse converter, 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.

Unit 6 – Inverters No of lectures – 08

- **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 emphasis 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 MOSFET / IGBT based voltage source inverter: half bridge & full bridge inverter with R and RL load; Fourier analysis of single phase inverter output voltage; IGBT based three phase bridge inverters – 180 & 120 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; basic series inverter, basic parallel inverter.
- **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 ensure understanding the operations of PWM and harmonics reduction techniques, series and parallel inverter.

Unit 7 – Control of AC & DC drive **N**o of lectures – 03

- **Prerequisite:** basics of AC & DC motors, controlled rectifiers, choppers, inverters and cycloconverters

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

- **Outcomes:**

After completing this unit, student –

1. Can select appropriate converter to control AC drive.
2. Can describe closed loop speed control system for AC drive using suitable microcontroller.
3. Can apply knowledge of controlled converters and choppers for controlling DC drives.
4. Can describe importance and closed loop speed control system for DC drive using suitable microcontroller.

- **Unit Content:**

Closed loop speed control of AC drives: single quadrant, four quadrant, speed control using microcontroller /DSP controller, fuzzy logic control of AC drive.

Closed loop control of DC drives - phase locked loop control, voltage and current feedback with microcontroller /DSP controller, fuzzy logic control of DC drive.

- **Content Delivery Methods:**

Chalk and talk; power point presentation

- **Assessment Methods:**

Questions based upon different methods for AC motor speed control, microcontroller based closed loop control of AC drive, closed loop control of DC drive, microcontroller based closed loop control of DC drive, fuzzy logic control of AC & DC drive.

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

ICA shall consist of minimum ten experiments based upon-

1. VI Characteristics of SCR.
2. Thyristor commutation techniques.
3. Single phase full controlled converter
4. Three phase full controlled converter (feeding resistive and DC motor load)
5. Step down chopper (feeding DC motor load)
6. Step up chopper
7. Jones chopper
8. Morgan's chopper
9. Single phase full bridge voltage source inverter
10. Three Phase Bridge Inverter
11. Series inverter.
12. Parallel inverter
13. Cycloconverter feeding resistive load.
14. Simulation of three phase converter, choppers, PWM inverters and cycloconverter using MATLAB
15. 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.

P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – I

EN413 MOBILE TECHNOLOGY

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

Examination Scheme
ESE – 70 Marks
ISE – 30 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 have 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

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Course Outcomes:
At the end of this course, student will be able to -

1. Analyze the accessing techniques for cellular and mobile communications.
2. Analyze basic cellular system by view of frequency reuse, co-channel Interference and different methods of cell splitting and sectoring.
3. Compare different cellular technologies such as CDMA, GSM, GPRS
4. Evaluate IEEE 802.11 and Bluetooth with architecture and protocol
5. Apply knowledge of TCP/IP extensions for mobile and wireless networking.

SECTION I

Unit 1 – Fundamentals of Mobile Communication No of lectures -06

- **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:**
  After completing this unit, student –
  1. Is able 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:**
  After completing 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-10

- **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:**
  After completing 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

- **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-02

- **Prerequisite: b**asics of computer network and internet
- **Objectives:**
  1. To introduce to student general architecture for mobile computing and various applications and services associated
- **Outcomes:**

  After completing 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-06

- **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:**

  After completing 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

- **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:**
  After completing 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-06

- **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:**
  After completing 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

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- **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

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P.A.H. Solapur University, Solapur

Final Year B. Tech (Electronics Engineering) Semester – I

Professional Elective – II

EN414A CMOS VLSI DESIGN

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
OE – 25 Marks

This is an introductory course which covers basic theories and techniques of digital VLSI design in CMOS technology. In this course, we will study the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, designing combinational and sequential circuits in CMOS. It also includes the timing issues in digital circuits.

Course Prerequisite:
Student shall have completed courses on ddigital circuit design and eelectronics devices and circuits

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Course Objectives:

1. To make student understand the MOS transistor theory and use it to analyze the static and dynamic behavior of CMOS Inverter.
2. To make student understand the combinational and sequential circuits design in CMOS.
3. To introduce to the students various timing issues in digital circuits.
4. To make student understand the design of arithmetic and memory building blocks.

Course Outcomes:

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

1. Use the basic MOS transistor theory to analyze the behavior of CMOS inverter.
2. Design various CMOS combinational and sequential circuits.
3. Explain different timing methodologies and analyze the impact of clock skew and clock jitter on the circuit performance
4. Design arithmetic and memory building blocks.

SECTION I

Unit 1 – MOS Transistor Theory No of lectures –06

- **Prerequisite**: Electronic device characteristics
- **Objective:**
  1. To introduce to student physical structure of MOS transistor
  2. To make student understand MOS device design equations and second order effects
  3. To make student understand how the operating characteristics and properties of the MOS transistor are influenced by reduction in feature size.
- **Outcomes:**

  After completing this unit, student will be able to –
  1. Explain the physical structure of MOS transistor
  2. Describe analytically the MOS transistor from a static (steady-state) and dynamic (transient) viewpoint
  3. Explain how reduction in feature size influences the operating characteristics and properties of the MOS transistor.
- **Unit Content:**

  Physical structure of MOS transistor, accumulation, depletion & inversion modes, MOS device design equations, second order effects, Technology scaling
- **Content Delivery Methods:**

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

  Questions based upon structure of MOS transistor and design equations.

