**Punyashlok Ahilyadevi Holkar Solapur University, Solapur**


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

**Name of the Faculty: Science and Technology**

# CHOICE BASED CREDIT SYSTEM

## Syllabus Structure for Electronics Engineering

**T.Y. B. Tech (Electronics Engineering) w.e.f. Academic Year 2022-23**

**V1.3**

**PAH SOLAPUR UNIVERSITY, SOLAPUR**
**FACULTY OF SCIENCE AND 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 t h e 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 mod

**PAH SOLAPUR UNIVERSITY, SOLAPUR**

**Faculty of Science And Technology**

*Credit System structure of T.Y. B. Tech. Electronics Engineering W.E.F. 2022-23* *Semester I*

| ***Course Code*** | ***Theory Course Name*** | ***Hrs./week*** | | | ***Credits*** | ***Examination Scheme*** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ***L*** | ***T*** | ***P*** | | ***ISE*** | ***ESE*** | ***ICA*** | ***Total*** |
| EN311 | Digital Communication | 3 | _ | _ | 3 | 30 | 70 | _ | 100 |
| EN312 | Digital Signal Processing | 3 | _ | _ | 3 | 30 | 70 | _ | 100 |
| EN313 | Microcontrollers | 3 | _ | _ | 3 | 30 | 70 | _ | 100 |
| EN314 | Open Elective I | 3 | 1 | _ | 4 | 30 | 70 | 25 | 125 |
| SLH31 | Self-Learning I – HSS# | _ | _ | _ | 2 | _ | 50 | _ | 50 |
| **Sub Total** | | 12 | 1 | _ | 15 | 120 | 330 | 25 | 475 |
| ***Course Code*** | ***Laboratory Course Name*** | | | | | | | | |
| | | | | | | | ***ESE*** | | |
| | | | | | | | ***POE*** | ***OE*** | |
| EN311 | Digital Communication | _ | _ | 2 | 1 | _ | _ | 25 | 25 | 50 |
| EN312 | Digital Signal Processing | _ | _ | 2 | 1 | _ | _ | _ | 25 | 25 |
| EN313 | Microcontrollers | _ | _ | 2 | 1 | _ | 25 | _ | 25 | 50 |
| EN315 | Programming with Java | 2 | _ | 2 | 3 | _ | 50 | _ | 25 | 75 |
| EN316 | Software Simulation Tools | _ | 1 | 2 | 2 | _ | _ | _ | 50 | 50 |
| **Sub Total** | | 2 | 1 | 10 | 8 | _ | 100 | | 150 | 250 |
| **Grand Total** | | **14** | 2 | **10** | **23** | **120** | **430** | | **175** | **725** |

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)

**PAH SOLAPUR UNIVERSITY, SOLAPUR**

**Faculty of Science And Technology**

*Credit System structure of T.Y. B. Tech. Electronics Engineering W.E.F. 2022-23* *Semester II*

| ***Course Code*** | ***Theory Course Name*** | ***Hrs./week*** | | | ***Credits*** | ***Examination Scheme*** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ***L*** | ***T*** | ***P*** | | ***ISE*** | ***ESE*** | ***ICA*** | ***Total*** |
| EN321 | Computer Networks | 3 | – | _ | 3 | 30 | 70 | – | 100 |
| EN322 | Embedded Systems | 3 | – | _ | 3 | 30 | 70 | – | 100 |
| EN323 | VLSI Design | 3 | – | _ | 3 | 30 | 70 | _ | 100 |
| EN324 | Open Elective II | 3 | – | – | 3 | 30 | 70 | – | 100 |
| EN325 | Professional Elective I | 3 | – | – | 3 | 30 | 70 | – | 100 |
| **Sub Total** | | 15 | – | – | 15 | 150 | 350 | _ | 500 |
| ***Course Code*** | ***Laboratory Course Name*** | | | | | | | | |
| | | | | | | | ***ESE*** | | |
| | | | | | | | ***POE*** | ***OE*** | |
| EN321 | Computer Networks | – | – | 2 | 1 | – | _ | 25 | 25 | 50 |
| EN322 | Embedded Systems | – | – | 2 | 1 | – | 25 | – | 25 | 50 |
| EN323 | VLSI Design | – | – | 2 | 1 | – | – | – | 25 | 25 |
| EN324 | Open Elective II | – | – | 2 | 1 | – | – | – | 25 | 25 |
| EN325 | Professional Elective I | – | – | 2 | 1 | – | – | – | 25 | 25 |
| EN326 | Mini Hardware Project | – | – | 2 | 1 | – | – | 25 | 25 | 50 |
| **Sub Total** | | – | – | | 6 | _ | 75 | | 150 | 225 |
| **Grand Total** | | **15** | – | **12** | **21** | **150** | **425** | | **150** | **725** |

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 Open Electives at TY Sem I & II – Common for Electronics Engineering, Electronics &Telecommunication Engineering and Electrical Engineering**

(Curriculum and theory examination for all courses under Open elective I and II is common for Electronics Engineering, Electronics and Telecommunication Engineering and Electrical Engineering)

| *Sr.* | *Semester* | *Branch Offering Open Elective* | | |
|---|---|---|---|---|
| | | *Electronics Engineering* | *Electronics & Telecommunication* | *Electrical Engineering* |
| 1 | TY Sem I | EN314A Information Technology & Management | EN314B Managerial Economics<br>EN314C Project Management and Operation Research | EN314D Business Ethics |
| 2 | TY Sem II | EN324A Operating Systems | EN324B Sensors and Applications<br>EN324C Open Source Technologies | EN324D Power System Planning |

**List of Self Learning I - HSS**

| *Course Code* | *Self-Learning I – HSS* |
|---|---|
| SLH31A | Economics |
| SLH31B | Intellectual Property Rights for Technology Development and Management |
| SLH31C | Introduction to Sociology |
| SLH31D | Stress and Coping |
| SLH31E | Professional Ethics and Human Values |
| SLH31F | Approved MOOC Course |

**List of Professional Electives at TY II**

| *Professional Elective I at TY II* | |
|---|---|
| *Course Code* | *Course* |
| EN325A | Image Processing |
| EN325B | Computer Organization |
| EN325C | Multimedia Systems |

- **Note** –

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining student exceeds 7, then a new batch shall be formed.
2. Student shall select one Self Learning I Humanities and Social Sciences (HSS) at T.Y. Part I
3. Curriculum Self Learning I Humanities and Social Sciences (HSS) at T.Y. Part I is common for all under graduate programs of faculty of Engineering and Technology
4. Project group for T.Y.(Electronics Engineering) Part II Mini Project shall not be of more than **three** students.
5. ICA assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable

**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-I**
**EN311 DIGITAL COMMUNICATION**

| **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** |

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This course provides a thorough introduction to the basic principles and techniques used in digital communications. The course intends to cover various digital modulation and demodulation techniques at block diagram levels and few at circuit level. The course also introduces analytical techniques to evaluate the performance of communication systems. Basics of information theory along with source and channel coding techniques and numerical problems related to these are also covered.

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**Course Prerequisite:**
Student has completed a course in analog communication and shall have an adept knowledge of various analog modulation and demodulation techniques. Student also has knowledge about signals and systems and basics of digital signal processing. Comprehension of the probability theory is also required.

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**Course Objectives:**

1. To make student understand functions of different components of a digital communication system with sampling theorem & digital pulse modulation techniques..
2. To make student understand the concept of baseband data transmission systems and pass band data transmission system.
3. To prepare mathematical background for communication signal analysis
4. To make student understand information theory and its relevance to digital communication
5. To make student understand different error detection and correction codes
6. To understand concept of spread spectrum communication system.

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**Course Outcomes:**
After learning the course the students should be able to-

1. Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
2. Represent the time and frequency domain signals in a digital communication system.
3. Know probability, random variable and various statistical analysis methods & Derive channel capacity for discrete memory less channel and continuous channel.
4. Understand noise as a random process and its effect on communication receivers.

5. Determine the performance of different source coding and channel coding schemes for the reliable transmission of digital signals and information over the channel
6. Understand techniques of spread spectrum communication system.

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**Section I**

**Unit 1 –Digital Pulse modulation** **No of lectures – 12**

- **Prerequisite:**
  Concepts of analog communication – general block diagram, need of modulation, concepts of time & frequency domain representation of signals, circuit design using discrete components & op amps, Concept of analog pulse modulation

- **Objectives:**
  1. To make student understand- comparison of analog, discrete & digital communication, need of digital communication, general block diagram of digital communication system, advantages & disadvantages, concepts of symbols, words, messages
  2. To make student understand relevance of sampling theory pertaining to discrete communication, effect of over and under sampling using frequency domain representation
  3. To introduce to student concept of quantization, its need, advantages & disadvantages, mathematical analysis for bandwidth requirement, non uniform quantization
  4. To make student understand need & concept of non uniform PCM
  5. To make student understand the block diagram and its working of different waveform coding techniques.
  6. To make student understand analytical concepts for different waveform coding techniques and their performance

- **Outcomes:**
  After completing this unit, student can-
  1. Compare analog, pulse and digital communication system &Can draw and explain various blocks of digital communication system
  2. Explain significance of sampling along with mathematical analysis
  3. Compare different quantization schemes
  4. Explain different blocks of PCM system
  5. Draw and explain block diagram of different coding modulator and demodulator
  6. Describe analytical concepts of different waveform coding techniques

- **Unit Content:**
  Digital communication system blocks, advantages of digital communication system, sampling theory, Nyquist rate, aliasing, PCM-Generation and reconstruction, quantization- uniform & non-uniform and companding, PCM bandwidth requirement, PCM-TDM, eye diagram, differential pulse code modulation, delta modulation, delta-sigma modulation, adaptive delta modulation

- **Content Delivery Methods:**
  Chalk and talk, power point presentations, MATLAB simulation for eye diagram

- **Assessment Methods:**
  Questions based upon block diagram, circuits for digital modulation and demodulation techniques, mathematical analysis for Nyquist rate, quantization error and bandwidth requirement, descriptive questions to ensure understanding of the basic concepts of digital communication, quantization, pulse modulation, PCM and baseband signaling, different waveform coding techniques, their advantages and limitations

**Unit 2 – Baseband Digital Transmission** No of lectures – 06

- **Prerequisite:** concept of digital modulation, baseband signaling

- **Objectives:**
  1. To introduce to student basic concepts of digital line codes
  2. To make student understand concept of Duo binary system & pulse shaping
  3. To make student understand need of synchronization & different levels of synchronization in digital communication

- **Outcomes:**
  After completing this unit, student –
  1. Can compare different line codes and can represent into time and frequency domain.
  2. Can describe Duo-binary baseband system & Pulse shaping by Digital Methods
  3. Can describe frame and symbol synchronization in a typical digital communication system

- **Unit Content:**
  Data formats with spectra, duo-binary baseband PAM system – use of controlled ISI in duo binary signaling scheme, Shaping of transmitted signal spectrum, Effect of precoding , pulse shaping by digital methods, equalization, synchronization , scrambler & unscramble

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

- **Assessment Methods:**
  Questions based upon data formats, inter-symbol interference and descriptive questions to ensure understanding of the basic concepts of duo-binary baseband PAM system pulse shaping by digital methods

**Unit 3 -Information Theoretic Approach to Communication** No of lectures – 06

- **Prerequisite:** Pulse modulation, mathematical foundation of probability theory & set theory.

- **Objectives:**
  1. To make student understand relevance of probability theory pertaining to digital communication
  2. To introduce to student measure of information, mathematical analysis for information & entropy with numeric examples
  3. To introduce to student concept of channel capacity, its limitations & different theorems related to it

- **Outcomes:**
  After completing this unit, student –
  1. Can view information as a removal of uncertainty and can solve numerical problems related to information
  2. Can describe analytical concepts related to entropy and information rate and can solve numerical problems related to it
  3. Can calculate theoretical limit of a capacity of a Gaussian channel
  4. Can describe need for source coding and can encode using Shannon- Fano coding and Huffman coding

- **Unit Content:**
  Discrete message and information content, entropy, information rate, mutual information, source coding to increase average information- Shannon Fano coding, Huffman coding, Shannon's theorem, channel capacity, capacity of a Gaussian channel, bandwidth –S/N trade off

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, MATLAB simulation for coding

- **Assessment Methods:**
  Numerical questions based upon information, entropy, information rate and coding and descriptive questions to ensure understanding of the basic concepts of channel capacity and theorem

## Section II

**Unit 4 – Digital Carrier Modulations and Detection** No of lectures – 12

- **Prerequisite:** Waveform coding, mathematical foundation of probability theory & set theory

- **Objectives:**
  1. To make student understand block diagram of different digital carrier modulation techniques
  2. To make student understand need and analytical concepts for different digital carrier modulation techniques and their performance
  3. To introduce to student need, mathematical & analytical concepts of matched & correlation filter receivers

- **Outcomes:**
  After completing this unit, student can–
  1. Describe analytical concepts of different digital carrier modulation techniques
  2. Compare performance of different digital carrier modulation techniques
  3. Describe mathematical & analytical concepts of matched & correlation filter receivers

- **Unit Content:**
  Binary ASK, FSK, PSK, methods of generations, signal space representation, spectrum, coherent and non-coherent detection, performance, comparison, differential PSK, QPSK, offset QPSK, M-ary, QAM, MSK, GMSK, OFDM, Optimum Receiver for Digital Modulation**:** Matched filter receiver, correlation receiver

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

- **Assessment Methods:**
  Questions based upon block diagram of generation and detection of different digital carrier modulation techniques, also descriptive questions to ensure understanding of the basic concepts of different digital carrier modulation techniques, their advantages, limitations and performance, matched & correlation filter

**Unit 5 –Error Control Coding** No of lectures – 08

- **Prerequisite:** Information theory, probability theory, matrix operations, digital electronics

- **Objectives:**
  1. To introduce to student concept of error control coding, its need & overheads
  2. To make student understand different error control coding techniques, its rationale, effect on efficiency with numeric examples

3. To make student understand simple hardware implementation of error control coding techniques

- **Outcomes:**
  After completing this unit, student can–
  1. View need of error control coding in a digital communication system
  2. Draw encoder and decoder for various error control coding techniques
  3. Solve numerical problems based upon various error control coding techniques

- **Unit Content:**
  Need of error control coding, error probability, block codes, Hadamard code, Hamming code, cyclic codes, encoder and decoder for cyclic codes, convolution codes, encoder and decoder for convolution codes, turbo codes

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

- **Assessment Methods:**
  Numerical questions based upon various error control coding techniques and descriptive questions to ensure understanding of the basic concepts of error control coding techniques

**Unit 6 – Spread Spectrum Techniques** No of lectures – 04

- **Prerequisite:** Digital carrier modulation, concept of signal bandwidth & Spectrum

- **Objectives:**
  1. To introduce to student concept of spread spectrum and Pseudo noise sequences
  2. To make student understand different spread spectrum techniques
  3. To introduce to student concept of frequency hopping
- **Outcomes:**
  After completing this unit, student can–
  1. Describe analytical concepts of spread spectrum
  2. Draw and explain block diagram of different spread spectrum modulator and demodulator.
  3. Describe concept of frequency hopping.

