

# Savitribai Phule Pune University

## FACULTY OF ENGINEERING



Syllabus for the

**S.E (Electronics /Electronics & Telecommunications Engineering)**

**2015 Course**

**(w.e.f . June 2016)**

**Savitribai Phule Pune University, Pune**  
**SE(E&TC/Electronics Engineering) 2015 Course**

(With effect from Academic Year 2016-17)

Semester I												
Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory	Tutorials	Practicals	In-Sem (On line)	End-Sem (Theory)	TW	PR	OR	Total	TH/TUT	PR+OR
204181	Signals & Systems	3	1	-	50	50	25	-	-	125	4	-
204182	Electronic Devices & Circuits	4	-	2	50	50	-	50	-	150	4	1
204183	Electrical Circuits and Machines	3	-	2	50	50	25	-	-	125	3	1
204184	Data Structures and Algorithms	4	-	2	50	50	-	-	50	150	4	1
204185	Digital Electronics	4	-	2	50	50	-	50	-	150	4	1
204186	Electronic Measuring Instruments & Tools	1	-	2	-	-	50	-	-	50	1	1
<b>204192</b>	<b>Audit Course 1</b>	--	--	--	--	--	--	--	--	--		
<b>Total</b>		19	1	10	250	250	100	100	50	750	20	05
<b>Total Credits</b>											<b>25</b>	

**Abbreviations:**

Th : Theory

TW: Term Work

OR: Oral

TUT : Tutorial

PR : Practical

**Note: Interested students of S.E. (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)**

**SE(E&TC/Electronics Engineering) 2015 Course****(With effect from Academic Year 2016-17)**

<b>Semester II</b>												
<b>Course Code</b>	<b>Course</b>	<b>Teaching Scheme Hours / Week</b>			<b>Semester Examination Scheme of Marks</b>						<b>Credit</b>	
		Theory	Tutorials	Practicals	In-Sem (on line)	End-Sem (Theory)	TW	PR	OR	Total	TH/TUT	PR+OR
207005	Engineering Mathematics III	4	1	-	50	50	25	-	-	125	5	-
204187	Integrated Circuits	4	-	2	50	50	25	50	-	175	4	1
204188	Control Systems	3	-	-	50	50	-	-	-	100	3	-
204189	Analog Communication	3	-	2	50	50	-	50	-	150	3	1
204190	Object Oriented Programming	3	-	4	50	50	-	-	50	150	3	2
204191	Employability Skill Development	2	-	2	-	-	50	-	-	50	2	1
<b>204193</b>	<b>Audit Course 2</b>	--	--	--	--	--	--	--	--	--		
<b>Total</b>		19	1	10	250	250	100	100	50	750	20	05
<b>Total Credits</b>											<b>25</b>	

**Abbreviations:**

TH: Theory  
 TW: Term Work  
 OR: Oral

TUT: Tutorial  
 PR: Practical

**Note: Interested students of S.E (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)**

**204181****Signals and Systems**  
**Credits: Th- 03,Tut-01****Teaching Scheme:****Theory : 03 hr/week****Tutorial: 01 hr/week****Examination Scheme:****In-Sem(Online): 50 Marks****End-Sem(Theory):50 Marks****Term Work : 25 Marks****Course Objectives:**

- To understand the mathematical description of continuous and discrete time signals and systems.
- To classify signals into different categories.
- To analyse Linear Time Invariant (LTI) systems in time and transform domains.
- To build basics for understanding of courses such as signal processing, control system and communication.
- To develop basis of probability and random variables.

**Course Outcomes:**

On completion of the course, student will be able to

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.
3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
4. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.
5. Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

**Course Contents****Unit I : Introduction to Signals and Systems****(8 Hrs)**

**Introduction and Classification of signals:** Definition of signal and systems, communication and control systems as examples. Sampling of analog signals, sampling theorem, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power.

**Elementary signals used for testing:** reasons for using standard test signals, exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc.

**Operations on signals:** Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding.

**Systems:** Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

**Unit II : Time domain representation of LTI System****(6 Hrs)**

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response in terms of impulse response.

**Unit III : Fourier Series****(6 Hrs)**

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, orthogonality, basis functions, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series. Applications of Fourier series, properties of Fourier series and their physical significance, Gibbs phenomenon, Discrete Time Fourier Series, properties, convergence of DTFS.

**Unit IV : Fourier transform****(7Hrs)**

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Properties and their significance, Interplay between time and frequency domain using sinc and rectangular signals, Fourier Transform for periodic signals, introduction to Discrete Time Fourier Transform.

