Name of Subject (TH): 5ETC01: MICROCONTROLLER

Course Pre-Requisite:

3ETC03**:** Digital System Design

Course Objectives:

1. To study fundamentals of microprocessor systems
2. To deal with interfacing of different peripheral devices with Microprocessor
3. To study fundamentals of microcontroller systems with Assembly Language Programming
4. To understand microcontroller C Language Programming concepts.
5. To know the importance of different peripheral devices and their interfacing to microcontrollers
6. To get familiar with RISC Architecture

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Attain the knowledge of Microprocessor 8085
2. Understand the Interfacing of various peripheral devices with Microprocessor 8085
3. Attain the knowledge of Microcontroller 8051
4. Understand assembly language & C Programming for Microcontrollers
5. Understand the Interfacing of various peripheral devices with Microcontroller 8051
6. Gain knowledge of advance Microcontrollers

	Subject: MICROCONTROLLER	L
Unit-1	**Introduction to Microprocessor** 8085: Pin Diagram and Architecture, Addressing Modes, Instruction Set, Stack & Subroutine, Interrupt system, Data transfer schemes	8
Unit-2	**I/O Interfacing of 8085** Address space partitioning schemes, Architecture and interfacing of: PPI 8255, PIT 8254, USART 8251	8
Unit-3	**Introduction to Microcontroller 8051** Architecture, Signal description, Memory organization, Interrupt structure, Timers and its modes, Addressing Modes, Instruction set, Assembly Language Programming, Serial communication modes	9
Unit-4	**8051 Programming in C :** Data types, IO programming, Logic operations, Data conversion programs, Accessing code ROM space, Data serialization	8
Unit-5	**Interfacing and Programming using C with 8051:** LED, LCD display, Keyboard, Stepper Motor, DC motor, Relays, ADC 0808, DAC 0809	8
Unit-6	**Introduction to RISC Processors:** RISC Features, Difference between CISC and RISC, 32 bit ARM7 Philips NXP LPC2148 Microcontroller : Architecture, Registers, Pipeline	7
	Total	**36**

Text Books:

1. Gaonkar R.S: "Microprocessor Architecture Programming and Applications with the 8085", Penram International Pub.
2. M. A. Mazidi, J. G. Mazidi and R. D. McKinley : "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Education (2nd Ed.)
3. Furber: "ARM System on Chip Architecure", 2nd Edition,Person India

References:

1. K. J. Ayala : "The 8051 Microcontroller", Penram Int. Pubs., 1996
2. Phillips NXP LPC 2148 User Mannual.
3. Data Sheet Manual by INTEL

Name of Subject (TH): 5ETC02: CONTROL SYSTEM

Course Pre-Requisite:

1. (IA1) Engineering Mathematics-I
2. (IB1) Engineering Mathematics-II
3. (4ETC3) Signals and Systems

Course Objectives:

1. To understand the fundamental concepts of Control systems and mathematical modeling of the physical systems.
2. To analyze time response of the LTI system.
3. To analyze LTI system using frequency response.
4. To develop and analyze State Variables of the system.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand mathematical models of electrical, mechanical and electromechanical systems.
2. Determine transfer functions from block diagrams and signal flow graph.
3. Evaluate transient response and steady state response parameters.
4. Analyze stability of the LTI system using Routh criterion and root locus
5. Analyze stability of the LTI system using bode plot and Nyquist criterion
6. Create the state model and Evaluate response of the system using state variable method.