Unit 2 – CMOS Inverter No of lectures –06

- **Prerequisite:** MOS transistors, device equations
- **Objective:**
  1. To make student understand analysis of CMOS inverter with respect to the different design metrics.
  2. To make student understand the impact of technology scaling on inverter
- **Outcomes:**

  After completing this unit, student will be able to –
  1. Analyze CMOS inverter with respect to cost, robustness, performance and energy efficiency.
  2. Explain the impact of technology scaling on the inverter performance.
- **Unit Content:**

  Static and dynamic behavior of CMOS inverter, power and energy delay, impact of technology scaling on inverter

- **Content Delivery Methods:**
  Chalk and talk, power point presentations
- **Assessment Methods:**
  Questions based upon various analysis of CMOS inverter behavior, impact of scaling.

Unit 3 – Combinational Logic Design in CMOS No of lectures –09

- **Prerequisite**: CMOS operation, digital circuits
- **Objective:**
  After completing this unit, student will be able to –
  1. Understand the design of various circuits including complementary CMOS, ratioed logic and pass transistor logic.
  2. Understand CMOS dynamic logic which avoids static power consumption
- **Outcomes:**
  After completing this unit, student will be able to –
  1. Design complementary CMOS, ratioed logic and pass transistor logic static circuits
  2. Design CMOS circuits with dynamic logic principle.
- **Unit Content:**

  Static CMOS design- complementary CMOS, ratioed logic and pass transistor logic; dynamic CMOS design- dynamic logic basic principle, speed and power dissipation, issues in dynamic design, cascading dynamic gates, comparison of static and dynamic designs in CMOS

- **Content Delivery Methods:**
  Chalk and talk, power point presentations
- **Assessment Methods:**
  Questions based upon logic design principle, static and dynamic CMOS design, speed and power dissipation.

SECTION II

Unit 4 – Sequential Logic Designs in CMOS No of lectures –09

- **Prerequisite:** CMOS Operation, digital circuits
- **Objectives**:
  After completing this unit, student will be able to –
  1. Understand CMOS implementation sequential building blocks.
  2. Introduce to choices in sequential primitives and clocking methodologies
  3. Understand impact of clocking methodologies on performance, power, design complexity of circuits.

- **Outcome**:

  After completing this unit, student will be able to –

  1. Design sequential building blocks in CMOS.
  2. Select a suitable sequential primitive and clocking method considering performance, power, and/or design complexity.

- **Unit Content:**

  Static latches and registers- the bistability principle, multiplexer based latches, master-slave edge triggered register, low voltage static latches, static SR flip flops, dynamic latches and registers- dynamic transmission-gate edge triggered registers,C2MOS- A clock- skew insensitive approach, true single-phase clocked register (TSPCR)

- **Content Delivery Methods:**

  Chalk and talk, power point presentations

- **Assessment Methods:**

  Questions based upon basic sequential logic designs and C2MOS- A clock- skew insensitive approach, true single-phase clocked register (TSPCR)

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Unit 5 – Timing Issues in Digital Circuits No of lectures –06

- **Prerequisite:** Sequential circuits timing

- **Objectives:**

  1. To make student understand various timing methodologies
  2. To introduce student understand the effect of timing variations on circuit performance and techniques to deal with it.

- **Outcome:**

  After completing this unit, student will be able to –

  1. Explain various timing methodologies in digital circuits.
  2. Analyze the impact clock skew clock jitter on the circuit performance

- **Unit Content:**

  Timing classification: synchronous interconnect, mesochronous interconnect, plesiochronous interconnect, asynchronous interconnect, synchronous design- clock skew, jitter, clock distribution, latch based clocking, synchronizers and arbiters, using PLL for clock synchronization

- **Content Delivery Methods:**

  Chalk and talk, power point presentations

- **Assessment Methods:**

  Questions based upon various timing issues, effect of clock skew and jitter on circuit performance

Unit 6 – Designing Arithmetic and Memory Building Blocks No of lectures –06

- **Prerequisite:** Digital design, memory devices.

- **Objectives:**
  After completing this unit, student will be able to –
  1. Understand designing basic arithmetic building blocks.
  2. Designing memory

- **Outcome:**
  After completing this unit, student will be able to –
  1. Design fast adders and multipliers.
  2. Design ROMs, static and dynamic RAMs

- **Unit Content:**
  Designing fast adders, designing fast multipliers, designing other arithmetic building blocks, designing ROMs, DRAMs & SRAMs

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

- **Assessment Methods:**
  Questions based upon designing different arithmetic building blocks

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

ICA shall consist of minimum eight Tutorials based on above syllabus.

- **Text Books:**
  1. Digital Integrated Circuits, Rabey, Chandrakasan, Nikolic, Pearson Education
  2. Principles of CMOS VLSI Design, Neil Weste, Kamran Eshraghian, Addison Wesley, Pearson Education
- **Reference Books:**
  1. CMOS circuit design , Layout nd Simulation, R. Jacob Baker, Wile Publication
  2. Basic VLSI Design by Douglas A. Pucknell, Kamran Eshraghian, PHI Publication

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P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – I

Professional Elective – II

EN414B PLC & INDUSTRIAL CONTOLLERS

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
	OE – 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 architecture of the PLC in industrial applications.
2. To make student design and analyze programs for different applications with sensor & actuator.
3. To make student acquainted with the process control, different types of controllers, its tuning and implementation.
4. To introduce to student different types of sensors and actuators.
5. To make student analyze and design with different signal conditioning circuits for interfacing sensors and actuators

Course Outcomes:

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

1. Outline the architecture of PLC and classify their applications.
2. Develop and analyze programs for different applications with sensor & actuator.
3. Analyze process controllers with necessary mathematical background with tuning control.
4. Illustrate the operating principle and classify the characteristics of various sensors and actuating systems.
5. Analyze and 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
     .
- **Outcomes:**
  After completing this unit, student will be able to –
  1. Describe purpose, functions, and operations of the PLC in industrial applications.
  2. Identify and describe various hardware components of PLC.