- **Unit Content:**
  Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Concept of jamming, Frequency hopping

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

- **Assessment Methods:**
  Descriptive questions to ensure understanding of the basic concepts of Pseudo noise sequences, direct sequence spread spectrum, jamming, Frequency hop spread spectrum

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- **Internal Continuous Assessment (ICA)**
  ICA consists of minimum assignments and ten experiments based on each unit**.** Minimum two experiments shall be on MATLAB platform.
  1. Sampling and reconstruction
  2. PCM system and eye pattern.
  3. Companding
  4. DPCM ,ADPCM
  5. DM,ADM
  6. Data Formats
  7. ASK,FSK, PSK, BPSK
  8. DBPSK
  9. Hamming code
  10. Cyclic redundancy code
  11. Convolution code
  12. Pseudo noise sequences generation
  13. Direct sequence spread spectrum modulation

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- **Text Books:**
  1. Taub's Principles of Communication Systems, Herbert Taub, Donald L Schilling, Goutam Saha, 4th edition, McGraw Hill Education (India) Pvt. Ltd.
  2. Digital Communication Systems Design, Martin S. Roden, Prentice- Hall International Inc
  3. Communication Systems, Analog & Digital, R P Sing, S D Sapre, 2nd Edition, Tata McGraw Hill Education Pvt. Ltd

- **Reference Books:**
  1. Digital Communication, Simon Haykin, John Wilely & Sons (Asia) Pvt. Ltd.
  2. Digital Communications, Fourth Edition, John G. Prokis, McGraw Hill International Edition
  3. Digital Communications Fundamentals and Applications, Bernard Skalar, 2nd Edition, Pearson Education

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**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-I**
**EN312 DIGITAL SIGNAL PROCESSING**

| **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** |

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The signal for processing is mathematically modeled as a function or a sequence of numbers that represents the state or behavior of a physical system. Examples includes speech, audio, image and video in multimedia systems, electrocardiograms in medical systems, electronic radar waveforms in military applications etc. Signal processing is concerned with the representation, transformation, and manipulation of signals and the information they contain. For example, we may wish to remove the noise in speech to make it clear, or to enhance an image to make it more natural. Signal processing is one of the fundamental techniques to construct modern information systems. The course includes the concept and the classification of discrete-time signal, representations of signals, z transform and discrete frequency transform, representations and analysis of systems, and filter designs.

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**Course Prerequisite:**
A course on basic concepts of signals and systems is desirable. Student shall also have mathematical background of Fourier series, Fourier Transform and Z Transform.

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**Course Objectives:**

1. To make student understand processing of signals in frequency domain using mathematical transforms
2. To make student understand the methods for realization of discrete time systems.
3. To make student understand the design methods for digital IIR & FIR filters.
4. To introduce to student digital signal processor functional blocks with focus on a typical processor.

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

1. Analyze a given signal or system using tools such as Fourier transform and z-transform
2. Apply properties of Discrete Fourier Transform and to determine the Discrete Fourier transform, inverse discrete Fourier transform by direct computation & Fast Fourier Transform algorithms.
3. Draw the structure for realization of a given system.

4. Design IIR & FIR digital filters.
5. Describe basic architectural features of digital signal processor.

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**Section I**

**Unit 1-Introduction to DSP** No of lectures – 03

- **Prerequisite:** Basics of signals and systems, ADC and DAC

- **Objectives:**
  1. To make student understand the significance and benefits of digital signal processing.
  2. To make student aware of the different application areas of DSP.

- **Outcomes:**
  After completing this unit, student can–
  1. Explain a typical DSP system along with the different application areas of DSP.
  2. Describe the benefits of DSP over analog processing.

- **Unit Content:**
  Introduction to DSP, comparison between analog & digital signal processing, concept of frequency in continuous and discrete signals, typical real time DSP system, application areas

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

- **Assessment Methods:**
  Questions based on block diagram of DSP system and applications.

**Unit 2–Z Transform Application to Analysis of LTI Systems** No of lectures – 04

- **Prerequisite:** Z transform and inverse Z transform, Fourier transform, stability of LTI systems

- **Objectives:**
  1. To make student understand the relation between z plane location of pole and time domain behavior of a signal.
  2. To make student understand the classification of systems based on its transfer function.
  3. To make student know the applications of Z transform in signal processing.

- **Outcomes:**
  After completing this unit, student can -
  1. Describe time domain behavior of a signal from its pole location.

2. Identify the system, given its transfer function.
3. Determine the stability of a given system from its transfer function.
4. Compute the frequency response of given LTI system.

- **Unit Content:**
  Overview of Z–transform & its properties, pole location and time domain behavior for causal signals, digital transfer function, stability considerations & frequency response of LTI system

- **Content Delivery Methods:**
  Chalk and talk, power point presentation
- **Assessment Methods:**
  Questions based on pole location and time domain behavior and frequency response, numerical on stability

**Unit 3–The Discrete Fourier transforms** No of lectures – 10

- **Prerequisite:** Z transform, convolution, Fourier transform

- **Objectives:**
  1. To make student understand the relationship between frequency domain samples and DFT.
  2. To make student know the relationship between Z transform and DFT.
  3. To make student understand various properties of DFT.
  4. To make student apply DFT for linear filtering and frequency analysis.
  5. To make student understand FFT algorithms

- **Outcomes:**
  After completing this unit, student can –
  1. Derive the equation for DFT
  2. Compute the DFT and IDFT using formula and using linear transformation.
  3. Compute DFT making use of transform properties
  4. Compute the circular convolution.
  5. Evaluate difference between circular convolution and linear convolution.
  6. Use DFT and IDFT for filtering of long sequences
  7. Evaluate how FFT reduces the number of computations compared to direct Fourier transform

- **Unit Content:**
  The discrete Fourier Transform (DFT), DFT as a linear transformation, relation between DFT & Z transform properties of DFT, circular convolution, linear filtering methods based on DFT, divide and conquer approach for computation of DFT, Radix -2 FFT algorithms

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

- **Assessment Methods:**
  Questions based on properties of DFT, circular convolution and fast convolution methods, numerical on computation of DFT, IDFT, using properties, circular convolution and computing DFT using FFT algorithms

**Unit 4–Realization of Digital Linear Systems** No of lectures – 5

- **Prerequisite:** Differential equation representing LTI system, Z transform, convolution

- **Objectives:**
  1. To make student understand the major factors influencing choice of structure realization.
  2. To make student understand the structure realization for FIR and IIR systems.
  3. To make student understand the computational requirements for each realizations.

- **Outcomes:**
  After completing this unit, student can –
  1. Describe the major factors that influence the choice of structure realization
  2. Draw the structure realization for given FIR and IIR systems.

- **Unit Content:**
  Structures for realization of discrete time systems, structures for FIR filters: direct form, cascade form, structures for IIR filters: direct form, signal flow graph & transposed structure, cascade form & parallel form

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

- **Assessment Methods:**
  Questions based on realization structures for a given system function.

**Section II**

**Unit 5–FIR Filter Design** No of lectures –8

- **Prerequisite:** Fourier transform, convolution, basics of analog filters

- **Objectives:**
  1. To make student understand characteristics of FIR filters.
  2. To make student understand the difference between of FIR and IIR filters.
  3. To make student understand the implications of causality on filter's frequency response.
  4. To make student understand different methods of FIR filter design.

5. To make student understand the effect of finite word length on frequency response of the filter.
6. To make student understand the implementation aspects of FIR filters.

- **Outcomes:**
  After completing this unit, student can –
  1. Describe the difference between FIR and IIR filters.
  2. Describe the characteristics of different window functions.
  3. Design the filter and plot the frequency response from the given specifications
  4. Describe the effects of finite word length on the frequency response characteristics of FIR filters.

- **Unit Content:**
  Causality and its implications, characteristics of practical frequency selective filters, symmetric and anti-symmetric FIR filters, FIR filter design using windowing & frequency sampling method, finite word length effects in FIR filters, FIR implementation techniques

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

- **Assessment Methods:**
  Questions based on characteristics and properties of FIR filters, frequency response of window functions, finite word length effects, numerical on filter design techniques.

**Unit 6–IIR Filter Design** No of lectures –8

- **Prerequisite:** Fourier transform, z transform, convolution, basics of analog filters

- **Objectives:**
  1. To make student understand IIR filter design techniques based on analog filter design.
  2. To make student understand frequency transformations for designing filters from prototype filters
  3. To make student understand the characteristics of Butterworth filters.
  4. To make student understand the effect of finite word length on frequency response of the filter.
  5. To make student understand the implementation aspects of IIR filters.

- **Outcomes:**
  After completing this unit, student can –
  1. Derive the mapping from s domain to z domain for various design techniques.
  2. Convert the given analog transfer function into corresponding digital transfer function.
  3. Calculate the cutoff frequency and design Butterworth filter from the given frequency response.

4. Describe the effects of finite word length on the frequency response characteristics of IIR filters.

- **Unit Content-**
  IIR filter design by Impulse invariant technique, IIR filter design by bilinear transformation, frequency transformations, analog Butterworth filter approximation, Chedyshev IIR filter design, finite world length effects in IIR filters, implementation of IIR Filters

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

- **Assessment Methods:**
  Questions based on techniques for converting analog filters into digital, characteristics and properties of Butterworth filters, frequency transformations and finite word length effects, numerical on filter design (Maximum up to 3rd Order) techniques.

**Unit 7–Introduction to Programmable Digital Signal Processors** No of lectures –06

- **Prerequisite:** Typical processor architecture

- **Objectives:**
  1. To make student understand architectural features of DSP processor.
  2. To make student understand requirement and importance of special addressing modes of P-DSP.

- **Outcomes:**
  After completing this unit, student can –
  1. Distinguish between conventional microprocessor & programmable DSP.
  2. Describe different building blocks of typical digital signal processors.
  3. Describe the architecture and hardware features of fixed and floating point DSPs.

- **Unit Content:**
  Number formats for signals & coefficients in DSP systems, basic architectural features DSP computational building blocks, bus architecture, special addressing modes, fixed point and floating point digital signal processors, overview of TMS320C54x DSP architecture

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

- **Assessment Methods:**
  Questions based on different blocks of DSP processor architecture, bus architectures.

- **Internal Continuous Assessment (ICA) :**
  ICA consists of minimum eight experiments based on DFT & IDFT, fast convolution, FIR & IIR filter design. One or two experiments on TMS hardware platform are recommended.

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- **Text Books:**
  1. Digital Signal Processing – Principles, Algorithms and applications, John G Proakies, Prentice Hall India
  2. Digital Signal Processing – A Practical Approach, Ifeachor E. C. & Jervis B. W., Pearson Education
  3. Digital Signal Processing Implementations using DSP Microprocessors, Avtar Singh & S. Srinivasan, Thomson Education

- **Reference Books:**
  1. Digital Signal Processing, S Salivahanan, A Vallavaraj & C Gnanapriya, Tata McGraw Hill
  2. Digital Signal Processors – Architecture, Programming and Applications, B Venkataramani & M. Bhaskar, Tata McGraw Hill India
  3. Scientist and Engineering Guide on Digital Signal Processing, Steven W. Smith , California Technical Publishing, California.
  4. Discrete time signal Processing, A.V. Oppenheim & R.W.Schalfer, John Wiley
  5. Introduction to Digital Signal Processing, Johnny R. Johnson, PHI publications.
  6. Digital Signal Processing, Sanjit K Mitra, Tata McGraw Hill.

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**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-I**

# EN313 MICROCONTROLLERS

**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**

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This course provides a thorough introduction to the architecture of microcontrollers 8051 and PIC 16F877. The course also introduces assembly language programming and 'C' language programming concepts for 8051 and PIC 16F877. The course enables student to write programs addressing fundamental programming skills and also interfacing with different peripherals. The SPI and I2C serial communication are also part of the syllabus

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**Course Prerequisite:**
Student has completed a course in Basic Electronics and Digital Logic Design. Student also has knowledge of C programming language.

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**Course Objectives:**

1. To introduce to students conception of microcontroller architecture with focus on typical microcontrollers- 8051 and PIC 16F877
2. To make student learn assembly language and "C" programming concepts for microcontrollers.
3. To make student to design interfacing of memory and peripherals with 8051
4. To introduce to student RS232, I2C,SPI serial communication and CAN protocol
5. To make student design microcontroller based systems for small applications

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

1. Apply knowledge of 8051 and PIC 16F877 microcontroller's architecture to develop these microcontroller based system.
2. Develop assembly language and C program for different applications with 8051 and PIC 16F877 microcontrollers.
3. Design the system for different applications using 8051 microcontrollers.
4. Program PIC 16F877 on chip peripherals for different applications.
5. Compare serial communication protocols RS232, SPI, I2C and CAN protocol

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## Section-I

**Unit 1 - Fundamentals of Microprocessors** No of lectures – 07

- **Prerequisite –** Basics of Boolean algebra, working of basic logic gates. Microprocessor

- **Objectives –**
  1. To introduce to student working of computer.
  2. To make student learn working of CPU inside the computer.
  3. To introduce to student different types of memory and memory organization
  4. To make student compare microprocessor and microcontroller

- **Outcomes –**
  After completing this unit student can-
  1. Describe microprocessor based system
  2. Describe the different memories
  3. Compare microprocessor and microcontroller

- **Unit Content:**
  Internal organization of computer, fundamentals of microprocessor architecture, addresses data and control bus, internal working of microprocessor with fetch decode and execution cycles, instruction timing diagram, types of memory, memory organization, introduction to microcontroller and its comparison with microprocessor

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

- **Assessment Methods**:
  Questions based upon microprocessor architecture, types of memory and memory organization

**Unit 2 - The 8051 Architecture:** No of lectures – 11

- **Prerequisite –** Basics of digital electronics and basic building blocks of microprocessor

- **Objectives –**
  1. To introduce to student architecture of 8051 microcontroller.
  2. To make student understand memory organization in 8051 microcontroller
  3. To make student understand functional block diagram of 8051 microcontroller
  4. To introduce to student software model for 8051 microcontroller with assembly program and “C” programming.