	Subject: CONTROL SYSTEM	L
Unit-1	**Basics of Control system** Types of control systems Classification of control system, Mathematical modeling of Physical Systems, Electrical Analogous Systems, Force - voltage analogy, force- Current analogy.	5
Unit-2	**Control system Representation** Block diagram reduction technique, rules for block diagram reduction. Analysis of multiple input multiple output systems, properties of signal flow graphs, Mason's gain formula basic control actions.	6
Unit-3	**Time Response Analysis:** Standard test signals, Time response of first order and second order system, impulse response function, Transient domain specifications, Steady state analysis: steady state error and error constants, dynamic error coefficients	6
Unit-4	**Stability of Control System:** Concept of stability, necessary conditions for stability, Routh stability criterion. Root locus Techniques: Introduction, Construction of root locus, construction rules, Stability analysis of systems using root locus, Effect of addition of open loop zeros & poles.	7
Unit-5	**Frequency- Domain analysis:** Introduction, correlation between time and frequency response, Bode plot: general procedure for construction, Gain margin and phase margin, Stability analysis of systems using Bode plots. Polar plots, Nyquist stability criterion.	6
Unit-6	**State Variable Analysis:** Space model representation of LTI systems using physical, phase and canonical variables, Relationship between state variable model and transfer function, state transition matrix and its computation, Solution of state equations. Controllability and Observability.	6
	Total	**36**

Text Books:

1. Nagrath I. J. and M. Gopal, "Control Systems Engineering", 5th Ed.New Age International.
2. K. Ogata: Modern Control Engineering, Fourth Edition (PHI)

References:

1. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", 11th Ed., Pearson Education.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
3. Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
4. Bhattarcharya: Control System Engineering, 2nd Edition (Pearson Education).
5. Benjamin C. Kuo , Automatic Control System "JOHN WILEY & SONS, INC.9th Edition

Name of Subject (TH): 5ETC03: DIGITAL SIGNAL PROCESSING

Course Pre-Requisite:

1. 3ETC01 Engineering Mathematics-III
2. 4ETC04 Signals and Systems

Course Objectives:

1. Learn discrete signal and system fundamentals.
2. Learn the discrete-time signals in the frequency domain, using Z-transform and DFT.
3. Understand the implementation of the DFT in terms of the FFT
4. Learn the basic forms and design of FIR and IIR filters.
5. Learn the application filter bank in multirate DSP.
6. Become aware of some applications of digital signal processing.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Manipulate the discrete time signals and identify the type system.
2. Compute the Z-transform of a sequence, identify its region of convergence , and compute the inverse Z-transform.
3. Evaluate the Fourier transform of a signal.
4. Design FIR and IIR filters.
5. Understand the concepts of Multirate Digital Signal Processing and need of Filter banks.
6. Understand the application of Digital Signal Processing

	Subject: DIGITAL SIGNAL PROCESSING	L
Unit-1	**Introduction to Discrete Time Signals[DTS]:** Discrete Time Signal, representations of DTS, Basic Signal Operations, Linear Convolution by using Analytical and Graphical Method.	6
Unit-2	**Z-Transform:** Definition and Properties of Z-Transform, Concept of Region of Convergence[ROC], Inverse Z-transform using long division method, PFE method and residue method.	6
Unit-3	**Discrete and Fast Fourier Transform:** Definition and Properties of DFT, IDFT. Circular convolution of sequences using DFT and IDFT. Fast Fourier Transforms(FFT), Radix-2 decimation in time and decimation in frequency FFT. [Numerical based on DIT-FFT & DIF-FFT]	6
Unit-4	**Finite Impulse Response (FIR) filters:** Design techniques for FIR filter by windowing method: Rectangular window. Realization of basic structure FIR system : Direct form and Cascade.	5
Unit-5	**Infinite Impulse Response (IIR) filters:** IIR Filter Design by Mapping of S-plane to Z-plane: impulse invariance method, bilinear transformation method. Realization of basic structure IIR system: Direct form-I, Direct Form-II, Cascade & Parallel.	6
Unit-6	**Multirate Digital Signal Processing:** Sampling, Sampling rate conversion, multilevel filter bank. Overview and architecture of DSP processor TMS320C54XX.Applications of DSP (Only Block Diagram): Speech Signal, RADAR & SONAR.	7
	Total	**36**

Text Books:

1. Nagoorkani,"DigitalSignalProcessing",TataMcGraw-HillEducation,SecondEdition.
2. S.Salivahanan,A.Vallavaraj,"DigitalSignalProcessing",TataMcGraw-HillEducation,2001.