**Unit V : Laplace transform and its applications****(7Hrs)**

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform and their significance, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, stability considerations in S domain, Application of Laplace transforms to the LTI system analysis.

**Unit VI : Probability and Random Signals****(6 Hrs)**

**Probability:** Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Uniform and Gaussian probability models.

**Random variables:** Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Statistical averages, mean, moments and expectations, standard deviation and variance.

**Introduction to Correlation:** Autocorrelation, Cross correlation, and their properties.

**Text Books:**

1. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India.
2. Charles Phillips, "Signals, Systems and Transforms", 3rd Edition, Pearson Education.

**Reference Books:**

1. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.
2. Shaila Apte, “Signals and Systems-principles and applications”, Cambridge University press, 2016.
3. Mrinal Mandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.
4. Peyton Peebles, “Probability, Random Variable, Random Processes”, 4th Edition, Tata Mc Graw Hill.
5. A. NagoorKanni “Signals and Systems”, 2nd edition, Mc Graw Hill.
6. NPTEL video lectures on Signals and Systems.

**Guidelines for Tutorial / TW Assessment**

Tutorials must be conducted batch wise. Batch size should not be more than 20 students. The main objective of this tutorial is to focus on the outcomes defined in the theory syllabus by solving the following assignments based on paper work.

***At least 8 tutorials to be conducted. (Any 4 from first 6)***

**List of Tutorials**

- 1 A) Sketch and write mathematical expression for the following signals in CT and Discrete Time (DT)
  - a) Sine
  - b) Rectangular
  - c) Triangular
  - d) Exponential
  - e) Unit Impulse
  - f) Unit Step
  - g) Ramp
  - h) Signum
  - i) Sinc
- B) Classify and find the respective value for the above signals
  - a) Periodic / Non Periodic
  - b) Energy / Power /Neither
2. Take any two CT and DT signals and perform the following operation Amplitude scaling, addition, multiplication, differentiation, integration (accumulator for DT), time scaling, and time shifting and folding.
3. Express any two system mathematical expressions in input output relation form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time invariant, Invertible.
4. Express any two system mathematical expressions in impulse response form and determine whether each one of them is, Memory less, Causal, Linear, Stable, Time in variant, Invertible.
5. Perform Convolution Integral of Two Continuous time Signals.  
(Various Combinations can be taken for this.)
6. To find Fourier series for the signals and plot its magnitude and phase response.  
(Signals like: Half/Full wave rectified signal, Saw tooth wave etc. )
7. State and prove the various properties of CT Fourier Transform. Take rectangular and sinc Signal as examples and demonstrate the applications of CTFT properties. And also demonstrate the interplay between the time and frequency domain.
8. State and prove the properties of CT Laplace Transform. Take any example of a system in time domain and demonstrate the application of LT in system analysis.
9. To perform auto and cross correlation for DT and CT signals. Also explain the relation between Convolution and Correlation.

10.

- A) List and Explain the properties of CDF & PDF, Suppose a certain random variable has the CDF

$$F_X(x) = \begin{cases} 0 & x \leq 0 \\ kx^2 & 0 < x \leq 10 \\ 100k & x > 10 \end{cases}$$

Evaluate k, Write the corresponding PDF and find the values of  $P(X \leq 5)$  and  $P(5 < X \leq 7)$

(This is only an example. Various Probability functions may be given)

- B) Find mean, mean square, standard deviation, variance of X

when  $f_X(x) = ae^{-ax}u(x)$  with  $a > 0$

(This is only an example. Various Probability functions may be given)



## 204182                      **Electronic Devices and Circuits**

**Credits: Th- 04, Pr -01**

**Teaching Scheme:**

**Theory:     04 hrs/week**  
**Practical:  02 hrs/week**

**Examination Scheme:**

**In-Sem (Online): 50 Marks**  
**End-Sem(Theory):50Marks**  
**Practical                : 50 Marks**

**Prerequisites:** - Basic knowledge of Semiconductor Physics

**Course Objectives:**

- To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications.
- To introduce concepts of both positive and negative feedback in electronic circuits.
- To analyse and interpret FET and MOSFET circuits for small signal at low and high frequencies.
- To simulate electronics circuits using computer simulation software and verify desired results.
- To study the different types of voltage regulators.

**Course Outcomes:**

On completion of the course, student will be able to:

1. Comply and verify parameters after exciting devices by any stated method.
2. Implement circuit and test the performance.
3. Analyze small signal model of FET and MOSFET.
4. Explain behavior of FET at low frequency.
5. Design an adjustable voltage regulator circuits.