- **Outcomes –**

  After completing this unit student can-

  1. Describe architecture of 8051 microcontroller
  2. Draw memory organization in 8051 microcontroller
  3. Describe the functionality of various pins of 8051 microcontroller
  4. Write assembly and "C" program for different arithmetic and logical operations of 8051

- **Unit Content:**

  8051-features, 8051 architecture- ALU, boolean processor, oscillator, timing and control, registers in 8051, clock and RESET circuits, stack and stack pointer, program counter, I/O ports, memory structures, data and program memory, pin configuration, addressing modes and instruction set

- **Content Delivery Methods:**

  Chalk and talk, power point presentation

- **Assessment Methods:**

  Questions based upon architecture of 8051 microcontroller, memory organization, pin configuration and assembly language programs and "C" programs - using basic instructions, different programming structures like loop, stack, and subroutine etc, efficient use of different addressing modes.

**Unit 3 – 8051 On-Chip Peripherals** No of lectures – 06

- **Prerequisite** – 8051 instruction set, concept of timer/counter and serial communication

- **Objectives –**

  1. To make student understand working of on chip peripherals of 8051 microcontroller.
  2. To make student program on chip peripherals of 8051 microcontroller for different applications

- **Outcomes-**

  After completing this unit student can–

  1. Describe working of on chip peripherals of 8051 microcontroller.
  2. Write programs for on chip peripherals of 8051 microcontroller for different applications

- **Unit Contents-**

  Port structure, timers and counters, serial port, interrupt structure, programming with on chip peripherals

- **Content Delivery Methods:**

  Chalk and talk, power point presentation, simulation software

- **Assessment Methods:**

  Questions based upon working of on chip peripherals like timer/counter, UART, ports etc. and their modes of operations, writing of programs for different on chip peripherals

**Section-II**

**Unit 4 - Memory and I/O Interfacing:** No of lectures – 07

- **Prerequisite –** 8051 architecture and instruction set, working of ports of 8051

- **Objectives –**
  1. To make student interface data and program memories to the 8051 microcontroller
  2. To make student interface different I/O devices with 8051 microcontroller
  3. To make student design a 8051 based minimum system

- **Outcomes-**

  After completing this unit, student can –
  1. Interface different memories and peripherals to the 8051 microcontroller
  2. Design a 8051 minimum system

- **Unit Contents-**

  Interfacing of different display devices like switches, LED's, seven segment display and LCD, data RAM and ROM, program memory, ADC 0808, DAC, stepper and DC motor, keypad

- **Content Delivery Methods:**

  Chalk and talk, power point presentation, simulation software

- **Assessment Methods:**

  Questions based upon memory interfacing, working of I/O devices and their interfacing with 8051 microcontroller

**Unit 5 - PIC Microcontroller 16F877A:** No of lectures – 07

- **Prerequisite–** Basics of digital electronics and building blocks of microprocessor

- **Objectives –**
  1. To introduce to student architecture of PIC 16F877 microcontroller.
  2. To make student write assembly language programs for PIC 16F877 microcontroller for different applications.

- **Outcomes-**
  After completing this unit, student can–
  1. Describe architecture of PIC 16F877 microcontroller
  2. Write assembly language programs PIC 16F877 for different applications.

- **Unit Contents-**
  RISC and CISC architecture, PIC 16F877-features, architecture-CPU registers, memory structures, pin configuration, addressing modes, instruction set, assembly language and 'C' programming

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

- **Assessment Methods:**
  Questions based upon architecture of PIC 16F877 microcontroller, assembly language programs and "C" programs - using basic instructions, different programming structures like loop and subroutine etc, efficient use of different addressing modes

**Unit 6 - PIC 16F877 On-Chip Peripherals:** No of lectures – 06

- **Prerequisite –**PIC 16F877 instruction set, concept of serial communication and interrupt. Knowledge of timer/counter and PWM are also required.

- **Objectives –**
  1. To make student understand working of on chip peripherals of PIC 16F877 microcontroller.
  2. To make student use on chip peripherals of PIC 16F877 microcontroller for different applications.

- **Outcomes-**
  After completing this unit, student can –
  1. Describe working of on chip peripherals of PIC 16F877 microcontroller.
  2. Make use of on chip peripherals of PIC 16F877 microcontroller for different applications

- **Unit Contents-**
  Parallel slave port, timers and counters, capture and compare modes, PWM mode, ADC

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

- **Assessment Methods:**
  Questions based upon working of on chip peripherals and writing of programs for different on chip peripherals

**Unit 7 - External Communication Interface** No of lectures – 03

- **Prerequisite –** Basics of serial data transfer

- **Objectives –**
  1. To make student understand working of serial communication interface.
  2. To make student understand communication protocols - RS232, SPI and $I^2C$
  3. To student understand external communication interface CAN protocol.

- **Outcomes-**
  After completing this unit student is able to-
  1. Describe serial communication interface
  2. Compare different communication protocols - RS232, SPI and $I^2C$
  3. Develop the microcontroller based system with CAN protocol

- **Unit Contents-**
  Synchronous and asynchronous communication, introduction to serial communication protocols - RS232, SPI, and $I^2C$, CAN

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

- **Assessment Methods:**
  Questions based upon working of serial communication protocols RS232, SPI, and $I^2C$.

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- **Internal Continuous Assessment :**
  Minimum 10 practical based on following with 5 experiments on MCS 51 and 5 experiments on Microchip PIC Microcontrollers
  1. Arithmetic and Logic operations
  2. Interfacing of Switches, LEDs and Buzzer.
  3. Interfacing of Matrix Keyboard
  4. Interfacing of LCD Display.
  5. Interfacing of DAC 0808 and generation of various waveforms.
  6. Interfacing of ADC 0808
  7. Use of Timer for generation of time delays
  8. Use of Timer as counter.
  9. Interfacing of Serial RTC
  10. Interfacing of Stepper motor.
  11. Speed control of DC Motor.
  12. Use of ADC in PIC Microcontrollers.
  13. Use of Interrupts for any Application.
  14. Serial communication.
  15. Use of PWM in PIC Microcontrollers

- **Text Books:**
  1. 8051 and Embedded C Programming, Mazidi , Pearson education(2nd edition)
  2. Microcontrollers, Ajay Deshmukh, Tata McGRAW HILL

- **Reference Books:**
  1. 8051 Microcontroller Architecture, Programming and Application', 3rd edition, Kenneth Ayala, Penram publication.
  2. Designs with PIC Microcontrollers, John B. Peatman, Pearson Education Asi LPE
  3. Datasheets of Microchip PIC family of Microcontrollers

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**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-I**

## OPEN ELECTIVE I

## EN314A INFORMATION TECHNOLOGY AND MANAGEMENT

**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**

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This course provides the basic tactical and strategic principles of information technology uses for management information systems and its various applications to the organizations. It also addresses changing face of business with proliferation of electronic commerce and ethical & social issues arising with it. It also introduces about the software projects, software development models and overview of project management

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**Course Prerequisite:**
Student shall have basic knowledge of computer hardware, software, programming and communication.

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**Course Objectives:**

1. To introduce to student concepts of information systems and its impact on business and organization
2. To show how e-commerce helps organization to increase productivity and competitive advantage.
3. To give overview of ethical and social issues concerning information systems
4. To make student aware of software project and its attributes
5. To introduce to student software development life cycle and software models

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

1. Present case studies about changing face of business and importance of management information system for today's business
2. Explain different e-commerce mechanisms along with the examples
3. Describe necessity and benefits of data management for business and organizations
4. Present examples of primary and higher organizational applications of information system
5. Illustrate software development life cycle and can describe popular software models
6. Describe various social and ethical issues related to IT

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## Section-I

**Unit 1-Information Systems** No of lectures – 07

- **Prerequisite:** Basic knowledge of computer hardware, software, programming and internet.

- **Objectives:**
  1. To introduce to student concepts of information system and describe various types of information system.
  2. To make student relate and contrast transaction processing and functional information system.
  3. To make student analyze support that IT provides to people in different roles in an organization.
  4. To make student understand how IT provides support to business processes
  5. To give student overview of IT infrastructure, architecture and emerging computer environments.
  6. To make student realize dimensions of information systems and contemporary approach to information system.

- **Outcomes:**
  After completing this unit, student -
  1. Can define information system and describe various types of information system.
  2. Able to relate and contrast transaction processing and functional information system.
  3. Can analyze the support that IT provides to people in different roles in an organization.
  4. Able to highlight IT infrastructure, architecture and emerging computer environments through case study.
  5. Able to portray dimensions of information systems and contemporary approach to information system.

- **Unit Content:**
  Business in digital economy & information age, information concepts – data, information & knowledge, information systems: concepts and definitions, classification and types of information systems, how IT support people, information technology, architecture and emerging computing environments

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

- **Assessment Methods:**
  Questions based upon information system concepts, classification and types of information systems, information system infrastructure, architecture and emerging computing environments, dimensions of information systems, contemporary approach to information system.

**Unit 2– E-business and E-commerce** No of lectures – 08

- **Prerequisite:** Information system concepts, information system infrastructure, architecture and emerging computing environments

- **Objectives:**
  1. To introduce to student importance and significance of e-business and e-commerce**.**
  2. To make student distinguish business to consumer applications and business to business applications.
  3. To make student understand e-commerce supports services.
  4. To create awareness about ethical and legal issues in e-business.
  5. To make student to gain knowledge about mobile e-commerce.

- **Outcomes:**
  After completing this unit, student –
  1. Can compare e-business and e-commerce.
  2. Can describe major e-commerce mechanisms.
  3. Able to identify e-commerce support services.
  4. Can explain e-payment systems with Indian context
  5. Can describe mobile e-commerce.

- **Unit Content:**
  Overview of e-business and e-commerce, major e-commerce mechanisms, business to consumer applications, business to business applications, major models of e-business, e-commerce supports services, infrastructure support required, e-payment systems, ethical and legal issues in e-business, mobile e-commerce

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

- **Assessment Methods:**
  Descriptive questions based upon e-business and e-commerce, major e-commerce mechanisms, business to consumer applications, business to business applications, major models of e-business, e-commerce supports services, ethical and legal issues in e-business, mobile ecommerce

**Unit 3–Data Management** No of lectures – 07

- **Prerequisite:** Operating system, information system, e-commerce.

- **Objectives:**
  1. To introduce to student importance of data management.
  2. To introduce to student database management system.
  3. To make student aware about data management issues
  4. To acquaint student with benefits of data warehouse, data marts and data centers.

- **Outcomes:**
  After completing this unit, student is –
  1. Able to compare traditional file system with database management system
  2. Able to describe functions of data base and data base management system.
  3. Can describe the tactical and strategic benefits of data warehouse, data marts and data centers.

- **Unit Content:**
  Data hierarchy, problems with traditional file environment, database approach, database management system, creating database, relational DBMS, logical vs physical view, DBMS components, data warehouse, data mart, data mining

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

- **Assessment Methods:**
  Descriptive questions based upon managing data, database approach, database and data base management system, data warehouse, data marts and data centers, enterprise content management, data visualization technology, managerial issues.

**Section II**

**Unit 4– Modern Organizational Applications** No of lectures – 08

- **Prerequisite:** Information system, information system infrastructure.

- **Objectives:**
  1. To make student aware about organization, features of organization & organizational structure.
  2. To make student understand how information system impact organizations and business firms
  3. To introduce to student primary organizational applications like OLAP, TPS
  4. To introduce to student higher organizational applications like ECM, ERP, supply chain management, decision support system
  5. To make student realize importance of data visualization and its applications

- **Outcomes:**
  After completing this unit, student –
  1. Can describe features of modern organizational structure
  2. Can explain with case studies how organization and information system are influencing each other in contemporary business practices
  3. Can explain with case studies primary applications of information system in a typical modern business

4. Can explain with case studies higher applications of information system in a typical modern business
5. Can list various commercial tools/ software available for data visualization

- **Unit Content:**
  What is an organization, features of organizations, organizational structure, doing business in digital economy, organizations and information systems, how information systems impact organizational practices, OLAP, TPS, enterprise content management, introduction to ERP and supply chain management, introduction to decision support systems, data visualization

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

- **Assessment Methods:**
  Questions based upon block diagram and descriptive questions to ensure understanding of what is an organization, features of organizations, organizational structure, doing business in digital economy, organizational responses and IT support, how information system impact organizations and business firms, primary and higher organizational applications of information system

**Unit 5–Project & Software Development Life Cycle** No of lectures – 08

- **Prerequisite:** Information system, data management, organizational structure, basics of programming

- **Objectives:**
  1. To introduce to student about project and its attributes.
  2. To make student realize difference between software project and other projects
  3. To make student understand project planning framework.
  4. To introduce to student need and concept of SDLC
  5. To provide to student a short induction to popular SDLC models used by industry
  6. To make student apprehend role and responsibilities of the software project manager
  7. To make student aware of IT project methodologies

- **Outcomes:**
  After completing this unit, student –
  1. Is able to differentiate software projects and other engineering projects
  2. Can explain major phases in SDLC
  3. Can explain popular SDLC models used by industry
  4. Can list project management knowledge areas
  5. Can describe IT project methodology

- **Unit Content:**
  What is a project? project attributes, project planning framework, software project comparison with other projects, context of project management, role of project manager, project life cycle, software development life cycle, software development process models, project management process and knowledge areas, IT project methodology

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

- **Assessment Methods:**
  Questions based upon block diagram and descriptive questions to ensure understanding project, project attributes, project planning framework, software project comparison with other projects, context of project management, the role of project manager, project life cycle, software development life cycle, software development process models, IT project methodology

**Unit 6–Ethical and Social Issues** No of lectures – 06

- **Prerequisite:** Information system, data management, E-business.

- **Objectives:**
  1. To make student aware about ethical and social issues evolved because of IT and IS
  2. To make student recognize the respect for intelligent property rights
  3. To make student aware about workplace behavior and health while working in IT industry
  4. To fetch the attention of the student to need and practice of green IT

- **Outcomes:**
  After completing this unit, student can–
  1. Describe ethical and social issues arose because of IT and IS
  2. Describe trade secrets, copyrights, patents with examples
  3. Explain issues related to workplace behavior and health and how to overcome them
  4. Explain green IT practices

- **Unit Content:**
  Ethical and social issues related to systems, moral dimensions of information age, ethical principles, intellectual property rights- trade secrets, copyrights, patents, privacy, workplace behavior and health, de-skilling and alienation, telecommuting, e waste, green IT

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

- **Assessment Methods:**
  Descriptive questions based upon privacy, workplace monitoring, power over users,

candidate ethical principles, workplace behavior and health, de-skilling and alienation, telecommuting, e-waste and green IT

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- **Internal Continuous Assessment (ICA)**
  ICA consists of minimum one assignment based on each unit - may be comprising of case studies, group discussion and information survey.