- **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 will be able to –
  1. Describe relay logic, timer and data manipulation instructions.
  2. 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 interface input and output devices to the PLC.
  2. To make student to design PLC systems like temperature controllers, valve sequencing, and conveyor belt control.

- **Outcomes:**
  After completing this chapter, student will be able to –
  1. Interface analog and digital devices with PLC.
  2. 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 will be able to –
  1. Describe mathematical concepts for on/off and PID controller.
  2. Design on/off and proportional controllers.
  3. 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 will be able to -
  1. Describe the operation of various types of sensors required in industrial process.
  2. Select appropriate sensors in different industrial applications.
  3. 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 & apply knowledge of these converters in floating load and grounded load applications.
  2. To make student design DAS using microcontroller.

- **Outcomes:**
  After completing this unit, student will be able to -
  1. Describe the operation of V to I and I to V converters for floating load and grounded load.
  2. 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 Tutorial sessions based upon above curriculum.

- **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 , 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

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P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – I

Professional Elective – II

EN414C SOFTWARE ENGINEERING

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
	OE – 25 Marks

Current Software engineering methods and techniques have made us much better at building large and complex systems than we were. However, there are still too many projects that are late, over budget, and do not deliver the software that meets customer's needs. The main aim of introducing this course is to understand the methods, processes, techniques, and approaches which are required to develop high-quality software products within schedule and budget. On top of that this course ensures understanding of the complete Software Development Life Cycle (SDLC) for the development of software products as per the customer's needs. Further, it ensures the knowledge of various quality standards used in the software system and the Agile Project Management Process.

Course Prerequisite:

Students shall have undergone a course on Object Oriented Programming through C++/ Java.

Course Objectives:

1. To make student comprehend various software development models
2. To make student understand software requirement and analysis process
3. To introduce to students software architecture and design
4. To give student overview of various methods for software testing
5. To introduce to student various processes involved in software project planning and management

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Course Outcomes:

After completing this course, student shall be able to -

1. Evaluate appropriate lifecycle model for software development.
2. Prepare SRS and SDS accordingly for a given problem.
3. Select and apply appropriate software testing method.
4. Explain quality management process.

SECTION-I

Unit 1 – Introduction to Software Engineering No of lectures – 08

- **Prerequisite – U**nderstanding of Programming and Object Orient Design.

- **Objectives:**
  1. To make students aware of the software development process
  2. To make students understand the Challenges and approaches
  3. To make students aware of SDLC
- **Outcome:**
  At the end of the unit students will be able to:
  1. describe software development process and its challenges
  2. differentiate between various software development processes
  3. explain characteristic of software development process.

- **Unit Content:**
  Introduction, the problem domain, software engineering challenges and approach, software process, characteristics of software process, software development process models: waterfall model, prototype model, iterative development model: incremental model, spiral model, rational unified process model, time boxing model, agile process model

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

- **Assessment Methods:**
  Questions based upon above unit contents and case study of any one SDLC.

Unit 2 – Software Requirement Analysis & Specification No of lectures – 06

- **Prerequisite –** Basic knowledge of software development and requirement gathering process.

- **Objectives:**
  1. To understand the need and importance of software requirement analysis and specification in the software development lifecycle.
  2. To learn the characteristics of a good SRS document and the requirement process.
  3. To explore the different approaches for requirement analysis and specification, including functional specification with use cases, data flow diagrams, and entity relationship diagrams.
- **Outcome:** At the end of the unit students will be able to:
  1. Document the software requirements
  2. Evaluate software requirements.
  3. Describe functional specification
  4. Express design requirements using DFD and ER diagram

- **Unit Content:**
  Need of SRS, characteristics of good SRS, requirement process, requirements specification, functional specification with use cases, other approaches for analysis: data flow diagram, entity relationship diagram

- **Content Delivery Methods:**
  Chalk and talk, PowerPoint presentations, case studies assignments
- **Assessment Methods:**
  Questions based upon the above unit contents and case study of SRC

Unit 3 – Software Architecture and Design No of lectures – 08

- **Prerequisite:** Basic knowledge of programming concepts and software development lifecycle.

- **Objectives:**
  1. To understand the importance of software design
  2. To learn the fundamentals of software architecture.
  3. To explore design concepts and its types.
- **Outcome:**
  After studying this topic, students will be able to
  1. Describe software architecture designs.
  2. Explain design principles, coupling, cohesion, and object-oriented design.
  3. Relate various design concepts

- **Unit Content:**
  Introduction to software design, software architecture: role of software architecture, architecture views, component & connector view, architecture style for component & connector view, documenting architecture design, design concepts: design principles, conceptual design and technical design, coupling, cohesion, open closed principle, function-oriented design, object oriented design, high level design, detailed design, verification, metrics

- **Content Delivery Methods:**
  Chalk and talk, PowerPoint presentations, case studies assignments

- **Assessment Methods:**
  Questions based upon the above unit contents.

SECTION II

Unit 4 – Testing No of lectures – 05

- **Prerequisite:** Basic understanding of software development process and programming concepts.

- **Objectives:**
  1. To understand the fundamentals of software testing and its importance
  2. To learn about the testing process.
  3. To explore software testing methods

- **Outcome:**
  At the end of the unit students will be able to:
  1. Describe the testing process and testing techniques.
  2. Relate various software testing methods.
  3. Explain various testing methods

- **Unit Content:**
  Testing fundamentals, testing process, black-box testing, white-box testing, object-oriented software testing methods, functional testing, unit testing, system testing, user satisfaction testing.

- **Content Delivery Methods:**
  Chalk and talk, PowerPoint presentations, case studies assignments

- **Assessment Methods:**
  Questions based upon the above unit contents.