### **Course Contents**

**UNIT I: JFET****(8 Hrs)**

Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self). FET as an amplifier and its analysis (CS) and its frequency response. Small signal model, FET as High Impedance circuits.

**Unit II :MOSFET & its DC Analysis****(8 Hrs)**

Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. Common source circuit, Load Line & Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing.

**Unit III : MOSFET A C Circuit Analysis: (8 Hrs)**

The MOSFET CS small signal amplifier, Small signal parameters, small signal equivalent circuit, Modeling, Body effect, Analysis of CS amplifier. Introduction to BiCMOS technology. The MOSFET internal capacitances and high frequency model.

Introduction to MOSFET as basic element in VLSI, V-I characteristic equation in terms of W/L ratio, MOSFET scaling and small geometry effects, MOSFET capacitances.

**Unit IV : MOSFET Circuits (7 Hrs)**

MOSFET as switch, diode/active resistor, Current sink and source, current mirror, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.

**Unit V : Feedback amplifiers and Oscillators (8 Hrs)**

Four types of amplifiers. Feedback topologies. Effect of feedback on terminal characteristics of amplifiers. Examples of voltage series and Current series FET feedback amplifiers and their analysis. Barkhausen criterion, stability with feedback. General form of LC oscillator. FET RC Phase Shift oscillator, Wein bridge oscillator, Hartley and Colpitts oscillators.

**Unit VI : Voltage Regulator: (7 Hrs)**

Block diagram of an adjustable three terminal positive and negative regulators (317,337). Typical connection diagram, current boosting. Low drop out voltage regulators. Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS.

**Text Books:**

1. Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000.
2. Donald Neaman, "Electronic Circuit Analysis and Design", 3<sup>rd</sup> Edition, Tata McGraw Hill.

**Reference:**

1. David A. Bell, "Electronic Devices and Circuits", 5<sup>th</sup> Edition, Oxford press
2. R. L. Boylestad, L. Nashlesky, "Electronic Devices and Circuits Theory", 9<sup>th</sup> Edition, Prentice Hall of India, 2006.
3. Anil K. Maini and Varsha Agarwal "Electronic Devices and Circuits", Wiley India
4. Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford.
5. K. R. Botkar, "Integrated Circuits", 5<sup>th</sup> Edition, Khanna Publication.

**Guidelines for Laboratory Conduction**

Perform minimum eight experiments out of which at least three experiments should be conducted on bread board.

**List of Practical**

1. Design a single stage FET Amplifier in CS configuration and verify DC operating point.
2. Build and test single stage CS amplifier using FET. Calculate  $R_i$ ,  $R_o$  and  $A_v$ .
3. Simulate frequency response of single stage CS amplifier (use same circuit) and find the bandwidth.
4. Simulate Voltage-Series feedback amplifier and calculate  $R_{if}$ ,  $R_{of}$ ,  $A_{vf}$  and Bandwidth.
5. Implement current series feedback amplifier and find  $R_{if}$ ,  $R_{of}$ ,  $G_{mf}$  and Bandwidth.
6. Simulate LC oscillator using FET.

OR

7. Implement Weinbridge /RC phase shift oscillator using FET/MOSFET.
8. Simulate MOSFET/ CMOS Inverter.

OR

9. Build and test MOSFET as a switch.
10. Design and implement an adjustable voltage regulator using three terminals voltage regulator IC.

**204183****Electrical Circuits and Machines****Credits: Th – 03, Pr -01****Teaching Scheme:****Theory: 03hrs/week**  
**Practical: 02 hrs/week****Examination Scheme:****In-Sem(Online): 50 Marks**  
**End-Sem: (Theory): 50 Marks****Term Work: 25 Marks****Course Objectives:**

- To analyse AC and DC networks with network simplification techniques.
- To gain basic knowledge of transformers and their types.
- To conduct experimental procedures on different types of electrical machines.
- To understand the constructional details, characteristics, features and application areas of various types of electric motors.

**Course Outcomes:**

On completion of the course, student will be able to

1. Analyze basic AC & DC circuit for voltage, current and power by using KVL, KCL, and network theorems.
2. Explain the working principle of different electrical machines.
3. Select proper electrical motor for given application.
4. Design and analyze transformers.

**Course Contents****Unit I :Basic Circuit Analysis and Simplification Techniques (8 Hrs)**

Kirchhoff's Current and Voltage Laws, Independent and dependent sources and their interconnection, power calculations.