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- **Text Books:**
  1. Information Technology for Management – Transforming Organizations into Digital Economy, Efraim Turban, Linda Volonino, Wiley Student Edition, Wiley India Pvt. Ltd.
  2. Management Information System, Kel Laudon, Jane Laudan, Rajanish Dass, 11th Edition, Pearson.
  3. Software Project Management, Bob Houghes, Mike Cotterall, Tata McGraw-Hill, 4th Edition

- **Reference Books:**
  1. Introduction to Information Technology, Turban, Rainer, Potter, Wiley Student Edition, 2nd Edition
  2. Information Systems, Ralph Stair, George Reynolds, Cengage Learning, 10th Edition
  3. Management Information System (MIS), Rahul De, Wiley India Pvt. Ltd.

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**PAH Solapur University, Solapur**
**T.Y. B. Tech. (Electronics Engineering) Semester-I**
**EN315 PROGRAMMING WITH JAVA**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| **Lectures – 2 Hours/week, 2 Credits** | **POE – 50 Marks** |
| **Practical– 2 Hours/week, 1 Credit** | **ICA - 25 Marks** |

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Java is a key programming language for the software development in today's network-centric environment such as internet. Its popularity and applicability stems from its inherent object oriented programming (OOP) structure along with ability to provide platform independent programming environment. This course introduces the transitional development of programming to students by beginning with the procedural approach towards focusing on the pure object oriented programming approach. Important features related to any OOP language such as data abstraction, data encapsulation, polymorphism, inheritance are also introduced along with additional packages and interfaces available within the Java development environment.

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**Course Prerequisite:**
Student shall have an adept knowledge of programming with C and C++. Student should be acquainted with the basics of procedural and object oriented programming concepts.

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**Course Objectives:**

1. To introduce to students core Java programming concepts.
2. To make student understand the concept of methods and classes in Java perspective and using the same for implementing various OOP features such as Inheritance etc.
3. To introduce to students various packages and interfaces available within Java.

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**Course Outcomes:**

After completion of this course, students will be able to -

1. Outline basics of core Java programming.
2. Employ the concept of classes and methods to solve real world problems.
3. Implement different types of inheritance and explain the importance of inheritance.
4. Choose an appropriate Java package for different programming tasks.

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## Section I

**Unit 1- Introduction to OOP and Java Environment** No. of Lectures-03

- **Prerequisite**: Concepts of object oriented programming in C++

- **Objectives**:
  1. To make student understand clearly the difference between object-oriented and procedural languages
  2. To make student comprehend the problems in procedural programming and how OOP overcomes them
  3. To make student learn the applications of OOP
  4. To make student understand the features of Java and its runtime environment
  5. To make student know the basic structure of a Java program
  6. To make student know the details about JDK installation

- **Outcomes:**
  After completing this unit, student will be able to
  1. Explain the foundational principles of object-oriented programming
  2. Summarize Java's contribution to the Internet
  3. Explain the importance of bytecode
  4. Create, compile, and run a simple Java program

- **Unit Content:**
  Introduction to OOP - need for object oriented programming**,** principles of object-oriented programming languages, procedural language vs. OOP, applications of OOP, the Java environment- history of Java, Java essentials, Java virtual machine, Java features, program structure, differences between Java and C++, installation of JDK, Java integrated development environment

- **Content Delivery Methods:**
  Chalk and Talk, Power point presentation.

- **Assessment Methods:**
  Student will be evaluated by questions on basic program structure of Java

**Unit 2- Java Programming Constructs** No. of Lectures-04

- **Prerequisites:** Basic program structure of Java, C, C++ programming constructs

- **Objectives:**
  To make student
  1. Understand how variables are used in Java
  2. Know the basic data types

3. Learn expressions and conditional statements
4. Use all the available operations in Java
5. Know the basics of type conversion and typecasting
6. Understand loops and branching statements

- **Outcomes:**
  After completing this unit, student will be able to
  1. Use literals and initialize variables
  2. Use the arithmetic operators
  3. Use the relational and logical operators
  4. Use shorthand assignments
  5. Implement type conversion in assignments
  6. Use the *switch* statement, the *while***,** the *do while* loop

- **Unit Content:**
  Variables, primitive data types, identifier, literals, operators, expressions, precedence rules & associativity, primitive type conversion & casting, flow of control

- **Content Delivery Methods:**
  Chalk and Talk, Power point presentation.

- **Assessment Methods:**
  Student will be evaluated by questions on Java programming constructs

**Unit 3- Classes, Objects and Methods** No. of Lectures-03

- **Prerequisite:** Knowledge about important OOP concepts and features such as class, object, function, constructor, polymorphism and overloading**.**

- **Objectives:**
  To make student
  1. Know how classes and objects are created and applied in Java
  2. Know how methods are implemented and used
  3. Understand the concepts of polymorphism and function overloading
  4. Understand what is a constructor
  5. Establish familiarity with *static* keyword

- **Outcomes:**
  After completing this unit, student will be able to
  1. Illustrate the fundamentals of the class
  2. Can create objects
  3. Create methods, return values, and use parameters

4. Create parameterized constructors
5. Utilize garbage collection
6. Use the keywords *new* and *this*

- **Unit Content:**
  Classes, objects, class declaration in Java, creating methods, constructors, cleaning up unused objects, use of *static* and *this* keywords, command line arguments, nested classes

- **Content Delivery Methods:**
  Chalk and Talk, Power point presentation

- **Assessment Methods:**
  Student will be evaluated by questions on the concepts of class, objects, methods, constructors

**Unit 4- Arrays and Strings** No. of Lectures-04

- **Prerequisite:** Knowledge of array and string declarations as in C & C++

- **Objectives:**
  1. To make student work with Java arrays
  2. To make student work with Java string objects

- **Outcomes:**
  After completing this unit, student will be able to
  1. Create and use multidimensional arrays
  2. Write alternative array declarations
  3. Use Java string objects
  4. Employ different string methods

- **Unit Content:**
  Java arrays, array constants, using arrays, copying array elements, string objects, string methods, string concatenation, converting objects to strings, converting strings to numbers

- **Content Delivery Methods:**
  Chalk and Talk, Power point presentation

- **Assessment Methods**
  Student will be evaluated by questions on the concepts of arrays and strings in Java

## Section-II

**Unit 5–Inheritance and Polymorphism** No. of Lectures-05

- **Prerequisite:** Knowledge of the concepts of inheritance and polymorphism in C++

- **Objectives:**
  To make student
  1. Know the difference between inheritance and aggregation
  2. Understand how inheritance is done in Java
  3. Learn polymorphism through method overriding
  4. Learn the keywords: *super* and *final*
  5. Understand the basics of abstract class
  6. Understand the difference between shadowing and overriding

- **Outcomes:**
  After completing this unit, student will be able to-
  1. Use *super* keyword to access superclass members
  2. Create a multilevel class hierarchy
  3. Demonstrate superclass references to subclass objects
  4. Illustrate polymorphism through method overriding
  5. Use abstract classes
  6. Use final keyword to prevent overriding in inheritance

- **Unit Contents:**
  Inheritance vs. aggregation, overriding method, *super* keyword, *final* keyword, abstract class, shadowing vs. overriding

- **Content Delivery Methods:**
  Chalk and Talk, Power point presentation

- **Assessment Methods:**
  Student will be evaluated by questions on the concept of inheritance and polymorphism in Java

**Unit 6- Packages and Interfaces** No. of Lectures-04

- **Prerequisite:** Knowledge about how to use Java application programming interface (API) document

- **Objectives:**
  To make student
  1. Understand what interfaces are and how they are different from abstract classes
  2. Understand the concept behind packages and how they are used
  3. Know about the *java. Lang* package

4. Understand object class and wrapper class

- **Outcomes:**
  After completing this unit, student will be able to-
  1. Create packages
  2. Import Java's standard packages
  3. Apply the *protected* access specifier
  4. Implement an interface
  5. Extend interfaces

- **Unit Contents:**
  Interfaces- **v**ariables in interface, extending interfaces, interface vs. abstract class, packages- creating packages, using packages, access protection, java.lang.Object class

- **Content Delivery Methods:**
  Chalk and Talk, Power point presentation

- **Assessment Methods:**
  Student will be evaluated by questions on the concepts of packages and interfaces in Java

**Unit 7–Exception Handling** No. of Lectures-05

- **Prerequisite:** Knowledge of exception handling in C++

- **Objectives:**
  To make student
  1. Understand the concepts and applications of exception handling
  2. Understand all the keywords used for exception handling
  3. Create user-defined exceptions

- **Outcomes:**
  After completing this unit, student will be able to-
  1. Use *try* and *catch* statement
  2. Demonstrate how to throw an exception
  3. Use *finally* and *throws* keywords

- **Unit Contents:**
  Exception handling- exception handling techniques**,** try…catch, throw keyword, throws, finally block, try-with-resources statements, multi catch, improved exception handling in Java, user-defined exception

- **Content Delivery Methods:**
  Chalk and Talk, Power point presentation

- **Assessment:**
  Student will be evaluated by questions on the concepts of exception handling

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- **Internal continuous assessment (ICA) :**
  Minimum 8 practical's based on following and a mini project:
  1. Programming with basic program structure of Java
  2. Programming using different java programming constructs
  3. Programming using the concepts of class, objects, methods, constructors
  4. Programming using the concepts of arrays in Java
  5. Programming using the concepts of strings in Java
  6. Programming using the concept of inheritance in Java
  7. Programming using the concepts of packages and interfaces in Java
  8. Programming using the concepts of exception handling

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- **Text Books:**
  1. Programming with Java: A Primer, E. Balagurusamy, Tata McGraw Hill Publication, New Delhi
  2. Programming in Java, Sachin Malhotra and Saurabh Choudhary, Oxford University Press, New Delhi
  3. Core Java: An Integrated Approach, R. Nageswara Rao, Dreamtech Press

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- **Reference Books:**
  1. Java: A Beginner's Guide, Herbert Schildt, McGraw-Hill Education
  2. Core Java 2: Volume-I Fundamentals, Cay S. Horstmann and Gary Cornell, Prentice Hall PTR
  3. Java 2: The complete Reference, Patrick Naughton and Herbert Schildt, McGraw-Hill.

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**P.A.H. Solapur University, Solapur**
**T. Y. B Tech. (Electronics Engineering) Semester-I**
**EN316 SOFTWARE SIMULATION TOOLS**

**Teaching Scheme**
**Practical –** 2 Hours/week, 1 Credit
**Tutorial –** 1 Hour/week, 1 Credit

**Examination Scheme**
**ICA-** 50 Marks

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MATLAB is widely used numeric computation software for engineering and scientific calculations. It is an interactive programming language that can be used in many ways, including data analysis and visualization, simulation and engineering problem solving. The course introduces MATLAB and other simulation software tools like OrCAD / PROTEUS to simulate electronic circuits for solving engineering problems.

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**Course Prerequisite:**
Student should have basic knowledge of structured programming language such as C.

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**Course Objectives:**

1. To make student understand the MATLAB environment along with basic programming constructs.
2. To make student use MATLAB and SIMULINK as a tool to simulate electronic circuits
3. To make student understand system behavior using different analysis tools and functions available in MATLAB and SIMULINK
4. To make student use OrCAD/PROTEUS as a tool to simulate electronic circuits

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**Course Outcomes:**
Student will be able to-

1. Create function for mathematical operation in MATLAB
2. Simulate diode and transistorized electronic circuits using MATLAB
3. Develop simple passive filter models using SIMULINK blocks.
4. Evaluate performance of AM, FM modulation and other communication related system by applying different analysis tools and functions of MATLAB SIMULINK.
5. Simulate simple electronic circuit using OrCAD / PROTEUS simulator.

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**Section - I**

**Unit 1: MATLAB Fundamental:**

- **Prerequisite**: Basics of structured language (like C)

- **Objective**:
  1. To introduce students basics of scientific programming
  2. To make student understand the fundamental abstractions in procedural programming (variable/values/types/assignment, control flow(conditional/loops/error handling))
  3. To make student understand MATLAB specific compounds data types
  4. To make student understand in-built functions and expression to write a program

- **Outcomes:**
  After completing this unit, student is able to –
  1. Write simple MATLAB programs using variables and expressions
  2. Write simple MATLAB programs using various in-built math functions
  3. Write simple MATLAB programs using loops and branching statements

- **Unit Content:**
  MATLAB Environment, constants, variables and expressions, operators, matrix operations, vectors, complex numbers, math functions, input–output, control structures-loops and branching

- **Content Delivery Methods:** Chalk and talk, programming

- **Assessment Methods:**
  Execute MATLAB program from question bank.

**Unit 2: MATLAB Functions:**

- **Prerequisite**: Syntax and semantics of MATLAB including data types, control structures, variables, operators.

- **Objective**:
  1. To make student understand how to define and execute a function file.
  2. To make student learn different ways to define a function file and function handling.
  3. To make student understand the difference between function file and script file.

- **Outcomes**:
  After completing this unit, student is able to –
  1. Write and execute a function file.
  2. Design and implement a function file and write appropriate function calls in a script file.
  3. Differentiate between functions file and script file.

- **Unit Content**:
  M files and script files, function sub programs, types of functions, functions handling, errors and warnings

- **Content Delivery Methods:**
  Chalk and talk, programming

- **Assessment Methods:**
  MATLAB programs

**Unit 3: MATLAB Graphics:**

- **Prerequisite**:
  Preliminary 2D geometry

- **Objective**:
  To make student understand how MATLAB can be used to create and format many types of two dimensional and three dimensional plots.