References:

1. Oppenheim & Schafer, "Discrete time Processing", PHI.
2. Proakis & Manolakis D.G.,"Digital Signal Processing",PHI.
3. MitraS.K.,"Digital Signal Processing",TMH.
4. RomanKuc,"Digital Signal Processing",MGH.
5. IfeacherE.C.,JervisB.W.,"DigitalSignalProcessing",AddisonWesley.
6. P.P.Vaidyanathan,"DSP and Multirate Systems", PHI.

Name of Subject (TH): **5ETC04 Professional Elective - I (PE-I):**

(i) POWER ELECTRONICS

Course Pre-Requisite:

1. 1B3 Basic Electrical Engineering.
2. 3ETC02 Electronic Devices and Circuits.

Course Objectives:

1. To introduce power electronics devices; SCR, TRIAC, IGBT, MOSFET and to learn their characteristics.
2. To develop the ability to analyze the dynamics in power electronic converters/drives systems.
3. To study AC-DC converters and effect of freewheeling diode.
4. To study AC-AC, DC-AC, DC-DC converters.
5. To build and test circuits using power devices such as SCR
6. To study applications of power converters in DC drives.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Analyze the characteristics of various power electronics devices .
2. Understand SCR firing circuits, commutation techniques.
3. Analyze and design controlled rectifiers and dual converters
4. Analyze and design DC to DC, AC to AC converters and DC to AC inverters,
5. Design and develop power electronic circuits for various applications.
6. Know various applications of power converters in DC drives.

	Subject: POWER ELECTRONICS	L
Unit-1	SCR -construction, characteristics, two transistor analogy for turning ON-OFF a SCR, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuit using UJT, Protection of SCR (snubber circuit)	6
Unit-2	Triac, Diac-construction, characteristics. power transistor, power MOSFET, IGBT - their construction & characteristics, Introduction to GTO, Classification of circuit for forced commutation.	7
Unit-3	Principle of phase control, single phase half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, derivation for output voltage and current, effect of freewheeling diode, single phase dual converters.	6
Unit-4	Series inverter, improved series inverter, parallel inverter, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. mode, single phase transistorized bridge inverter.	6
Unit-5	Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper circuit, Jones chopper, step-up chopper, step up/down chopper and AC chopper.	6
Unit-6	Basic principle of cycloconverter, single phase to single phase cycloconverter. speed control of DC series motors speed control of DC shunt motor using phase controlled rectifiers UPS, fan speed regulator	5
	Total	**36**

Text Books:

1. M.D.Singh, K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill.
2. Muhammad H. Rashid, "Power electronics" Prentice Hall of India

References:

1. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
2. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.
3. V.R.Moorthi, "Power Electronics", Oxford University Press.
4. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
5. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International
6. Publishers. SCR manual from GE, USA.

Name of Subject (TH): **5ETC04 Professional Elective - I (PE-I):**
(ii) FIBER OPTICS COMMUNICATION

Course Pre-Requisite:

1. 3ETC04 Electromagnetic Waves
2. 4ETC01 Analog and Digital Communication

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
3. To learn the various optical source materials, LED structures, quantum efficiency, Laser diode
4. To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
5. To learn the fiber optical network components, variety of networking aspects, operational principles WDM.
6. To learn and understand the applications.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the principles fiber-optic communication, the components and Losses and dispersion in fiber.
2. Understand the properties of the optical fibers and optical components in sources.
3. Understand operation of lasers, LEDs, and detectors in fiber
4. Analyze system performance of optical communication systems in networks
5. Understand the block diagram of FOC System with Power budgeting parameters.
6. To apply the knowledge of fiber optical components, links, and systems.