Unit 5 – Project Planning and Management No of lectures – 08

- **Prerequisite:** Basic knowledge of software development process and project management principles.

- **Objectives:**
  1. To understand the project management process and its importance in software development.
  2. To learn about the inspection, audit process and quality planning.
  3. To explore various concepts about project planning and management.

- **Outcome:**
  At the end of the unit students will be able to:
  1. Explain project planning and management process
  2. Describe various aspect of planning, estimation, scheduling and management in software development
  3. Discuss about quality control, risk management in software development process

- **Unit Content:**
  Project management process, the inspection and audit process, software configuration management process, effort estimation, project schedule and staffing, quality planning: quality concepts, qualitative quality management planning. CMM project management process, risk management planning, project monitoring plan, detailed scheduling

- **Content Delivery Methods:**
  Chalk and talk, PowerPoint presentations, case studies assignments

- **Assessment Methods:**
  Questions based upon the above unit contents.

Unit 6 – Agile Project Management No of lectures – 08

- **Prerequisite:** Basic knowledge of project management principles and software development process.

- **Objectives:**
  1. To understand the fundamentals of Agile Project Management and its importance
  2. To learn about the iterative and adaptive project management life cycle.
  3. To explore concepts such as adaptive and integrating the APM toolkit, the science of Scrum.
- **Outcome:**
  At the end of the unit students will be able to:
  1. Describe agile project management and its components.
  2. Explain scrum methodology, and new management responsibilities.
  3. Evaluate control of project progress through effective project management techniques

- **Unit Content:**
  Introduction to APM, implementation, iterative project management life cycle, adaptive project management life cycle, adaptive & integrating the APM toolkit, the science of scrum, new management responsibilities.

- **Content Delivery Methods:**
  Chalk and talk, PowerPoint presentations, case studies assignments

- **Assessment Methods:**
  Questions based upon the above unit contents.

- **Internal Continuous Assessment (ICA)**
  ICA consists of a minimum of eight tutorials based on the above curriculum and the following are the model tutorial assignments that can be included:
  1. Create a software development plan for a given project, including project scope, schedule, and budget, and give a presentation.
  2. Use version control systems, such as Git, to manage software code and collaborate with team members. Demonstrate the benefits of version control and collaboration tools.
  3. Write a technical report on a software development topic, such as software testing strategies, Agile development methodologies, or software security practices.
  4. Participate in a team project to develop a software system, and contribute to the project's development plan, design, and implementation.
  5. Reflect on the ethical, legal, and professional implications of software development and write an essay/ give presentation on a related topic.

- **Textbooks:**
  1. An Integrated Approach to Software Engineering, Pankaj Jalote, 3rd Edition (Narosa Publishers)
  2. Effective Project Management Traditional, Agile, Extreme, Robert K. Wysocki, 6th Edition, Wiley India
  3. Software Project Management in Practice, Pankaj Jalote Pearson India Ltd

- **Reference Books:**
  1. Software Engineering, Ian Sommerville, 6th edition, Pearson education Asia
  2. Software Engineering Fundamentals, Ali Behforooz and Frederick j. Hudson (Oxford University Press).
  3. Project Management with Scrum, Ken Schwaber.
  4. Software Engineering-A precise approach, Pankaj Jalote Wiley Precise Precise Textbook

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P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – I

EN415 SEMINAR & PROJECT PHASE I

Teaching Scheme
Practical – 4 Hours/week, 2 Credits

Examination Scheme
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

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Course Pre-requisite:

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

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Course Objectives:

1. To expose student to industry in electronics engineering and allied fields to identify the problem area and formulate the problem statement
2. To make student aware of the present trends used to solve the problem undertaken
3. To make student able to design the electronic system according to the scope of the problem
4. To make student able to conduct preliminary experiments, simulations to solve the problem undertaken.
5. To make student able to write technical specifications, project document over problem undertaken.

Course Outcomes:

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

1. Identify the problem area and formulate the problem statement
2. Analyze the present trends used to solve the problem
3. Design the system according to the scope of the problem
4. Conduct preliminary experiments, simulations and modelling techniques to solve the problem
5. Write synopsis, technical specification and project report on solution to problem undertaken.

The objective of Project Phase – I is to enable the student to take up investigative study in the broad field of Electronics Engineering and allied fields, either fully practical or involving both theoretical and practical work to be assigned by the department on basis three students in a group, under the guidance of a supervisor.

This is expected to provide a good initiation for the students in further career building. The tasks during Project Phase – I includes –

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis / Modeling / Simulation / Experiment /Design / Feasibility.
4. Preparing a written report on the study conducted for presentation to the department.
5. Seminar as oral presentation in front of a departmental assessment & evaluation committee.

P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – I

EN417 VOCATIONAL TRAINING

Teaching Scheme
1 Credit

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 posses necessary technical report writing skills, presentation skills and shall have proficiency in office software for word processing and presentation

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Course Objectives:

1. To 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:

After completing this course, student will be able to –

1. Identify suitable project based on the learning in vocational training and successfully completes it.
2. Articulate vocational training report
3. Demonstrates presentation skills
4. Apply 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.Y. Part II but before Final Year Part I and the report prepared and submitted by the student will be evaluated in Final Year BTech 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.

P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – II

Self-Learning – II Technical

EN421A ELECTRONIC INSTRUMENTATION

Teaching Scheme
Self Learning

Examination Scheme
ESE – 50 Marks

The Electronic Instrumentation course is a study of the basic principles of electronic instrumentation and measurement techniques. It covers topics such as performance characteristics, errors and sources, indicators and display devices, signal generators, signal analyzers, data acquisition and transmission, and quality management. The course aims to equip students with a strong foundation in electronic instrumentation and measurement techniques, and the ability to apply these concepts in various real-world scenarios.