- **Outcomes**:
  After completing this unit, student is able to –
  1. Plot two and three dimensional graphs to represent result / output.
  2. Compare results using different format and types of plots
- **Unit content**:
  Two dimensional plots, multiple plots, sub plots, specialized two dimensional plots, three dimensional plots

- **Content Delivery Methods:**
  Chalk and talk, programming

- **Assessment Methods:**
  MATLAB programs

**Section - II**

**Unit 4: Problem Solving Using MATLAB:**

- **Prerequisite:** Concepts of DC circuit analysis, RL, RC and RLC circuits, MATLAB basics

- **Objectives:**
  1. To make student develop MATLAB functions to solve electronic circuit problems
  2. To make student analyze circuit behavior by plotting graphs of important circuit entities

- **Outcome:**
  After completing this unit, student is able to –
  1. Solve DC circuit analysis problems using MATLAB.
  2. Analyze transient response of RC circuit using MATLAB

3. Analyze transient response of RLC circuit using MATLAB

- **Unit Content:**
  DC circuit analysis using MATLAB: solving nodal analysis, loop analysis problems using MATLAB, verification of maximum power transfer theorem using MATLAB; solving transient analysis problems of RC and RLC circuits using MATLAB

- **Content Delivery Methods:**
  Chalk and talk, programming

- **Assessment Methods:**
  MATLAB programs

**Unit 5: Simulation MATLAB/SIMULINK:**

- **Prerequisite**: Concept of active, passive devices, analog and digital circuits, MATLAB basics

- **Objectives:**
  1. To make student use MATLAB and SIMULINK as a tool to simulate electronic circuits
  2. To make student analyze circuit behavior using different analysis tools and functions available in SIMULINK

- **Outcome:**
  After completing this unit, student is able to –
  1. Create simple models for rectifiers and resonance circuits using SIMULINK blocks.
  2. Analyze behavior of series and parallel circuits using MATLAB and SIMULINK
  3. Validate network theorems using SIMULINK visualization functionalities

- **Unit Content:**
  Introduction to SIMULINK, modeling, commonly used blocks, simulation using MATLAB / SIMULINK - rectifiers, filters, series and parallel circuits, validation of network theorems, resonance circuits, any other circuits / concepts covered in course -Electronic Circuit Analysis and Design and Network Theory and Analysis

- **Content Delivery Methods:**
  Chalk and talk, circuit simulation & programming

- **Assessment Methods:**
  Simulation of circuits / concepts covered in Electronic Circuit Analysis and Design and Network Theory and Analysis Course using MATLAB/ SIMULINK

**Unit 6: Simulation Using Other Software Simulation Tools:**

- **Prerequisite**: Knowledge of analog and digital circuits

- **Objectives:**
    1. To make student correlate theoretical concepts with practical design and simulations.
    2. To make student viable to check the performance and feasibility of design through simulation before hardware realization
    3. To make student skilled at circuit testing using simulation
    4. To make student innovate circuit design through small problems

- **Outcome:**
  After completing this unit, student is able to–
    1. Correlate theoretical concepts with practical design using simulations.
    2. Check the performance and feasibility of design through simulation before hardware realization
    3. Test / debug circuit using simulation
    4. Innovate circuit design through small problems

- **Unit Content:**
  Simulation of circuits using software simulation tool like OrCAD / PROTEUS – multistage transistor amplifiers, feedback amplifiers, power amplifiers, oscillators, multivibrators, opamp configurations, op amp applications, active filters, any other circuits / concepts covered in courses -Electronic Circuit Analysis and Design and Analog Integrated Circuits courses

- **Content Delivery Methods:**
  Chalk and talk, circuit simulation

- **Assessment Methods:**
  Simulation of circuits / concepts covered in Electronic Circuit Analysis and Design and Analog Integrated Circuits courses

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- **Internal Continuous Assessment (ICA):**
  ICA *shall consist of minimum ten experiments and a small project based upon-*

1. MATLAB Programming – Students shall solve/simulate simple electronic circuit related problems to learn various MATLAB features / concepts
2. Simulation of circuits / concepts covered in Electronic Circuit Analysis and Design and Network Theory and Analysis Course using MATLAB/ SIMULINK.
3. Simulation of circuits / concepts covered in Electronic Circuit Analysis and Design and Analog Integrated Circuits courses using OrCAD/PROTEUS
4. It is recommended that with a group of 4/5 students, few lab sessions shall be utilized for carrying out a small project.

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- **Text Books:**

1. MATLAB and its application in Engineering, R.K.Bansal, A.K.Goel and M.K.Sharma, Pearson Education
2. MATLAB & Simulink, Agam Kumar Tyagi, Oxford University Press
3. Getting starting with MATLAB-7, Rudra Pratap, Oxford University Press
4. Electronics and Circuit Analysis using MATLAB, John O. Attia, CRC Press
5. PSPICE and MATLAB for Electronics: An Integrated Approach, John O. Attia, CRC Press

- **Reference Books:**

1. MATLAB and SIMULINK manuals
2. OrCAD/ PROTEUS manual

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**PAH Solapur University, Solapur**
**T.Y. B. Tech. (Electronics Engineering) Semester-II**

## EN321 COMPUTER NETWORKS

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

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

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

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**Course Objectives:**

To make student

1. Understand importance of organizational structure and selection of appropriate networking architecture and technology.
2. Recognize benefits of layered model approach and network devices.
3. Understand different LAN topologies
4. Investigate routing algorithm performance
5. Aware of networking commands and network programming to implement server – client communication

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**Course Outcomes:**

After completing this course, student will be able to -

1. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technology.
2. Evaluate benefits of layered model approach and network devices
3. Analyze and evaluate the performance of different LAN topologies
4. Correlate and select appropriate routing algorithms for networking.
5. Write different network programming commands and implement server –client communication

## Section I

**Unit 1-Data Communication** No of lectures –05

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

- **Objectives:**
  1. To make student aware of limitations offered by conventional telephone network during data communication
  2. To introduce to student various issues related to data communication, concept of layered reference model, communication across the layers.
  3. To introduce to student serial communication support in PC.

- **Outcomes:**
  After completing this unit, student is able to
  1. Analyze limitations of telephone network during data communication
  2. Utilize serial communication facility in a PC.

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

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

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

**Unit 2– Data Link Layer** No of lectures – 08

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

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

- **Outcomes:**
  After completing this unit, student is able to
  1. Compare error correcting and detection code for error free data communication
  2. Evaluate necessary parameters for data communication between two dissimilar computers.

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

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

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

**Unit 3– IEEE LAN Standards** No of lectures – 07

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

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

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

- **Unit Content:**
  LAN topologies
  IEEE 802.3 LAN- MAC sub layer, megabit LAN, Gigabit LAN
  IEEE 802.4 & IEEE 802.5- architecture, MAC sub layer and maintenance.
  IEEE 802.15 Blue tooth- architecture, applications, protocol stack, frame structure

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

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

**Unit 4–Network Devices** No of lectures –03

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

- **Objective:**
  1. To make student understand selection of appropriate network device for a particular network.
  2. To make student install different network devices in network

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

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

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

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

**Section II**

**Unit 5– TCP/IP Reference Model** No of lectures–09

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

- **Objectives:**
  1. To make student aware about ways of providing internet services on available computer.
  2. To introduce to student different address schemes like IP and MAC during data communication

- **Outcomes:**
  After completing this unit, student is able to -
  1. Program IP address and other parameters to computer to avail internet services.

2. Use various networking commands and parameters in different types of communication protocols.

- **Unit Content:**
  TCP/IP reference model, encapsulation, de-capsulation, Transmission Control Protocol (TCP) – header format, three-way handshake, TCP communication, TCP congestion & its control, IPv4- header format, IP communication, addressing – sub netting & masking, numerical over sub-netting, NAT, User Datagram Protocol (UDP) – header format, checksum, UDP communication

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

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

**Unit 6–Network Layer** No of lectures–06

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

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

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

- **Unit Content:**
  Virtual circuit & datagram approach, routing protocols – shortest path, distance vector routing, link state, BGP and OSPF

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

- **Assessment Methods:**
  Questions based on various routing protocols, protocols like BGP, OSPF.

**Unit 7–Client Server Model -** No of lectures –05

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

- **Objectives:**
  1. To introduce to student use of socket to communicate between client and server.
  2. To make student understand client –server communication using standard communication protocol.
- **Outcomes:**
  After completing this unit, student is able to -
  1. Create simple server and client network and start the communication services.
  2. Establish communication between server and multiple clients
- **Unit Content:**
  Client server paradigm- simple server, simple client, client server architecture, client server model characteristics, socket, client server communication
- **Content Delivery Methods:**
  Along with chalk and talk, the instructor is strongly encouraged to take help of power point presentations, videos.
- **Assessment Methods:**
  Questions based upon sockets, various services over sockets, practical on client-server communication using various protocols

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- **Internal Continuous Assessment (ICA):**
  ICA consists of minimum eight experiments based upon above curriculum.

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

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

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**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-II**
**EN322 EMBEDDED SYSTEMS**

| **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** |
| | **POE - 25 Marks** |

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This course provides a thorough introduction to the architecture of ARM7TDMI core based microcontroller. The course also introduces assembly and C programming for microcontroller and enables student to write programs addressing high level programming skills and also interfacing with different peripherals. The real time operating system concepts are also introduced.

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**Course Prerequisite:**
Student has completed a course in microcontroller and its interfacing and has an adept knowledge of assembly language and C language programming. Student also has knowledge of interfacing techniques and working of different peripherals.

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**Course Objectives:**

1. To make student aware of hardware and software architecture of embedded system
2. To make student learn architecture of ARM7TDMI core.
3. To make student write assembly and C language programs for ARM7TDMI core based microcontroller.
4. To make student learn interfacing of different peripherals with microcontroller.
5. To make student learn architecture of real time operating system and its services.

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

1. Describe hardware and software architecture of embedded system.
2. Describe ARM7TDMI core architecture,
3. Write assembly and C program for different applications for microcontroller.
4. Interface different peripherals with microcontroller.
5. Discuss and use different services of real time operating system.

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## Section I

**Unit 1 - Introduction to Embedded system** No of lectures – 04

- **Prerequisite –** Basics of digital electronics and basic building blocks of microcontroller.

- **Objectives –**
  1. To make student learn basic fundamentals of embedded systems.
  2. To make student learn software and hardware architecture of embedded system.

- **Outcomes –**
  After completing this unit student -
  1. Can describe basic fundamentals of embedded systems.
  2. Can describe software and hardware architecture of embedded system.

- **Unit Content:**
  Concept of embedded system**,** RISC and ARM design philosophy, embedded system hardware and embedded system software

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

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

**Unit 2 – ARM7 Core Fundamentals** No of lectures – 09

- **Prerequisite** – Basics of microcontroller and embedded system architecture.

- **Objectives –**
  1. To make student learn hardware fundamentals of ARM7TDMI core.
  2. To make student learn the instruction set of ARM7TDMI core & write assembly language program for different tasks.

- **Outcomes-**
  After completing this unit student –
  1. Can describe architecture of ARM7TDMI core.
  2. Can write assembly language program by using of ARM7TDMI core instruction set for different tasks.

- **Unit Contents**
  ARM7TDMI core programmer's model: data types, processor modes, registers, exceptions, memory format support, unaligned access support, pipeline concept, core extensions and ARM7TDMI instruction set: data processing instructions, branch instructions, load/store instructions, software interrupt instruction, program status register instructions, and loading constants, arm addressing modes, introduction to thumb instruction set

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

- **Assessment Methods:**
  Questions based upon hardware architecture of ARM7TDMI core, and programming by using the instruction set.

**Unit 3 – Architecture of ARM7TDMI Based Microcontroller** No of lectures – 09

- **Prerequisite –** ARM7TDMI core architecture

- **Objectives –**
  1. To make student learn the architecture of microcontroller.
  2. To make student learn the working of on chip peripherals of microcontroller.

- **Outcomes -**
  After completing this unit, student –
  1. Can describe architecture of microcontroller.
  2. Can describe working of on chip peripherals of microcontroller.

- **Unit Contents-**
  ARM7TDMI based microcontroller architecture: study of on-chip peripherals like I/O ports, timers, interrupts, on-chip ADC, DAC, RTC, WDT, PLL, PWM, SPI, I2C etc

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

- **Assessment Methods:**
  Questions based upon architecture of ARM7TDMI based microcontroller, working of on chip peripherals.

**Section II**

**Unit 4 – Microcontroller Interfacing and Programming** No of lectures – 09

- **Prerequisite –** ARM7TDMI core architecture and knowledge of C language programming

- **Objectives –**
  1. To make student able to use on chip peripherals of microcontroller for different applications.
  2. To make student able to interface different peripherals to microcontroller.

- **Outcomes -**
  After completing this unit, student can-
  1. Write programs microcontroller for different applications.
  2. Interface different peripherals to the microcontroller.

- **Unit Contents-**
  Basic embedded C programs for ARM7TDMI based microcontroller's on-chip peripherals of like ADC, DAC, timer/counters etc., I/O devices interfacing like led's, switches, LCD's etc. and serial communication, analog interfacing & data acquisition

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

- **Assessment Methods:**
  Questions based upon interfacing of different peripherals, and programming on interfacing.

**Unit 5 – Real Time Operating System Concepts** No of lectures – 09

- **Prerequisite–** Basics of embedded system software development.

- **Objectives –**
  1. To make the student aware of the need of real time systems.
  2. To make the student understand basic concepts of RTOS and its issues.

- **Outcomes-**
  After completing this unit, student –
  1. Can elaborate the need of real time systems.
  2. Can discuss fundamentals and different issues of real time operating systems.

- **Unit Contents-**
  Concepts of real time operating system, need of RTOS, comparison of traditional and embedded OS, foreground/background systems, multitasking, tasks, context switching, kernel structure, schedulers, mailboxes, task management, time management, inter-task communication, messages and memory management, interrupts, clock tick

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

- **Assessment Methods:**
  Questions based upon real time systems and upon concepts like Kernel, Mailboxes, Task management, Memory management, Interrupts etc.

**Unit 6 - RTOS Programming** No of lectures – 05

- **Prerequisite –** Basic concepts of real time operating system, knowledge of C language programming.

- **Objectives –**
  1. To make student learn µC/OS-II as a case study of real time operating system.
  2. To make student able to use different system services of µC/OS-II.

- **Outcomes-**
  After completing this unit, student –
  1. Can describe µC /OS-II architecture and its system services.
  2. Can build simple applications by using system services of µC /OS-II.

- **Unit Contents-**
  Introduction to µC/OS-II RTOS, features of µC/OS-II, kernel structure of µC/OS-II, system services related to task management, time management, semaphore management, and mailbox management, programs by using above system services

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

- **Assessment Methods:**
  Questions based upon system services and writing of programs for different applications by making use of system services.