	Subject: FIBER OPTICS COMMUNICATION	L
Unit-1	**Optical Fiber Communication System:** Basic optical laws and definitions, Optical fiber modes and configurations, N.A. Attenuation: Units, absorption, scattering losses radioactive losses, core and cladding losses. Step index fibers, Graded index fibers, Single mode fibers, Cutoff wavelength, Mode field diameter, effective refractive index. Material dispersion, wave guide dispersion, intermodal dispersion. [Numerical based on N.A. and mode calculations]	6
Unit-2	**Optical Sources:** Light Emitting Diodes: Structure, Light source materials. Laser Diodes: Structure, threshold conditions, Modulations of laser diodes. Light source linearity, reliability considerations.	6
Unit-3	**Optical Detectors:** Principles of photodiodes, Photo detector noise, Detector response time, Avalanche multiplication noise, Temperature effect on avalanche gain.	6
Unit-4	**Optical switches** Coupled mode analysis of directional couplers, electro-optic-switches. Optical amplifiers - EDFA, Raman amplifier	6
Unit-5	WDM and DWDM systems. Principles of WDM networks. Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and solution based communication.	6

Unit-6	Block Diagram of fiber optic communication, selection of optical fiber types for short haul, long haul and high speed data links, optical power and dispersion budget calculations of fiber optic communication link, Repeaters, optical fiber amplifiers, optical fiber transmitter and optical fiber receiver design considerations. [Numerical are not expected]	6
	Total	**36**

Text Books:

1. G. Keiser, "Optical Fibre Communication", McGraw Hill International.

References:

1. Seniors J. M., "Optical Fibre Communication and Applications", Prentice Hall of India Pvt. Ltd., New Delhi

Name of Subject (TH): **5ETC04 Professional Elective - I (PE-I):**
(iii) SPEECH AND AUDIO PROCESSING

Course Pre-Requisite:

1. 3ETC01 Engineering Mathematics-III
2. 4ETC04 Signals and Systems
3. 4ETC01 Analog and Digital Communication

Course Objectives:

1. To be able to relate human physiology and anatomy with signal processing paradigms.
2. To acquire the knowledge of speech generation and speech recognition models.
3. To understand methods/techniques used in speech signal estimation & detection.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Illustrate how the speech production is modeled
2. Summarize the techniques involved in collecting the features from the speech signal in time and frequency domain.
3. Summarize the various speech coding techniques.
4. Understand the process Speech Synthesis.
5. Apply techniques/methods used for speech enhancement.
6. Apply techniques/methods used for speech recognition.

	Subject: SPEECH AND AUDIO PROCESSING	L
Unit-1	**Speech Production and Acoustic Phonetics:** Process of speech production, Articulatory phonetics, Acoustic Phonetics, Acoustic theory of speech production, Co- articulation, Prosody, Digital models of speech signals, Brief applications of speech & audio processing	6
Unit-2	**Speech Analysis:** Time and frequency domain methods for analysis of speech: Methods for extracting energy ,average magnitude, zero crossing rate, silence discrimination using ZCR and energy, short time Fourier analysis, Formant extraction, Pitch extraction, Cepstral analysis.	6
Unit-3	**Coding of Speech Signals:** Introduction, Quantization, Speech redundancies, Time domain waveform coding, Linear predictive coding: Linear Delta Modulation ,Adaptive Delta Modulation, Adaptive Differential Pulse Code Modulation	6
Unit-4	**Speech Synthesis:** Principles of speech synthesis, Articulatory synthesis, Formant synthesis and LPC synthesis.	6
Unit-5	**Speech Enhancement:** Introduction, Nature of interfering sounds, speech enhancement techniques: spectral subtraction and filtering, harmonic filtering, Spectral subtraction, Adaptive noise cancellation	6
Unit-6	**Speech Recognition:** Introduction, Baye's rule, Segmental feature extraction, MFCC, DTW, HMM approaches for speech recognition	6
	Total	**36**

Text Books:

1. "Speech Communications: Human & Machine", Douglas O'Shaughnessy, Universities Press.
2. "Digital Processing of Speech Signals", Rabiner and Schafer, Prentice Hall, 1978.