**Network Analysis:** Mesh, Super mesh, Node and Super Node analysis. Source transformation and source shifting.

**Network Theorems:** Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems, Millers Theorem and its dual. (AC circuit analysis for all the topics of this unit)

**Unit II :Transformer (6 Hrs)**

Types, Construction, Transformer on No-load (Transformation ratio, emf equation), impedance transformation, losses in transformer, regulation and efficiency, rating. Auto transformer, coupling transformer, Isolation transformer, C.T. and P.T., Design of single phase transformer for instrument power supply, High frequency transformers.

**Unit III :DC Machines (7 Hrs)**

Construction of DC Machine, Motoring and generation action, types, EMF equation, Torque equation (Torque-armature current characteristics, Torque-speed characteristics, speed-armature current characteristics), Power flow diagram. Problems on speed, torque & losses. Different methods of speed control, different types of starters for DC shunt motor. Permanent Magnet DC motors, Applications of DC Motors

**Unit IV :AC Motors****(7 Hrs)**

Three phase Induction motors, construction and principle of operation, types, slip and torque equation, Torque-slip characteristics, condition for maximum torque & ratios, types of starters, speed control, V/f control, Applications.

Synchronous motors: Construction, principle of operation, characteristics (V curves) and applications.

**Unit V :Special Motors 1****(6 Hrs)**

BLDC Motor, Construction, principle, characteristics, control circuit, sensors, applications. Construction, principle & applications of Reluctance Motor, Universal Motor.

**Unit VI :Special Motors 2****(6Hrs)**

Construction, types, principle, Characteristics, control circuit & applications of Stepper Motor and Servo motor.

Construction, principle, characteristics, Types and applications of single phase Induction Motor.

**Text Books:**

1. Abhijit Chakrabarti & Sudipta Debnath, "Electrical Machines",Tata McGraw-hill Publication.
2. William H Hayt, Jack E Kimmerly and Steven M. Durbin, "Engineering Circuit Analysis", TataMcGraw Hill.

**Reference:**

1. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans,"Electrical Machinery", TataMcGraw-hill Publication 6th Edition.
2. I.J Nagarath& D.P Kothari, "Electrical Machines", Tata McGraw-hill Publication 4th Edition.
3. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives",OxfordUniversity Press(1989)
4. Ned Mohan, "Electric Machines and Drives": A first course, Wiley.
5. B. L. Theraja, "Electrical technology" volume 2, S. Chand

**Guidelines for Laboratory Conduction**

Perform any 8 experiments:

**List of Practical**

1. Network Theorems : To verify Thevenin's and Norton's theorem ( DC or AC)
2. O.C. And S.C. Test on single phase transformer
3. Polarity test on single phase transformer.
4. Equivalent Circuit of a Single Phase Induction Motor by performing the no- load and blocked rotor tests.
5. Study of BLDC Motor Drive.
6. Speed control of DC motor using armature voltage and field current control method. Measure RPM and plot graph of speed versus armature voltage and field current.
7. Load test on 3-phase induction motor
8. Determination of equivalent circuit parameters of 3-phase induction motor using no load & blocked-rotor test.
9. To plot speed- torque characteristic of three phase induction motor.
10. To study various operating modes of stepper motor.

## Data Structures and Algorithms

### Credits: Th – 04, Pr -01

**Teaching Scheme:**

Theory: 04 hrs/week

Practical: 02 hrs/week

**Examination Scheme:**

In-Sem(Online): 50 Marks

End-Sem: (Theory):50 Marks

Oral : 50 Marks

**Prerequisites:** Basic knowledge of C language is required.**Course Objectives:**

- To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To study the systematic way of solving problems, various methods of organizing large amounts of data.
- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.

To employ the different data structures to find the solutions for specific problems

**Course Outcomes:**

On completion of the course, student will be able to :

1. Discuss the computational efficiency of the principal algorithms such as sorting & searching.
2. Write and understand the programs that use arrays & pointers in C
3. Describe how arrays, records, linked structures are represented in memory and use them in algorithms.
4. Implement stacks & queues for various applications.
5. Understand various terminologies and traversals of trees and use them for various applications.
6. Understand various terminologies and traversals of graphs and use them for various applications.

**Course Contents****Unit I : Introduction to C and Algorithm****(8 Hrs)**

Constants, variables and keywords in C, operators and control structure in c(decision, loop and case), functions, macros, arrays and string manipulation, structure, union, enumeration, bitwise operations  
 Functions: Parameter passing call by value and call by reference, scope rules, functions and pointers, function returning pointer, pointer to function, String manipulations using Arrays, pointer to pointer, Dynamic memory management.