Course Prerequisite:

It is recommended that students have completed an introductory course in electrical circuits and electronic components prior to taking this course. Additionally, students should have a solid understanding of mathematical concepts and programming languages to be able to apply them in the context of electronic instrumentation.

Course Objectives:

1. To introduce students to the basic principles of electronic instrumentation and measurement techniques.
2. To help students develop an understanding of the different types of measurement errors and their sources.
3. To enable students to identify and select appropriate indicators and display devices for various measurement applications.
4. To introduce students to the theory and practical application of signal generators and signal analyzers.
5. To provide students with an understanding of data acquisition and transmission systems.

Course Outcomes:

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

1. Explain the importance of measurement quality and the different types of measurement errors and their sources.
2. Select and use appropriate indicators and display devices for various measurement applications.
3. Generate different types of signals using signal generators and analyze signals using signal analyzers.
4. Design and implement data acquisition and transmission systems for various measurement applications.
5. Explain the principles of quality management and the requirements of ISO 9000 quality management systems.

SECTION – I

Unit 1 – Qualities of Measurements

Performance characteristics, static & dynamic characteristics, errors & sources. Basic measurements – frequency, time, period.

Unit 2 – Indicators & Display Devices

Analog meters – AC & DC, digital voltage measurement techniques, display devices- LED, LCD etc.

Unit 3 – Signal Generators

Audio frequency signal genitors, radio frequency signal generators, function generator, frequency synthesis techniques – direct, indirect, digital, arbitrary waveform generator, synthesized function generator, data generator.

SECTION - II

Unit 4 – Signal Analyzers

Distortion measuring instruments, spectrum analyzer, FFT analyzer, vector analyzer, logic analyzer.

Unit 5 – Data Acquisition & Transmission

Data acquisition system (DAS), single & multi-channel DAS, multiplexing, data loggers, hierarchy of instrument communication, field bus & device networks.

Unit 6 – Quality Management

Quality, ISO 9000 quality management system overview.

- **Text Books:**
  1. Electronic Instrumentation & Instrumentation Technology, M.M.S. Anand, Prentice Hall of India Pvt. Ltd.
  2. Electronic Instrumentation, Second Edition, H.S. Kalasi, Tata McGraw-Hill Publishing Company Ltd.

- **Reference Books:**
  1. Electronic Instrumentation and Measurements. Bell, D. A., United States: Reston Publishing Company.
  2. Principles of Electronic Instrumentation and Measurement by Howard M. Berlin and David M. Hill

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P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – II

Self-Learning – II Technical

EN321B BIOMEDICAL INSTRUMENTATION

Teaching Scheme
Self Learning

Examination Scheme
ESE – 50 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:

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

1. Analyze bio electrical signals from various parts of body
2. Select appropriate transducer/sensor and necessary instrumentation for physiological parameter measurement.
3. Describe functioning of basic medical equipment's
4. Plan for protection to biomedical instrument against electrical shocks.

SECTION I

Unit 1 – The Origin of Bio-potentials

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

Unit 2 – Bio-potential Electrodes, Sensors, and Transducers

Need of electrode, electrode and electrolyte interface, 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

Unit 3 – Instrumentation in Diagnostic Cardiology

ECG lead, electrocardiograph machine, ECG signal- various distortion, artifacts from electric transients, interference from other electric devices, transient protection, cardio tachometer, cardiac monitors, 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

SECTION II

Unit 4 – Instrumentation for Blood Circulation and Respiration

Blood flow and blood volume measurement: indicator dilution, thermodilution 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.

Unit 5 – Medical Imaging, Therapeutic and Prosthetic Instruments

X-ray machine; computed tomography- CT scanner. Cardiac pacemakers, Defibrillators, ventilators, infant incubators

Unit 6 – Electrical Safety

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

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- **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

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P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – II

Self-Learning – II Technical

EN421C - CYBER SECURITY

Teaching Scheme	**Examination Scheme**
Self Learning	**ESE –** 50 Marks

Cyber security is becoming an increasingly important factor in consumer decision-making, particularly when it comes to technology products and services. Cyber security is a growing field, and there is high demand for professionals with a strong understanding of cyber security principles and practices. Learning cyber security can help engineers create more secure and reliable systems, comply with regulatory requirements, gain a competitive advantage, and enhance their career prospects.

Course Prerequisite:

Students should have a basic understanding of operating systems, and networking concepts such as TCP/IP, DNS, and firewalls.

Course Objectives:

1. Understanding the Fundamentals: Providing students with a foundation in the fundamental concepts and principles of cyber security, including risk assessment, threat modeling, vulnerability assessment, and security controls.
2. Enhancing Analytical Skills: Developing students' critical thinking and problem-solving skills in order to analyze and respond to security threats and incidents.
3. Promoting Ethical and Professional Behavior: Emphasizing the importance of ethical and professional behavior in cyber security, including legal and ethical considerations, privacy, and compliance with regulatory frameworks.
4. Developing Technical Skills: Equipping students with practical skills in areas such as network security, cryptography, secure coding, and incident response.

Course Outcomes:

After completing this course, the student shall be able to -

1. Explain cyber security concepts and principles, including terminology, risk management, and security controls.
2. Develop skills in areas such as network security, cryptography, and incident response.
3. Evaluate cyber threats and vulnerabilities, and learn how to identify and respond to them.
4. Describe how to apply basic cyber security techniques to protect personal and enterprise systems.

SECTION I

Unit 1 – Introduction to Cyber Security

What is cyber Security, Black-hats vs White-hats, How the Internet Works, The Black-hat Attack methodology, How black hats find you, hide from attack, and analyze your network.