References:

1. "Discrete-Time Speech Signal Processing: Principles and Practice", Thomas F. Quatieri, Publisher: Prentice Hall.
2. "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", Nelson Morgan and Ben Gold, John Wiley & Sons.
3. "Speech Analysis Synthesis and Perception", J. L. Flanagan, Second edition, Springer-Verlag(1972).
4. "Speech and Audio Signal Processing", Gold & Morgan, 1999, Wiley and Sons.

Name of Subject (TH): **5ETC05 Open Elective - I (OE-I):**

(i) SENSORS AND TRANSDUCERS

Course Pre-Requisite:

1. 1B3 Basic Electrical Engineering.
2. 3ETC02 Electronic Devices and Circuits.

Course Objectives:

1. To provide a basic knowledge about Sensors and transducers.
2. To learn about the various sensor and transducer for measurement of physical quantities.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the basic aspect of transducers and sensors
2. Gain knowledge of statistical characteristic and Errors of system.
3. Realize the fundamental concept about temperature and Velocity measurement
4. Acquire knowledge of measurement of displacement and Humidity.
5. Familiarize the basic information about measurement of Pressure, Flow, Level
6. Aware about the basics of Strain gauge and smart sensors

	Subject: SENSORS AND TRANSDUCERS	L
Unit-1	**Sensor & Transducers:** Definition, Types & selection of sensors, Need of sensor, Difference between Sensors & Transducers, Classification of Transducer, Selection criteria. Introduction to Generalized Instrumentation system with example.	6
Unit-2	**Characteristic, parameters and Errors** Characteristics of instruments – static characteristics, Statistical Parameters with numericals. Error and its Types: Gross error, Systematic Error, Random Error with remedies.	6
Unit-3	**Temperature Measurement:** Introduction to Thermistor, RTD, Thermocouple and LM 335, Total Radiation Pyrometer **Velocity Measurement:** Velocity measurement system by encoder, Magnetic Pickup and Photo detector (Linear and Angular Measurement)	6
Unit-4	**Measurement of Displacement:** Resistive, Inductive (LVDT), Capacitive Methods **Humidity Measurement:** Resistive, Capacitive, Piezoelectric, and Infrared	6
Unit-5	**Measurement of Pressure:** Primary pressure sensors - elastic elements like bourdon tube and diaphragm Electrical/Secondary Pressure Transducers: Capacitive, piezo-electric and its material, Low Pressure (Vacuum): Pirani gauge. **Measurement of Flow:** Hot wire anemometer **Measurement of Level:** Resistive method, Ultrasonic level detector	6
Unit-6	**Strain Measurement:** Introduction, types of strain gauge, gauge factor calculation, materials for strain gauge, resistance strain gauge bridges, temperature compensation and applications of strain gauges. **Introduction to smart sensors**: Objective, block diagram, advantages and disadvantages.	6
	Total	**36**

Text Books:

1. Sawney A K and Puneet Sawney, “A Course in mechanical measurements and instrumentation and control”, 12th edition, Dhanpat Rai and Co, new delhi,2013.
2. Electronics instrumentation" by H. S. Kalsi [TMH]

References:

1. David A. Bell, Electronic Instrumentation and Measurements, Third Edition, Oxford Higher Education
2. D.Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
3. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.
4. Ernest O.Doebelin, Measurement systems Application and Design, International Student Edition, IV Edition, McGraw Hill Book Company, 1998.

Name of Subject (TH): **5ETC05 Open Elective - I (OE-I):**

(ii) DATA STRUCTURE

Course Pre-Requisite:

1. 3ETC05 Object Oriented Programming

Course Objectives:

To impart the concepts of data structures and algorithms.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Able to understand basics and applications of different linear and nonlinear data structures
2. Able to design and implement various data structure algorithms and analyze the efficiency of an algorithm.
3. Able to understand Linked List and implement algorithm.
4. Able to understand the working principle and Implementation of stacks and queues.
5. Able to implement learn Trees, Graph and their applications
6. Able to write an algorithm on different sorting methods and analyze the complexities of algorithms.