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- **Internal Continuous Assessment (ICA):**
  *ICA consists of minimum 8 practical based on curriculum. Recommended practicals:*
  1. Program to interface LCD & Keypad to microcontroller.
  2. Program to interface analog input devices using on-chip ADC.
  3. Program to generate different waveforms using on-chip DAC.
  4. Program to introduce timer based events for microcontroller.
  5. Program to interface different peripherals using I2C protocol.
  6. Program to introduce interfacing using UART for microcontroller.
  7. Program to interface different peripherals using SPI/SSP protocol.
  8. Multitasking in µC/OS RTOS using different tasks.
  9. Semaphore as signaling & synchronizing on microcontroller.
  10. Mailbox implementation for message passing on microcontroller.

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- **Text Books**
  1. ARM System Developers Guide, Andrew Sloss, Elsevier.
  2. MicroC/OS-II: The Real Time Kernel, Jean J Labrose, CMP Books.
  3. ARM System On Chip Architecture, Steve Furber, Addison-Wesley.

- **Reference Books**
  1. ARM7TDMI based microcontroller's datasheet.
  2. Embedded systems software primer, David Simon, Pearson.
  3. Embedded Systems: Architecture, Programming and Design, Raj Kamal, McGraw Hill India.

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**PAH Solapur University, Solapur**
**T.Y. B. Tech. (Electronics Engineering) Semester-II**

# EN323 VLSI DESIGN

| **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** |

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This course provides a thorough introduction to hardware description language (VHDL). The course intends to cover VHDL modeling and testing of various combinational and sequential circuits. The course also introduces the architectures of complex programmable logic device and field programmable gate arrays. CMOS logic, CMOS fabrication and layout and testing of logic circuits are also covered.

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**Course Prerequisite:**
Student has completed a course in digital techniques and has an adept knowledge of various combinational and sequential circuits. Student also has knowledge about PLDs and MOS transistors.

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**Course Objectives:**

1. To introduce to student VHDL language.
2. To make student understand modeling combinational circuits and sequential circuits using VHDL.
3. To make student understand impediments of synchronous design.
4. To introduce to student architecture of CPLD and FPGA.
5. To make student understand CMOS logic and CMOS fabrication.
6. To make student understand the importance and method for digital circuit testing.

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**Course Outcomes:**

After completion of this course, student will be able to -

1. Explain VHDL features with suitable example
2. Write VHDL code & test bench for modeling and testing combinational and sequential circuits
3. Elaborate steps in the high level design flow and implement some functions using CPLD/FPGA.
4. Explain the characteristics of CMOS and implement digital functions using CMOS logic and gates.
5. Describe the testing methods and design the minimal test set required for testing the circuits.

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## Section I

**Unit 1 -VHDL** No of lectures – 12

- **Prerequisite:** Structured programming language concepts

- **Objectives:**
  1. To make student understand VLSI design flow.
  2. To introduce to student features and capabilities of VHDL, different design units of VHDL.
  3. To make student understand the concept of data flow, structural and behavioral architectures and to learn VHDL statements used in different architectures.
  4. To make student understand the subprograms in VHDL, use of generate statement, use of generics and concept of operator overloading.
  5. To introduce to student concept of test benches – module to test the circuit.

- **Outcome:**
  After completing this unit, student will be able to-
  1. Identify the differences between different coding styles and can select an appropriate one for application.
  2. Explain the difference between signal and variable.
  3. Implement common VHDL constructs.
  4. Use different data types to represent information.
  5. Simulate a basic VHDL design.
  6. Write a VHDL test bench.

- **Unit Content:**
  Introduction, design flow, features & capabilities of VHDL, entity, architectures, configuration, library, package, data types, operators, multi valued logic, transport and inertial delays, concurrent signal assignment, process statement, wait statement, sequential statements, signal assignment within sequential construct, signal & variable, subprograms, generate statement, generics, test benches

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

- **Assessment Methods:**
  Questions based upon VHDL architectures, data types, delay models, subprograms. Also questions will be asked on different statements to test the understanding of student.

**Unit 2 – VHDL Modeling** No of lectures – 06

- **Prerequisite:** Concepts of combinational logic, functionality of different combinational circuits.

- **Objectives:**
  1. To make student understand modeling of combinational circuits using VHDL.
  2. To make student understand testing the model using test benches.
  3. To make student understand VHDL modeling of RAM & ROM.

- **Outcomes:**
  After completing this unit, student will be able to–
  1. Write VHDL code using different architectures for modeling of combinational circuits.
  2. Write VHDL test bench for testing simple combinational circuits.

- **Unit Content:**
  VHDL modeling of combinational circuits such as decoder, encoder, tri state buffer, multiplexer, parity checker, parity generator, comparator, adder, multiplier

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

- **Assessment Methods:**
  Questions based upon writing VHDL code for modeling combinational circuits and test bench.

**Unit 3 – Synchronous Design** No of lectures – 05

- **Prerequisite:** Concepts of sequential logic, functionality of different sequential circuits, basics of FSM design, state table & state diagram representation of sequential circuit

- **Objectives:**
  1. To make student to derive the state table/state diagram for given sequential circuit.
  2. To make student to create VHDL model for different sequential circuits.
  3. To make student understand Mealy and Moore machines, able to write VHDL code for different Mealy and Moore state machines.
  4. To make student understand different factors to consider while designing synchronous circuits.

- **Outcomes:**
  After completing this unit, student will be able to–
  1. Design state table for simple Mealy and Moore FSM.
  2. Write VHDL code for different types of counters, shift registers, LFSRs.
  3. Write VHDL code for Mealy and Moore FSM.
  4. Explain the importance of considering clock skew, clock jitter in synchronous design

- **Unit Content:**
  Review of FSM design, VHDL modeling of flip flops, counters, and shift registers
  Mealy and Moore machines

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

- **Assessment Methods:**
  Questions based upon writing VHDL code for modeling sequential circuits, Mealy and Moore machines. Also questions to test the understanding of concepts of synchronous design.

**Section II**

**Unit 4 – Programmable Logic Devices** No of lectures – 05

- **Prerequisite:** Basics of digital design

- **Objectives:**
  1. To introduce to student Xilinx 9500 complex programmable logic device architecture.
  2. To introduce to student architecture of Spartan FPGA architecture.
  3. To make the student understand difference between CPLD and FPGA.
  4. To make the student to implement small functions in FPGA.

- **Outcomes:**
  After completing this unit, student will be able to –
  1. Draw the block diagram of CPLD and FPGA architectures.
  2. Explain how the functions are implemented in CPLD.
  3. Draw the schematic showing implementation of small functions on FPGA.

- **Unit Content:**
  PLA, PAL, CPLD architecture, FPGA architecture, programmable logic block architectures, programmable interconnect, implementing functions in FPGAs

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

- **Assessment Methods:**
  Questions based upon CPLD and FPGA architectures.

**Unit 5 – High Level Design Flow** No of lectures – 05

- **Prerequisite:** VHDL basics

- **Objectives:**
  1. To introduce to student synthesis process and how to write synthesizable designs.
  2. To make student understand the complete high level design flow from VHDL capture to VITAL simulation.

- **Outcomes:**
  After completing this unit, student will be able to –
  1. Analyze the simulation waveforms and verify the functionality.
  2. Write code for simulation and synthesis.
  3. Explain the difference between functional simulation and timing simulation.

- **Unit Content:**
  RTL simulation, synthesis, gate level verification, place and route, post layout timing simulation

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

- **Assessment Methods:**
  Questions based upon RTL simulation, synthesis and design flow.

**Unit 6 – CMOS** No of lectures – 06

- **Prerequisite:** Concepts of MOS transistors (NMOS & PMOS), logic gates.

- **Objectives:**
  1. To introduce to student CMOS logic, building basic gates, compound gates, multiplexers using CMOS transistors.
  2. To make student understand characteristics of CMOS inverter, different operating regions of inverter, effect of β ratio on characteristics.
  3. To make student understand CMOS fabrication process.
  4. To make student understand operation of transmission gate and its advantages over pass transistors.
  5. To make student understand concepts of noise margin, fan in, fan out, factors affecting power dissipation.

- **Outcomes:**
  After completing this unit, student will be able to –
  1. Draw the schematic for given function using CMOS logic.
  2. Explain the different regions of operation of CMOS inverter along with equations.
  3. Sketch the stick diagram and to estimate the area requirement.
  4. Derive the equations for power dissipation, timing parameters and noise margin

- **Unit Content:**
  MOS transistors, CMOS logic, CMOS fabrication and layout, CMOS inverters- DC characteristics, beta ratio effects, transmission gates, characteristics of digital circuits (power dissipation, noise margin, and fan in, fan out)

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

- **Assessment Methods:**
  Questions based upon CMOS logic, fabrication process, DC characteristics, beta ratio and characteristics of digital circuits.

**Unit 7 – Testing of Logic Circuits** No of lectures – 06

- **Prerequisite:** Basics of combinational & sequential circuits.

- **Objectives:**
  1. To make the student aware of need to test the circuits.
  2. To make the student conversant with basic aspects of testing.
  3. To make student understand difference between testing of combinational & sequential circuits.

- **Outcomes:**
  After completing this unit, student will be able to –
  1. Derive the test set for the given circuit for detecting faults.
  2. Draw and explain the schematic arrangement for testing sequential circuit.
  3. Design the built in self test arrangement for testing sequential circuit.

- **Unit Content:**
  Fault model, complexity of a test set, path sensitizing, random tests, testing of sequential circuits, built in self-test, boundary scan

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

- **Assessment Methods:**
  Questions based upon fault modeling, path sensitizing. Also questions on deriving test using random tests, sequential circuit testing.

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- **Internal Continuous Assessment :**
  ICA consists of minimum eight experiments based on following designs. Student shall test the designs using VHDL test bench.

  Simulation, synthesis and implementation of:
  1. Combinational logic: decoder, priority encoder, comparator, adder, multiplier, multiplexer
  2. Sequential logic: counters with synchronous / asynchronous reset signal, cascading of counters, shift registers, Melay & Moore state machines
  3. RAM & ROM

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- **Text Books:**
  1. Fundamentals of Digital Logic with VHDL Design, Stephan Brown and Z Vranesic, TMH
  2. Digital Systems Design using VHDL, Charles H Roath, Lizy John, Cengage Learning Second Edition
  3. VHDL Programming by Example ,Douglas Perry, TMH
  4. CMOS VLSI Design A Circuits and Systems Perspective, Neil Weste, David Haris, 3rd Edition, Pearson Education

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- **Reference Books:**

  1. Digital Design, Principles and Practices, John F Wakerly, PHI
  2. The Designer's Guide to VHDL, Peter J. Ashenden, Morgan Kaufmann Publishers
  3. A VHDL Primer , Jayaram Bhasker

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**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-II**
**OPEN ELECTIVE II**
**EN324A OPERATING SYSTEMS**

| **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** |

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This course covers the classical internal algorithms and structures of operating systems, including CPU scheduling and memory management. It also includes the unifying concept of the operating system as a collection of cooperating sequential processes. It also covers topic such as file systems, memory management, virtual memory and deadlocks.

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**Course Prerequisite:**
Student shall possess knowledge of data structure, microprocessors and microcontrollers. Elementary knowledge of computer architecture, algorithms and serial communication concepts is desirable. A strong programming skill is necessary.

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**Course Objectives:**

1. To introduce to student structure of operating system and its types.
2. To make student realize importance of processes and inter process communication.
3. To make student analyze and design algorithm for process scheduling, synchronization and removing deadlock.
4. To make student analyze memory management during process execution
5. To make student create directory structure and file system in an operating system

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**Course Outcomes:**
After completion of this course, student is able to -

1. Identify and describe structure, operations and different types of operating system.
2. Describe the concept of process and inter process communication.
3. Analyze effect of different scheduling criteria on scheduling techniques.
4. Evaluate deadlock condition and implement methods to overcome deadlock
5. Analyze memory management concepts like logical and physical addressing
6. Make use of file systems, directories and different commands associated to it.

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## Section I

**Unit 1–Introduction and Overview of Operating System** No of lectures –05

- **Prerequisite:**
  Evolution of computer system and operating system, concepts of basic computer system hardware & software architecture, programming languages

- **Objectives:**
  1. To make student aware about operating system, its goals and various operations supported by it.
  2. To make student acquaint with different types of operating systems and their significance.
  3. To introduce to student structure of operating system.
  4. To introduce to student operation of system call.

- **Outcomes:**
  After completing this unit, student -
  1. Is able to explain goals and services provided by operating system.
  2. Can draw and explain simple batch system and multi programming system.
  3. Is able to explain significance of time sharing system, real time operating system and distributed operating system.
  4. Can draw and explain structure of general operating system.
  5. Is able to explain the concept of system call.

- **Unit Content:**
  Operating system, goals of an operating system, services of an operating system, classes of an operating system -simple batch system, multiprogramming system, time sharing system, real time system, distributed operating systems, structure of OS, system call and its uses

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

- **Assessment Methods:**
  Questions based upon goals and services of an operating system, descriptive questions to ensure understanding batch processing, real time system, and time sharing system, distributed system, system call, block diagram of operating system structure

**Unit 2–Process Management** No of lectures – 06

- **Prerequisite:** Program execution environment in computer system, concepts of queue and buffer

- **Objectives:**
  1. To make student understand how to create a process.
  2. To make student analyze operations on process.
  3. To introduce to student concept of cooperating processes.
  4. To introduce student the notion of threads.
  5. To make student understand inter process communication and its types.

- **Outcomes:**
  After completing this unit, student –
  1. Is able to describe concepts of process.
  2. Can draw and explain different states of process and process control block.
  3. Can demonstrate operations on processes and implement the concepts like process creation using C programming.
  4. Is able to describe the notion of threads
  5. Can explain different types of inter process communication.

- **Unit Content:**
  Process concept, process state diagram and process control block, operations on processes- creation & termination, cooperating processes, inter process communication, threads: multi- threading models and threading issues

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

- **Assessment Methods:**
  Questions based upon block diagram and descriptive questions to ensure understanding of the process state diagram and PCB, process creation and termination, threads and inter process communication.