Unit 2 – Types of Attack- Phishing and Malware

What is Phishing, protecting from phishing, why phishing attack, Analyzing phishing email.
What Is Malware, types of malware, deploying malware, defense against malware, analyzing malware in PDF attachment.

Unit 3 – Password Thefts and Other Account Access Attacks

Authorization and Authentication, Information Accounting Methods, Case Study- Understanding authentication and authorization by account setup in Windows-10 OR Mac-OS

SECTION II

Unit 4 – Network Tapping

Basics of network design, Attacking Your Network, Defense Against Network Attacks, Case Study-Firewall setup.

Unit 5 – Attacks in the Cloud and Wireless Networks

How Cloud Computing Works, Attacking the Cloud, Defending the Cloud. How Wireless Networks Work, Wireless Standards, Wireless Security, Wireless Attacks, Setting Up a Wireless Network with Security in Mind, Case Study-WAP setup.

Unit 6 – Cryptography - Encryption and Decryption

What Is Cryptography, What We Encrypt, History, Modern Cryptography, cryptography in websites, How Black Hats Steal Your Keys, Protecting Your Keys, salting. Case study- Encrypting and Hashing a File in Windows 10.

- **Textbooks:**
  1. How Cybersecurity Really Works by Sam Grubb, No Starch Press Publication, First Edition.

- **Reference Book:**
  1. Cryptography and network security by Atul Kahate, Tata Mc-Graw Hill Publication
  2. Cryptography and Network Security by William Stallings -Principles and Practice, Global Edition-Pearson (2022)

P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – II

Professional Elective – III

EN422A SPEECH PROCESSING

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks

Speech and music are the most basic means of adult communication. With the advancement of technology more sophisticated techniques have become 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

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Course Outcomes:

At the end of the course student will be able to –

1. Explain the need of different speech processing operations and can list applications for each
2. Express the speech signal in terms of its time and frequency domain representations and the different ways in which it can be modeled.
3. Analyze simple features used in speech classification applications.
4. Explain various speech coding techniques
5. Explain various speech recognition and synthesis techniques

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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:**

  After completing this unit, student will be able to –
  1. Describe various speech processing areas and applications
  2. Explain basic steps for speech processing
  3. 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:**
  After completing this unit, student will be able to –
  1. Explain the time domain processing of speech signals.
  2. Explain different measurement used in the time domain processing.
  3. 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:**
  After completing this unit, student will be able to –
  1. Explain homomorphic systems for speech processing
  2. Explain pitch detection based on homomorphic processing
  3. 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:**
  After completing this unit, student will be able to –
  1. Compare different methods of linear predictive coding for speech analysis
  2. Evaluate the LPC parameters.
  3. Explain the relation between different speech parameters
  4. 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:**
  After completing this unit, student will be able to –
  1. Explain and compare different features of speech useful for speech recognition.
  2. 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:**
  After completing this unit, student will be able to –
  1. 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.

- **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

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P. A. H. Solapur University, Solapur
Final Year B. Tech. (Electronics Engineering) Semester – II

Professional Elective – III
EN422B MECHATRONICS

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits

Examination Scheme
ESE – 70 Marks
ISE – 30 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 mechatronics 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. They shall also possess knowledge about basic mechanical systems

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Course Objectives:
1. To introduce to students the basic concept and key elements of mechatronics system.
2. To make student understand the working principal of different sensors and transducers & their selection.
3. To make student understand pneumatic and hydraulic actuation system.
4. To introduce to student mechanical and electrical actuation system.
5. To introduce to student mechatronics system case studies.

Course Outcomes:
At the end of this course, student will be able to -
1. Apply design process and control systems to implement small mechatronics system.
2. Apply working principal of sensors to measure various physical parameters
3. Design simple systems, for sequential control systems involving hydraulic/ pneumatic directional control valves and cylinders.
4. Evaluate the capabilities of linkages, cams, gears, ratchet-and-pawl, belt and chain drives and bearings for actuation systems.
5. Evaluate the operational characteristics of electrical actuation systems: relays, solenoids, d.c., a.c. and stepper motors.
6. Outline different components of various mechatronics systems

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SECTION I

Unit 1 - Introduction to Mechatronics No of lectures – 07

- **Prerequisite:** Fundamentals of electronics and mechanical engineering, control system theory, basics of microcontrollers

- **Objectives:**
  1. To make student understand key elements and design process of mechatronics.
  2. To introduce role of control system in mechatronics and the microprocessor based controllers

- **Outcomes:**
  After completing this unit, student will be able to -
  1. Apply design process and control systems to implement small mechatronics system.
  2. Comprehend different elements of control system and microprocessor based controllers.

- **Unit Content:**
  What is mechatronics, mechatronics key elements, the design process, systems, measurement systems, control systems, microprocessor based controllers, examples of mechatronics systems

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, assignments as a home work

- **Assessment Methods:**
  Questions based upon control system, microprocessor based controllers, examples of mechatronics systems.

Unit 2 – Sensors and Transducers No of lectures – 07

- **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 will be able to –
  1. Analyze the working of sensors and transducers.
  2. 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:**
  Questions based upon working principal of different sensors and transducers and system development.

Unit 3 – Pneumatic and Hydraulic Actuation System No of lectures – 06

- **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 will be able to–
  1. Interpret system drawings for sequential control systems
  2. Design simple systems, for sequential control systems involving hydraulic/pneumatic directional control valves and cylinders.

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

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

- **Assessment Methods:**
  Questions based upon pneumatic and hydraulic actuating systems, directional control valves, system drawings and design of simple systems.