	Subject: DATA STRUCTURE	L
Unit-1	**Introduction and Overview** Basic Terminologies: Elementary Data Organizations, Introduction to Linear Array, Types and Representation in Memory, Data Structure Operations, Algorithms: Complexity, Time-Space Tradeoff, Searching Methods: Linear Search and Binary Search Techniques and their Complexity Analysis..	6
Unit-2	**Linked List** Introduction to Linked List, Representation of Linked List in Memory, Traversing a Linked List, Searching a Linked List, Memory Allocation; Garbage Collection, Insertion into a Linked List, Deletion from linked list, Header Linked Lists, Circular Linked Lists, Two-Way Lists (Doubly linked list) and Operations.	6
Unit-3	**Stacks, Queues and Its Applications** Introduction to Stack, Array and Linked List Representation of Stack, Applications of Stacks: Arithmetic Expressions: Polish Notation, Recursion, Tower of Hanoi Problem, Queues: Linked Representation of Queues, Circular queue, Deques, Priority Queues.	6
Unit-4	**Tree** Basic Tree Terminologies and Representing Binary Trees in Memory, Traversing Binary Trees, Header Nodes; Threads, Threaded Binary Trees, Binary Search Trees, Searching and Inserting in Binary Search Trees, Deleting in a Binary Search Tree, Balanced Binary Trees, AVL Search Trees, Heap and Heapsort, Path lengths; Huffman's Algorithm. General trees.	6
Unit-5	**Graph and Their Applications** Introduction, Graph Theory Terminology, Sequential Representation of Graphs; Adjacency Matrix; Path Matrix, Warshall's Algorithm; Shortest Paths, Linked Representation of Graph, Traversal algorithms, Operations on Graph, BFS, DFS, Spanning Trees	6

Unit-6	**Sorting And Hashing** Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Radix Sort, Performance and Complexity Analysis of various Sorting Methods, Hashing.	6
	Total	**36**

Text Books:

1. "Introduction to data structures with C" by Seymour lipschutz.
2. Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

References:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. Data Structures through C by Yashwant Kanetkar

Name of Subject (TH): **5ETC05 Open Elective - I (OE-I):**

(iii) INTRODUCTION TO JAVA

Course Pre-Requisite:

1. 3ETC05 Object Oriented Programming

Course Objectives:

1. To Learn basics of programming
2. To understand the foundation of Object-Oriented Programming
3. To learn basic principles of Object-Oriented Programming
4. To study the process of building an application in a modular fashion using Java Programming Language

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Fundamentals of Object Oriented Programming and can build & run a basic application at their own
2. Use of selection & repetition statements in Java Program, dealing with methods and playing with classes and objects in real world
3. To create and process single dimensional & multidimensional arrays, to handle strings in Java
4. To create interactive graphical user interface in a desktop application using AWT and/or SWING Components.
5. To handle exceptions and create user defined exception, also learns file handling in Java.
6. To learn concept of multithreading; create, manage threads; and purpose of synchronization.