**Unit 3–Process Scheduling & Synchronization** No of lectures – 10

- **Prerequisite:** Concept of system call and process concepts

- **Objectives:**
  1. To introduce to student concept of process scheduling and different scheduling criteria
  2. To make student implement FCFS, SJF, SRTF, priority and round-robin scheduling algorithms
  3. To make student identify classical problems of synchronization
  4. To make student analyze and resolve critical section problem.
  5. To make student use synchronization tool: semaphore to avoid critical section problems

- **Outcomes:**
  After completing this unit, student –
  1. Is able to design an algorithm for process scheduling and scheduling criterions.
  2. Can describe analytical concepts related to FCFS, SJF, priority scheduling and round robin scheduling algorithms.
  3. Is able to examine classical problem of synchronization and to analyze semaphore implementation.
  4. Is able to explain critical section problem

- **Unit Content:**
  Process scheduling concept, scheduling criteria, scheduling algorithms- non pre-emptive, pre-emptive, different scheduling algorithm- FCFS, SJF, SRTF, priority based, round robin , classical problems of synchronization- the critical section problem, semaphore as synchronization tool

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

- **Assessment Methods:**
  Numerical questions based upon process scheduling and descriptive questions to ensure understanding of the process scheduling and their algorithms, classical problems of synchronization and critical section problems.

**Section II**

**Unit 4-Deadlock** No of lectures – 05

- **Prerequisite:** Basics of process and synchronization

- **Objectives:**
  1. To introduce to student concept of deadlock characterization.
  2. To make student understand different methods for handling deadlocks
  3. To make student investigate deadlock states.

- **Outcomes:**
  After completing this unit, student –
  1. Is able to evaluate deadlock and its characterizations
  2. Is able to design & describe resource allocation graph to handle deadlock.
  3. Can analyze and describe deadlock prevention methods to avoid deadlock.

- **Unit Content:**
  Introduction to deadlock, deadlock characterization, methods for handling deadlocks, dead lock prevention, deadlock avoidance, deadlock detection , recovery from deadlock

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

- **Assessment Methods:**
  Questions based upon deadlock and deadlock characterization, descriptive question based on deadlock prevention and deadlock avoidance and detection methods.

**Unit 5-Memory Management** No of lectures – 06

- **Prerequisite:** Memory storage schemes, primary memory, secondary memory, RAM partitioning

- **Objectives:**
  1. To make student realize logical versus physical address space mapping.
  2. To introduce to student concept of process swapping for effective utilization of memory.
  3. To make student understand contiguous allocation of memory.
  4. To make student explore paging & segmentation

- **Outcomes:**
  After completing this unit, student –
  1. Can illustrate logical versus physical address mapping.
  2. Is able to draw & describe need and procedure of process swapping.
  3. Can describe types of memory allocation scheme along with memory fragmentation.
  4. Is able to draw & describe paging and segmentation.

- **Unit Content:**
  Background of memory, logical versus physical address space, swapping, contiguous memory allocation, paging, segmentation, segmentation with paging

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

- **Assessment Methods:**
  Descriptive questions based on logical versus physical address mapping, swapping, contiguous memory allocation, paging & segmentation.

**Unit 6- Virtual Memory** No of lectures – 06

- **Prerequisite:** Basics of memory management

- **Objectives:**
  1. To introduce to student basics of virtual memory management and demand paging
  2. To make student analyze page replacement policy and solve problems related to it.
  3. To make student realize frame allocation & thrashing
  4. To make student understand demand segmentation.

- **Outcomes:**
  After completing this unit, student –
  1. Can describe concept of virtual memory.
  2. Is able to draw & describe demand paging.
  3. Is able to describe and analyze page replacement algorithm.
  4. Can draw and explain frame allocation & thrashing.

- **Unit Content:**
  Background, demand paging, need of page replacement, page replacement algorithms, allocation of frames, thrashing concept, demand segmentation

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

- **Assessment Methods:**
  Descriptive question based upon demand paging, page replacement techniques & algorithm, allocation of frames, thrashing, and demand segmentation, page replacement - analytical problems based on page replacement algorithm

**Unit 7- File System** No of lectures – 05

- **Prerequisite:** Basics of disk input output system & direct memory access

- **Objectives:**
  1. To introduce to student concept of file system and directory.
  2. To make student comprehend file system mounting and protection.
  3. To make student apply file allocation methods.

- **Outcomes:**
  After completing this unit, student –
  1. Is able to demonstrate file system.
  2. Can describe and implement file access methods, file system mounting and protection
  3. Can describe and implement file allocation methods.

- **Unit Content:**
  File system concept, file access methods, directory structure, file-system mounting, protection, directory implementation, allocation methods, free-space management

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

- **Assessment Methods:**
  Questions based upon file access method, file directories, file allocation methods, procedure description of file system mounting and protection, directory implementation

- **Internal Continuous Assessment (ICA):**
  It consists of minimum eight experiments based on operations on process, system calls, scheduling algorithm, threads, memory management using C programming language over Linux platform

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- **Text Books:**
  1. Operating System Concepts -Silberschatz Galvin- John Wiley Publications
  2. Operating System Concept Based Approach-Dahanjay M. Dhamdhare, 3rd Edition-Tata McGraw Hill
  3. Operating System – Rohit Khurana – 2nd Edition – Vikas Publications

- **Reference Books:**
  1. Operating Systems Internals and Design Principles- William Stallings-5th Edition, Prentice Hall India
  2. Operating System with Case Studies in UNIX, Netware and Windows NT-Achyut S. Godbole,- Tata McGraw Hill
  3. Operating System in Depth- Thomas W. Doeppner- Wiley Student Edition, Wiley India Pvt. Ltd.

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**PAH Solapur University, Solapur**

**T.Y. B. Tech (Electronics Engineering ) Semester-I**

**PROFESSIONAL ELECTIVE-I**

**EN325A IMAGE PROCESSING**

| **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** |

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Image processing is becoming increasingly significant in a variety of areas, from the process industry to the medical field. The fundamentals of image processing will be covered in this course. Students will also learn how to apply different techniques to images in order to better comprehend them. The design and implementation of image processing programmes are also covered in the course.

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**Course Prerequisite:**

Digital Signal Processing, Transform techniques, Applied Mathematics

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**Course Objectives:**

1. To describe and performs basic operations on image.
2. To design and apply filter on images in spatial and frequency domain.
3. To analyze and implement algorithm for image application using modern tools.
4. To select and apply appropriate technique for preprocessing, segmentation and feature extraction of images in different applications.

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**Course Outcomes:**

After learning the course the students should be able to:

1. Apply knowledge of mathematics for image understanding and analysis.
2. Design and analysis of techniques / processes for image understanding.
3. Design, realize and troubleshoot various algorithms for image processing case studies.
4. Select the appropriate hardware and software tools (Contemporary) for image analysis.

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## Section I

**Unit 1 — Fundamentals of Digital Image Processing** **No of lectures – 8**

- **Prerequisite:** Concepts of signal and system, sampling theorem

- **Objectives:**
  To study the image fundamentals and mathematical transforms necessary for image processing.

- **Outcomes:**
  After completing this unit, student are able to review the fundamental concepts of a digital image processing system.

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

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

- **Assessment Methods:**
  Introduction to image processing toolbox in MATLAB and question based on read an 8 bit image and then apply different image enhancement techniques like brightness improvement, brightness reduction and thresholding, negative of an image, log transformation and power law transformation

**Unit 2 – Image Transforms** No of lectures – 06

- **Prerequisite:** Applied Mathematics, Transform techniques

- **Objectives:**

1. To analyze images in the frequency domain using various transforms and apply filter on images in spatial and frequency domain**.**
2. Classify and analyze discrete time signals and systems

- **Outcomes:**
  After completing this unit, student –
  1. Apply the concept of DT Signal and DT Systems.
  2. Classify and analyze discrete time signals and systems
  3. Implement Digital Signal Transform techniques DFT and FFT.

- **Unit Content:**
  Discrete fourier transform, discrete cosine transform, wavelet transform, eigen analysis, singular value decomposition, principle component analysis

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

- **Assessment Methods:**
  Write a program to implement various low pass filters and high pass filter in frequency domain

**Unit 3 – Image Pre Processing** No of lectures – 08

- **Prerequisite:** knowledge of Digital Signal Processing

- **Objectives:**
  1. To study the image enhancement techniques
  2. To study image restoration procedures.

- **Outcomes:**
  After completing this unit, student –
  1. Use the enhancement techniques for digital Image Processing
  2. Use of the image restoration procedures

- **Unit Content:**
  Pixel brightness transformations, geometric transformations, local pre-processing, pre-processing in frequency domain, detection of maximally stable regions, image restoration in spatial domain & frequency domain

- **Content Delivery Methods:**
  Chalk and talk, power point presentation, MATLAB simulation for coding

- **Assessment Methods:**
  Write a program to implement digital manipulation of images; image acquisition; preprocessing; segmentation; Fourier domain processing

**Section II**

**Unit 4 – Image Analysis** No of lectures – 8

- **Prerequisite:** knowledge of Digital Signal Processing

- **Objectives:**
  1. To apply digital image processing techniques for line, corner, boundary detection and edge detection.
  2. To apply digital image processing techniques for splitting, merging, matching

- **Outcomes:**
  After completing this unit, student –
  1. Use different for image segmentation

- **Unit Content:**
  Edge detection, line detection, corner detection, boundary detection, hough transform, threshold, edge based segmentation, region based segmentation- splitting, merging, matching

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

- **Assessment Methods:**
  Write a program to implement of segmentation based on Discontinuities (point, Line, Edge)

**Unit 5 –- Image Representation & Description** No of lectures – 08

- **Prerequisite:** knowledge of Digital Signal Processing

- **Objectives:**
  To apply digital image processing techniques for image representation and recognition

- **Outcomes:**
  After completing this unit, student use different –
  1. Techniques for boundary representation
  2. Techniques for boundary description
  3. Techniques for Regional Descriptors

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

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

- **Assessment Methods:**
  Write a program to implement for image representation and recognition

**Unit 6 – Image Compression** No of lectures – 06

- **Prerequisite:** knowledge of Digital Signal Processing

- **Objectives:**
  1. To apply digital image processing techniques for image compression
  2. To apply techniques for reducing the storage required to save an image
  3. To apply techniques for bandwidth required to transmit it over the network.

- **Outcomes:**
  After completing this unit, student –
  Use different techniques for image compressions

- **Unit Content:**
  Transforms for image compressions, predictive compression, vector quantization, hierarchical & progressive compression, coding, JPEG & MPEG

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

- **Assessment Methods:**
  Write a program to implement image compression like JPEG and MPEG

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- **Internal Continuous Assessment (ICA)**
  ICA consists of minimum ten experiments based on each unit. Experiments shall be performed on MATLAB platform and Python.

  1. Introduction to Image Processing Toolbox
  2. Read an 8 bit image and then apply different image enhancement techniques:
     (a) Brightness improvement
     (b) Brightness reduction
     (c) Thresholding
     (d) Negative of an image
     (e) Log transformation
     (f) Power Law transformation.
  3. Implement different interpolation techniques using MATLAB/ Scilab
  4. Read an image, plot its histogram then do histogram equalization. Comment about the result.
  5. (a) Implement Gray level slicing (intensity level slicing) in to read cameraman image.
     (b) Read an 8 bit image and to see the effect of each bit on the image.
     (c) Read an image and to extract 8 different planes i.e. 'bit plane slicing."
  6. Implement various Smoothing spatial filter.
  7. Read an image and apply (1) Gaussian 3x3 mask for burring (2) High pass filter mask with different masks (3) Laplacian operator with center value positive and negative (4) High boost filtering.
  8. Write a program to implement various low pass filters and high pass filter in frequency domain.
  9. Write a program for erosion and dilation, opening & closing using inbuilt and without inbuilt function.
  10. Implement and study the effect of Different Mask (Sobel, Prewitt and Roberts)
  11. Implement various noise models and their Histogram
  12. Implement inverse filter and wiener filter over image and comment on them
  13. Implement Image compression using DCT Transform

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- **Text Books:**
  1. Gonzalez & Woods, ―Digital Image Processing‖, 3rd ed., Pearson education, 2008
  2. Jain Anil K., ―Fundamentals Digital Image Processing‖, Prentice Hall India, 2010

- **Reference Books:**
  1. Milan Sonka, Vaclav Hlavav, Roger Boyle, ―Image Processing, Analysis and Machine Vision‖, 2nd ed., Thomson Learning, 2001
  2. Rangaraj M. Rangayyan, ―Biomedical Image Analysis‖, CRC Press, 2005
  3. Pratt W.K, ―Digital Image Processing‖, 3rd ed., John Wiley & Sons, 2007
  4. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education

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**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-II**

**PROFESSIONAL ELECTIVE-I**

**EN325B COMPUTER ORGANIZATION**

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

Computer organization is a set of rules and methods that describe the functionality, organization, and implementation of computer systems. Some definitions of architecture define it as describing the capabilities and programming model of a computer but not a particular implementation. Computer organization deals with structural relationships that are not visible to the programmer, such as interfaces to peripheral devices, the clock frequency, and the technology used for the memory.