SECTION II

Unit 4–Mechanical Actuation System No of lectures – 07

- **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 will be able to–
  1. Determine possible mechanical actuation systems for motion transmission involving linear-to-rotary, rotary-to-rotary, rotary-to-linear and cyclic motion transmission.
  2. Evaluate the capabilities of linkages, cams, gears, ratchet-and-pawl, belt and chain drives and bearings for actuation systems.

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

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

- **Assessment Methods:**
  Questions based upon mechanical actuating systems, motion transmissions, capabilities of chains, belts, and bearings etc.

Unit 5 – Electrical Actuation System No of lectures – 07

- **Prerequisite:** electronic devices, basics concepts of electrical motors

- **Objectives:**
  1. To make student able to evaluate the operational characteristics of electrical actuation systems
  2. To make student understand requirements in selecting motors for inertia matching, torque and power requirements

- **Outcomes:**
  After completing this unit, student will be able to–
  1. Evaluate the operational characteristics of electrical actuation systems: relays, solenoids and stepper motors.
  2. Select motors as per the requirement of applications

- **Unit Content:**
  Electrical systems, relays, solenoids, direct current motors and speed control: brush-type, brush-type with field coils, brush less permanent magnet, alternating current motors, stepper motor and its control, motor selection

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

- **Assessment Methods:**
  Questions based upon various motors and their speed control and selection of motors.

Unit 6 – Mechatronics 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 mechatronics system

2. To make student aware of mechatronics system design requirements and process with the help of case studies

- **Outcomes:**

  After completing this unit, student will be able to–

1. Differentiate conventional system design and mechatronics system design process
2. Can develop small mechatronics systems

- **Unit Content:**

Traditional and mechatronics designs, possible mechatronics design solutions, case studies of mechatronics systems like pick and place manipulator, automatic car park barriers, digital camera system etc.

- **Content Delivery Methods:**

Chalk and talk, power point presentation, animation, case studies

- **Assessment Methods:**

Questions based upon mechatronics design process and its different case studies, and development of small mechatronics systems

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- **Text Books:**

1. Mechatronics: Electronic control systems in mechanical and electrical engineering; W. Bolton Pearson Publications, 6th 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

- **Reference Books:**

1. Computer Control of Manufacturing Systems; Yoram Koren; McGraw Hill
2. Mechatronics Principles and Applications; Godfrey Onwubolu, Elsevier Butterworth-Heinemann
3. Mechatronics System Design; Devdas Shetty, Richard A. Kolk, Cengage Learning

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P. A. H. Solapur University, Solapur
Final Year B. Tech. Electronics Engineering Semester – II

Professional Elective – III
EN422C CLOUD COMPUTING

Teaching Scheme
Lectures – 3 Hours/week, 3 Credits

Examination Scheme
ESE – 70 Marks
ISE – 30 Marks

Cloud computing is a rapidly growing field, and engineers with cloud computing skills are in high demand. Studying cloud computing can open up new career opportunities. Cloud computing provides engineers with the ability to quickly and easily scale their computing resources up or down to meet changing business needs. Engineers who understand cloud computing can design and implement systems that are highly scalable and flexible.

Course Prerequisite:
Students shall have adept knowledge of operating system, computer architecture and networking and protocols.

Course Objectives:

1. Understand the fundamental concepts and characteristics of cloud computing.
2. Learn the different service and deployment models of cloud computing.
3. Develop an understanding of cloud infrastructure and virtualization.
4. Gain knowledge about cloud-native application development and deployment.
5. Understand cloud security, privacy, and management.
6. Learn about emerging technologies and trends in cloud computing.

Course Outcomes:
After completing this course, students shall able to -

1. Explain the concept and characteristics of cloud computing.
2. Describe the different service and deployment models of cloud computing.
3. Understand cloud infrastructure using virtualization technologies.
4. Develop cloud-native applications using microservices and containers.
5. Analyze and assess the security, privacy, and management of cloud computing systems.
6. Evaluate and compare emerging technologies and trends in cloud computing.

SECTION I

Unit 1: Introduction to Cloud Computing No. of Lecture-06

- **Prerequisite:** Students should be familiar with operating System concepts and networks.

- **Objectives:**
  1. To make students aware of the concept of cloud computing.
  2. To make students understand the different models of cloud computing.
  3. To make students explain cloud service deployment methods.
  4. To make students evaluate the benefits and challenges of cloud computing.

- **Outcome:**
  At the end of the unit students will be able to:
  1. Define cloud computing models.
  2. Apply methods to deploy the cloud.
  3. Explain cloud service models.
  4. Evaluate the challenges and benefits of cloud computing.

- **Unit Content:**
  Definition and characteristics of cloud computing, Service models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Deployment models: Public cloud, private cloud, hybrid cloud, Benefits and challenges of cloud computing.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study of public cloud like AWS, Azure

- **Assessment Methods:**
  Questions based upon concept of cloud, definitions, service models, deployment models.

Unit 2: Cloud Infrastructure and Virtualization No. of Lecture-06

- **Prerequisite:** Students should be familiar with operating system concepts and microprocessor.

- **Objectives:**
  1. To make students aware of the concept virtualization.
  2. To make students understand the hypervisors, container technology
  3. To make students evaluate the cloud infra components.
  4. To make students investigate the security and privacy in cloud.

- **Outcome –**
  At the end of the unit students will be able to:
  1. Define virtualization technology.
  2. Evaluate cloud infrastructure components
  3. Investigate cloud security and privacy.

- **Unit Content:**
  Virtualization technologies: Hypervisors, containers, Cloud infrastructure components: Compute, storage, networking, Cloud resource provisioning and management, Cloud security and privacy.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study of public cloud like AWS, Azure

- **Assessment Methods:**
  Questions based upon concept of Virtualization technologies, Cloud infrastructure components, Cloud security and privacy.