	Subject: INTRODUCTION TO JAVA	L
Unit-1	**Java Basics:** History of Java, Characteristics of Java, Types of Java Program, an introduction to Classes & Objects, Messages & methods, introduction to Inheritance, Software Engineering & Software Life Cycle, Structure of a java application, Edit-Compile-Run cycle of a java program. **Java Building Elements**: Identifiers, Variables, Constants, Data types, Arithmetic Expressions, Standard Input & Output, Programming Style & Documentation	6
Unit-2	**Control Structure:** Selection Statements- if, if…else, Nested if, switch. Repetition Statements- for loop, While loop & do loop, using break & Continue. **Methods:** Creating Methods, Calling a method, Overloading Methods, Concept of Recursion **OOP:** Objects & classes, Passing Objects to methods, Instance Variables & class Variables, Instance Methods & Class Methods, Scope of Variables, Introduction to Packages, the Math Class	6
Unit-3	**Arrays:** Declaring & Creating Arrays, Initializing & Processing Arrays, Array of Objects, Multidimensional arrays. **Strings:** The String Class, The StringBuffer Class, The StringTokenizer Class, Command Line Arguments **Inheritance:** Super classes and Subclasses, the super keyword, the *this* keyword, the Object class, the final and abstract modifiers, the concept of Wrapper Classes, Introduction to Interfaces.	6
Unit-4	**Graphics Programming:** The AWT Class Hierarchy, Frames, Event Driven Programming (Delegation Event Handling Model), Layout Managers, Panels, The Color Class, The repaint(), update() and paint(), Methods, Drawing Lines & different shapes, introduction to adapter	6

	classes. **Creating GUI:** Button, Label, TextField, TextArea, Choice, List, Checkbox, Dialog, Menu, Creating Multiple Windows, introduction to swing components.	
Unit-5	**Exception Handling:** Exceptions & Exception Types, Understanding Exception Handling, Creating Exception classes, the finally clause. **File Input & output:** File & JFileChooser Objects, Low-Level File I/O, High Level File I/O.	6
Unit-6	**Multi-Threading:** Concept of thread, The Thread class, The runnable interface, Thread Life cycle, Thread Priority, Thread Groups, concept of synchronization.	6
	Total	**36**

Text Books:

1. Y. Daniel Liang, "An Introduction to Java Programming" Eastern Economy Edition, PHI
2. C. Thomas Wu, "An Introduction to Object-Oriented Programming JAVA", Fourth Edition, Tata McGraw Hill

References:

1. Kathy Sierra & Bert Bates, "Head First Java", O'REILLY
2. E Balagurusamy, "Programming with JAVA, A Primer", Third Edition, TMH

Name of Subject (Pr): 5ETC06- MICROCONTROLLER LAB

- Minimum Eight Experiments based on syllabus of **5ETC01: MICROCONTROLLER** must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

Name of Subject (Pr): 5ETC07- Digital Signal Processing LAB

- Minimum Eight Experiments based on syllabus of **5ETC03: DIGITAL SIGNAL PROCESSING** must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

Subject (Pr): 5ETC08- Power Electronics LAB

- Minimum Eight Experiments based on syllabus of **5ETC04: PE(1): (i) POWER ELECTRONICS** must be conducted.
- Course Objectives and Course Outcomes shall be specified based on the experiments conducted

Subject (Pr) 5ETC09: Electronic Lab based on Instrumentation

Course Outcomes:

At the end of this course student will demonstrate the ability to

1. Learn about various Sensors
2. Examine the measurement of various physical quantities using transducers
3. be aware of statistical data analysis of different transducers
4. Understand computerized data acquisition

Minimum Eight Experiments from the list give must be conducted

List of Experiments:

1. Temperature measurement using temperature sensor.

2. Measurement of linear displacement using LVDT.

3. Study of instrumentation amplifier

4. Measurement of force using strain gauge

5. Measurement of Pressure using Piezo-electric Transducer.

6. To measure the speed of a motor shaft with the help of non-contact type pick-ups (magnetic or photoelectric).

7. Displacement measurement by Capacitive Transducer

8. Temperature measurement by thermistor.

9. Liquid level measurement using level transducers.

10. Displacement measurement by resistive Transducer.

11. Comparative study of temperature measurement using: RTD, Thermistor and Thermocouple.

12. Study of Smart Sensors and Data Acquisition Systems

Note:

1. Students completing foreign language course or completing minimum 4 weeks internship (Full time in Vacation) or participating in sports at National / International level shall be exempted from Open Elective (O.E.) in the same / adjacent semester
2. An orientation program of 15 hours duration / MOOC to be offered to the students during
   (a) V^{th} semester : Indian Constitution
   (b) VI^{th} semester : Indian Traditional Knowledge