**Course Prerequisite:**

Student has completed a course on microcontrollers and embedded systems and has adept knowledge of assembly language programming. Student also has completed a course in operating systems and hasadept knowledge of paging and demand paging

**Course Objectives:**

1. To introduce to student the functional architecture of computing systems
2. To make student understand various algorithms for arithmetic computation and decide the fastestone
3. To make student to use ARC processor based instructions to write assembly language program
4. To introduce to student the design aspects of memory, instruction level parallelism and multiprocessors

**Course Outcomes:**

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

1. Describe the functional architecture of computing systems
2. Analyze various algorithms for arithmetic computation and arrive at fastest one.
3. Use ARC Processor based instructions to write assembly language program.
4. Demonstrate the design aspects of memory, instruction level parallelism and multiprocessors

## Section - I

**Unit 1: Introduction to Computer Technology** No of lectures – 04

- **Prerequisite**: Basics of Operating Systems and Microprocessors
- **Objective**:
  1. To introduce to student the Von Neumann model
  2. To make student to understand the system bus model
  3. To expose student to the levels of machines
- **Outcomes:**
  After completing this unit, student will be able to –
  1. Describe the Von Neumann model
  2. Explain the system bus model
  3. Explore the levels of machines: upward compatibility and the levels of computer
- **Unit Content:**

  A brief history of computing, the Von Neumann model, the system bus model, levels of machines:upward compatibility and the levels, a typical computer system
- **Content Delivery Methods:** Chalk and talk, power point presentations
- **Assessment Methods:**
  Questions based upon Von Neumann model, the system bus model and the levels of machines

**Unit 2: Data Representation and Arithmetic** No of lectures – 05

- **Prerequisite:** Basics of Digital Logic Design
- **Objectives:**
  1. To expose student to basic data representation
  2. To make student understand the representation of floating point numbers
  3. To make student understand various fixed point and floating point arithmetic operations
- **Outcome:**
  After completing this unit, student will be able to –
  1. Describe basic data representation
  2. Describe the representation of floating point numbers
  3. Can perform various fixed point and floating point arithmetic operations
- **Unit Content:**

  Fixed point numbers, floating point numbers, fixed point addition and subtraction, fixed point multiplication and division, floating point arithmetic, high performance arithmetic: high performance addition, high performance multiplication

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

- **Assessment Methods:**
  Questions based upon representation of basic data, conversion of basic data, various fixed point andfloating point arithmetic operations

**Unit 3: The Instruction Set Architecture and Memory** No of lectures – 10

- **Prerequisite**: Fundamentals of Digital Logic Design and Microcontrollers

- **Objective**:
  1. To introduce to student the hardware components of the instruction set architecture
  2. To make student understand the assembly language programming in context of the instructional ARC (A RISC Computer) based on the commercial SPARC architecture
  3. To make student understand the organization of basic random access memory and cache memory

- **Outcomes**:
  After completing this unit, student will be able to –
  1. Describe the basic architectural components involved in program execution
  2. Write assembly language programs based on ARC – A RISC Computer
  3. Describe the organization of basic random access memory and cache memory

- **Unit Content**:

  Hardware components of the instruction set architecture, ARC - A RISC Computer, pseudo-operations, synthetic instructions, examples of assembly language programs, accessing Data in memory-addressing modes, the memory hierarchy, semiconductor memories, RAM(Random Access Memory), ROM (Read Only Memory), types of ROM, cache memory, NAND flash memory, introduction to DDR1, DDR2,DDR3, eMMC, SRAM

- **Content Delivery Methods:**

  Chalk and talk, power point presentations

- **Assessment Methods:**
  Questions based on basic architectural components involved in program execution, assemblylanguage programming, cache memory

**Unit 4: Input / Output** No of lectures – 04

- **Prerequisite**: Fundamentals of Digital Logic Design and Microcontrollers

- **Objective**:
  1. To introduce to student the input output interface

2. To make student understand the memory mapped input output
3. To make student understand the direct memory access

- **Outcomes**:

  After completing this unit, student will be able to –
  1. Describe the input output interface
  2. Describe the memory mapped input output
  3. Describe the direct memory access

- **Unit Content**:

  I/O interface, programmed IO, memory mapped IO, interrupt driven IO, DMA.

- **Content Delivery Methods:**

  Chalk and talk, power point presentations

- **Assessment Methods:**

  Questions based on memory mapped IO, interrupt driven IO, DMA.

**Section- II**

**Unit 5: Fundamentals of Computer Design** No of lectures – 07

- **Prerequisite:** Fundamentals of Microprocessor and Digital Logic Design

- **Objectives**:
  1. To introduce to student classes of computers
  2. To make student understand the computer architecture
  3. To make student understand the trends in power in integrated circuits

- **Outcome**:
  After completing this unit, student will be able to –
  1. Explain classes of computers
  2. Describe the computer architecture
  3. Explain the trends in power in integrated circuits

- **Unit Content:**
  Classes of computers, defining computer architecture, trends in technology, trends in power in integrated circuits, trends in cost, dependability, measuring, reporting and summarizing performance, quantitative principles of computer design

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

- **Assessment Methods:**

  Questions based upon classes of computers, computer architecture, measuring, reporting andsummarizing performance

**Unit 6: Instruction Level Parallelism** No of lectures – 08

- **Prerequisite:** Fundamentals of Microprocessors and Operating System

- **Objectives**:
  1. To introduce to student instruction level parallelism
  2. To introduce to students the basic compiler techniques for exposing ILP
  3. To make student understand to overcome data hazards with dynamic scheduling

- **Outcome**:

  After completing this unit, student will be able to –
  1. Describe instruction level parallelism
  2. Explain the basic compiler techniques for exposing ILP
  3. Apply dynamic scheduling to overcome data hazards

- **Unit Content:**

  Instruction- level parallelism: concepts and challenges, basic compiler techniques for exposing ILP, reducing branch costs with prediction, overcoming data hazards with dynamic scheduling, dynamicscheduling: examples and the algorithm, hardware based speculation, exploiting ILP using multipleissue and static scheduling

- **Content Delivery Methods:**

  Chalk and talk, power point presentations

- **Assessment Methods:**

  Questions based upon instruction- level parallelism, overcoming data hazards with dynamic scheduling, dynamic scheduling

**Unit 7: Multiprocessors and Thread-Level Parallelism** No of lectures – 08

- **Prerequisite:** Fundamentals of Microprocessors and Operating System

- **Objectives:**
  1. To introduce to student symmetric shared memory architectures
  2. To make student understand the performance of symmetric shared memory multiprocessors
  3. To introduce to student distributed shared memory

- **Outcome:**

  After completing this unit, student will be able to –
  1. Explain architecture of symmetric shared memory
  2. Describe the performance of symmetric shared memory multiprocessors

3. Explain distributed shared memory

- **Unit Content:**
  Symmetric shared memory architectures, performance of symmetric shared memory multiprocessors, distributed shared memory and directory based coherence

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

- **Assessment Methods:**
  Questions based upon architecture of symmetric shared memory, performance of symmetric sharedmemory and distributed shared memory

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- **Internal Continuous Assessment :**
  Minimum 10 practical based on above syllabus.

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- **Text Books:**
  1. Computer Architecture and Organization: An Integrated Approach, Miles Murdocca andVincent Heuring , Wiley India Pvt. Ltd.
  2. Computer Architecture, A Quantitative Approach, John L. Hennessey and David A.Patterson, Fourth Edition, Morgan Kaufmann Publishers (An imprint of Elsevier)
  3. Computer Organization & Architecture, Rajaraman, PHI Learning

- **Reference Book:**
  1. Computer Architecture and Organization, John P. Hayes, Tata McGraw- Hill
  2. Computer Organization and Architecture, William Stallings
  3. Computer System Architecture, M. Moris Mano (2006), 3rd edition, Pearson/PHI, India.

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**PAH Solapur University, Solapur**
**T. Y. B. Tech. (Electronics Engineering) Semester-II**
**PROFESSIONAL ELECTIVE I**

## EN325C MULTIMEDIA SYSTEMS

**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

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A course in multimedia is rapidly becoming a necessity in electronics engineering curricula, especially now that multimedia touches most aspects of electronics and computers. Once seen as a vertical application area, multimedia today is an essentially a horizontal application area and forms an important component of electronics and computer engineering. This course aims to give a sense of the underlying principles for various multimedia areas including images, audio and video.

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**Course Prerequisite:**
Students shall have fundamental knowledge of electronic circuits, analog and digital communication and signal processing

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**Course Objectives:**

1. To introduce to students fundamental concepts of image, audio and video signals with focus on digitization of these
2. To introduce to students various image compression techniques
3. To introduce to students various audio compression techniques
4. To introduce to students various video compression techniques
5. To introduce to students working principles of digital television and its state of the art variant & to make them aware about various other modern audio-video systems

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**Course Outcomes:**
At the end of the course student can-

1. Explain digitization of image, audio and video signals-
2. Evaluate various image compression techniques
3. Evaluate various audio compression techniques
4. Evaluate various video compression techniques
5. Explain modern digital TV system and compare its variants & discuss various other modern audio-video systems

## Section – I

**Unit 1: Introduction to Multimedia** No of Lectures: 07

- **Prerequisite:** basics of electronic signal processing and digital electronics

- **Objectives:**
  1. To introduce to students the fundamentals of various multimedia – image, audio and video
  2. To make student understand digitization of various multimedia – image, audio and video

- **Outcomes:**
  After completing this unit student can
  1. Discuss fundamentals of various multimedia – image, audio and video
  2. Explain digitization of various multimedia – image, audio and video

- **Unit Content:**
  What is multimedia, multimedia and hypermedia, multimedia data and systems, different media types, classification of multimedia systems, digital images, digital video, digital audio, digital graphics, example multimedia systems

- **Content Delivering Methods:**
  Chalk and talk, ppts

- **Assessment Methods:**
  Questions based on multimedia and digitization, numerical examples

**Unit 2: Fundamental Concepts in Image, Audio and Video** No of Lectures: 08

- **Prerequisite:** basics of electronic signal processing

- **Objectives:**
  1. To make students understand various color models in image and videos
  2. To make students understand various types and models of image and videos

- **Outcomes:**
  After completing this unit student -
  1. can discuss & solve examples based on color models
  2. can explain methods for analog and digitized audio & video

- **Unit Content:**
  Color problem, trichromacity theory, color models in image and video, digitization of sound, MIDI, types of video signal, analog video, digital video (Li, havaldar)

- **Content Delivering Methods:**
  Chalk and talk, presentations

- **Assessment Methods:**
  Questions based on color models, numerical examples, audio and video

**Unit 3: Introduction to Image Compression** No of Lectures: 07

- **Prerequisite:** Basics of signal processing and transforms

- **Objectives:**
  To make students understand various image compression techniques

- **Outcomes:**
  After completing this unit student can evaluate various image compression techniques

- **Unit Content:**
  Redundancy and relevancy of image data, classes of image compression techniques, lossless image coding, transform image coding, wavelet based coding

- **Content Delivering Methods:**
  Chalk and talk, ppts

- **Assessment Methods:**
  Questions based on various image compression techniques

**Section – II**

**Unit 4: Introduction to Video Compression** No of Lectures: 08

- **Prerequisite:** Basics of signal processing and transforms

- **Objectives:**
  To make students understand various video compression techniques

- **Outcomes:**
  After completing this unit student can evaluate various video compression techniques

- **Unit Content:**
  General theory of video compression, types of predictions, complexity of motion compensation, introduction to video-coding standards

- **Content Delivering Methods:**
  Chalk and talk, ppts

- **Assessment Methods:**
  Questions based on various video compression techniques

**Unit 5: Introduction to Audio Compression** No of Lectures: 08

- **Prerequisite: b**asics of signal processing and transforms

- **Objectives:**
    1. To make students understand various audio compression techniques

- **Outcomes:**
  After completing this unit student -
  can evaluate various audio compression techniques

- **Unit Content:**
  Need for audio compression, audio-compression theory, audio as a waveform, model-based audio compression, audio compression using event lists, introduction to audio coding standards

- **Content Delivering Methods:**
  Chalk and talk, presentations.

- **Assessment Methods:**
  Questions based on various audio compression techniques

**Unit 6: Digital Television & Other Modern Devices** No of Lectures: 07

- **Prerequisite:** Basics of electronic signal processing, color models, digital systems

- **Objectives:**
    1. To make students understand working of a modern digital TV system
    2. To make students understand working of a modern audio video devices

- **Outcomes:**
  After completing this unit student -
    1. can explain working of a modern digital TV system
    2. can discuss working of a modern audio video devices

- **Unit Content:**
  Digital baseband signal, digital picture transmission and reception, surround sound system, HDTV, EDTV, smart TV, LED TV, introduction to DTH systems and OTT, Digital TV over IP

- **Content Delivering Methods:**
  Chalk and talk, presentations.

- **Assessment Methods:**
  Questions based on working of digital TV system and modern audio video devices

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- **Internal Continuous Assessment (ICA):**
  ICA *shall consist of minimum eight experiments and a small project based on above curriculum. Some of the experiments shall be of simulation using suitable software like MATLAB*

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- **Text Books and Reference Books:**


1. Multimedia Systems: Algorithms, Standards and Industrial Practices, Parag Havaldar and Gerard Medioni, Cengage Learning
2. Fundamentals of Multimedia, Ze-Nian Li, Mark S Drew, PHI Learning
3. Digital Television: Satellite, Cable, Terrestrial, IPTV, Mobile TV in the DVB Framework, Hervé Benoit, Elsevier
4. Television Engineering and Video Systems, R G Gupta, Tata McGraw Hill Education Private Limited


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**PAH Solapur University, Solapur**
**T.Y. B. Tech (Electronics Engineering) Semester-II**
**EN326 MINI HARDWARE PROJECT**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| **Practical – 2 Hours/week, Credit: 1** | **ICA – 25 Marks** |
| | **OE- 25 Marks** |

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This course encourages student for project based learning through development of hardware mini project in applied areas. The course aims to apply acquired skills of electronic circuit designing, digital design, instrumentation, microcontroller, electronic components specifications and their testing. The hardware project also provides experience of working in a team with set target. The project report writing allows student to gain knowledge of technical documentation of certain product. The entire experience in the project may be useful for entrepreneurship development.

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**Course Prerequisite:**
Electronic component identification and their testing, fundamentals of electronic circuit designing, concepts in digital designing, knowledge of various sensors, knowledge of control systems fundamentals, microcontrollers

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**Course Objectives:**

1. To encourage student to undertake and execute mini hardware project in a group which includes selection of appropriate hardware components, understanding their specifications and testing procedures.
2. To make student acquaintance with computer aided PCB designing tool
3. To develop electronic hardware assembly, soldering and testing skills amongst student
4. To nurture technical report witting skills amongst student
5. To understand the product development cycle through mini project.

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

1. Select appropriate electronic hardware project in the applied area.
2. Design circuit, select and test required electronic components
3. Use modern software tools for PCB designing and circuit simulation
4. Test developed circuit / project as a system
5. Write technical report of the project
6. Estimate cost of the project and demonstrate social and safety aspects associated with project
7. Work in a team with proper sharing of responsibilities and work

- **Course Curriculum:**
  The mini hardware project is mainly focused on circuit selection, component selection, pre- testing of electronic circuit on bread board, making of PCB for proposed project, project assembly, debugging, testing and technical report writing.

- **Guidelines:**
  Project group shall consist of not more than 3 students.
  The mini project plan shall include phases group formation , mini project topic selection, circuit component selection, pre-testing of project over breadboard, PCB artwork designing using EDA tool, simulation, hardware assembly, testing, enclosure design, testing and analysis, presentation and report writing

- **Domains for mini projects** (***but not limited to following***) :
  1. Instrumentation and control systems
  2. Electronics communication systems
  3. Embedded systems
  4. Internet of Things
  5. Audio and video systems
  6. Renewable Energy systems
  7. Mechatronics systems
  8. Disaster management systems

- **Assessment Methods:**
  Below scheme is recommended for assessment of mini project –
  1. Selection of the project and pre circuit testing 20 %
  2. Circuit design, simulation, PCB and assembly 30%
  3. Results / Output from final assembly 10%
  4. Mini project presentation seminar 10%
  5. Project report 20%
  6. Viva-voce of individual student 10%