Unit 3: Cloud Service Models and Deployment No. of Lecture-08

- **Prerequisite:**. Students should be familiar with operating system concepts and IT management.

- **Objectives:**
  1. To make students aware of the concept of cloud deployment models.
  2. To make students relate the cloud architecture and design principals
  3. To make students evaluate one of the public cloud IaaS.

- **Outcome:**
  At the end of the unit students will be able to:
  1. Describe cloud deployment models
  2. Relate cloud architecture and design principals
  3. Evaluate IaaS of AWS, Google or Azure

- **Unit Content:**
  Overview of IaaS, PaaS and SaaS, Deployment models: Public cloud, private cloud, hybrid cloud, Cloud architecture and design principles, Case Study- AWS, Google and Azure - IaaS Deployments.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study of public cloud like AWS, Azure

- **Assessment Methods:**
  Questions based upon concept of deployment models, architecture and design principles, Case study on IaaS of AWS, Azure and Google.

SECTION II

Unit 4: Cloud Applications No. of Lecture-08

- **Prerequisite:** Students should be familiar with operating system concepts and IT management.

- **Objectives:**
  1. To make students understand the application of cloud
  2. To make students comprehend microservice and container architecture.
  3. To make students study serverless computing

- **Outcome:**
  At the end of the unit students will be able to:
  1. Describe cloud microservice and container architecture
  2. Explain the serverless computing
  3. Relate vender specific serverless provisions.

- **Unit Content:**
  Cloud-native application architecture, Microservices and Container orchestration with Kubernetes, Serverless computing and Function as a Service (FaaS), Case Study-AWS Serverless – Lambda, API Gateway.

- **Content Delivery Methods –**
  Chalk and talk, power point presentations, case study of public cloud like AWS, Azure

- **Assessment Methods –**
  Questions based upon concept cloud-native application architecture, Microservices and Container orchestration, serverless computing, function as a Service (FaaS), AWS Lambda, API Gateway.

Unit 5: Cloud Security and Management No. of Lecture-06

- **Prerequisite:** Students should be familiar with network security.

- **Objectives:**
  1. To make students aware of the security aspect in cloud
  2. To make students understand service management and optimization
  3. To make students study cost management

- **Outcome:**
  At the end of the unit students will be able to:
  1. Describe cloud security and privacy
  2. Explain service management
  3. Evaluate vender specific cost and service management.

- **Unit Content:**
  Cloud security and privacy, Cloud service management and optimization, Cost management in the cloud. Case Study- AWS service and cost management services.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study of public cloud like AWS, Azure

- **Assessment Methods:**
  Questions based upon concept of cloud security and privacy, cloud service management and optimization, Cost management in the cloud.

Unit 6: IoT and Cloud Computing No. of Lecture-06

- **Prerequisite:**. Students should be familiar with wireless network and basics of IoT.

- **Objectives:**
  1. To make students aware of the provisioning for IoT in cloud
  2. To make students understand components of IoT in cloud
  3. To make students study cloud based IoT platforms and data management

- **Outcome:**
  At the end of the unit students will be able to:
  1. Explain cloud services for IoT and edge computing
  2. Describe challenges and opportunities for IoT in cloud
  3. Relate different use cases of IoT in cloud.

- **Unit Content:**
  Introduction to IoT and Cloud Computing, Overview of IoT architecture and components, IoT and Cloud Integration: Challenges and Opportunities, Cloud-based IoT platforms and services-on AWS, IoT data management and analytics in the cloud, Use cases and applications of IoT and Cloud Computing.

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, case study of public cloud like AWS, Azure

- **Assessment Methods:**
  Questions based upon concept services for IoT in cloud, Integration with IoT, data management, challenges, opportunities, edge computing.

- **Textbooks:**
  1. Cloud Computing: Principles and Paradigms" by Rajkumar Buyya, James Broberg, and Andrzej Goscinski (for Unit 1)
  2. Virtualization: A Manager's Guide" by Dan Kusnetzky. (for Unit 2)
  3. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS)" by Michael J. Kavis. (for Unit – 3)
  4. Cloud Native: Using Containers, Functions, and Data to Build Next-Generation Applications" by Boris Scholl, Trent Swanson, and Peter Jausovec. (for Unit 4)
  5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance by Tim Mather, Subra Kumaraswamy, and Shahed Latif (for Unit 5)
  6. Internet of Things for Architects by Perry Lea and Venkatesh Kumaran, Packt Publication (for Unit 6)

P.A.H. Solapur University, Solapur

Final Year B.Tech. (Electronics Engineering) Semester – II

EN423 PROJECT PHASE – II / INTERNSHIP

Teaching Scheme	**Examination Scheme**
Practical – 10 Hours /week, 10 Credits	**ICA –** 150 Marks
	OE – 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.

Course Pre-requisite:

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

Course Outcomes:

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

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

The objective of Project- II is to enable the student to extend further the investigative study taken up under Project-I, either fully practical or involving both theoretical and practical work, under the guidance of a supervisor from the department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the report prepared under project – I
2. Review and finalization of the approach to the problem relating to the assigned topic
3. Preparing an action plan for conducting the investigation, including team work;
4. Detailed analysis/modeling/simulation/design/problem solving/experiment as needed
5. Final development of product/process, testing, results, conclusions and future directions
6. Preparing a paper for conference presentation/publication in journals, if possible
7. Preparing a project document in the standard format for being evaluated by the department.
8. Final seminar presentation before a departmental committee

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Internship – Student may complete an internship of minimum one month and maximum four month duration at industry during Final Year Sem II. Work done by the student at the industry and related report will be accepted as 'Project Phase II'