**Analysis of algorithm:** frequency count and its importance in analysis of an algorithm, Time complexity & Space complexity of an algorithm, Big 'O' notation

**Unit II :Searching and Sorting****(8 Hrs)**

Need of searching and sorting, why various methods of searching and sorting, Sorting methods: Linear, binary search and Fibonacci Search.

**Sorting methods:** Bubble, insertion, selection, merge, Time complexity of each searching and sorting algorithm, Hashing Techniques.

**Unit III : Stack and Queues****(7 Hrs)**

**Stacks:** Concept, Basic Stack operations, Array representation of stacks, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation.

**Queues:** Concept, Queue operations, Array representation of queues, Queue as ADT, Circular queues, Application of queues: Categorizing data, Simulation of queues.

**Unit IV : Linked List****(7 Hrs)**

Concept of linked organization, singly linked list, stack using linked list, queue using linked list, doubly linked list, circular linked list, Linked list as ADT. Representation and manipulations of polynomials using linked lists, ,comparison of sequential linked organization with linked organization

**Unit V : Trees****(7 Hrs)**

Introduction to trees: Basic Tree Concepts, Binary Trees:Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree, Binary Search Trees (BST): Basic Concepts, BST operations.

**Unit VI : Graphs****(7 Hrs)**

Basic Concepts & terminology, Sequential representation of graphs; Adjacency matrix, Path matrix, Linked representation of a graph, Operations on graph, Traversing a graph, Spanning trees; Minimum Spanning tree, Kruskal's Algorithm, Prim's Algorithm. Dijkstra's Shortest Path Algorithm

**Text Books:**

1. Ellis Horowitz, SartajSahni, "Fundamentals of Data Structures", Galgotia Books Source. ISBN:10: 0716782928
2. Richard F. Gilberg& Behrouz A. Forouzan, Data Structures APseudocode Approach with C, Cengage Learning, second edition. ISBN-10: 0534390803

**Reference:**

1. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata McGrawHill. ISBN-10: 1259029964
2. E Balgurusamy - Programming in ANSI C, Tata McGraw-Hill, Third Edition. ISBN-10: 1259004619
3. YedidyahLangsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications, Second Edition ). ISBN 10: 8120311779

**List of Practical**

**Note: Practical 1-8 are compulsory. Practical 9-15 are optional.**

**Write C program to implement**

1. Write C program to store student information (e.g. RollNo, Name, Percentage etc.).
  - a. Display the data in descending order of Percentage (Bubble Sort).
  - b. Display data for Roll No specified by user (Linear Search).
  - c. Display the number of passes and comparisons for different test cases (Worst, Average, Best case).
2. Perform following String operations with and without pointers to arrays (without using the library functions): a. substring, b. palindrome, c. compare, d. copy, e. reverse.
3. Data base Management using array of structure with operations Create, display, Modify, Append, Search and Sort.(For any database like Employee or Bank database with andwithout pointers to structures)



4. Create a singly linked list with options:
  - a. Insert (at front, at end, in the middle),
  - b. Delete (at front, at end, in the middle),
  - c. Display,
  - d. Display Reverse,
  - e. Revert the SLL.
5. Implement Stack using arrays & Linked Lists. Write a menu driven program to perform following operations on stack a) Push b) Pop c) Display
6. Implement Queue using arrays & Linked Lists. Write a menu driven program to perform following operations on Queue a) Insert b) Delete c) Display
7. Binary search tree: Create, search, recursive traversals.
8. Graph using adjacency Matrix with BFS & DFS traversals.
9. Implement set operations using arrays and perform union, intersection, difference, symmetric difference
10. Accept input as a string and construct a Doubly Linked List for the input string with eachnode contains, as a data one character from the string and perform:
  - a) Insert b) delete, c) Display forward, d) Display backward
11. Represent graph using adjacency list or matrix and generate minimum spanning tree using Prim's algorithm
12. Read & write operations in a text file.
13. Polynomial addition using array of structure.
14. Evaluation of postfix expression (input will be postfix expression)
15. Implement following Matrix operations:
  - a. addition with pointers to arrays
  - b. multiplication without pointers to arrays
  - c. transpose with pointers to arrays

**204185**

**Digital Electronics**  
**Credits: Th – 04, Pr -01**

**Teaching Scheme**

**Theory: 04 hrs/week**  
**Practicals: 02 hrs/week**

**Examination Scheme**

**In-Sem(Online): 50 Marks**  
**End-Sem (Theory):50 Marks**

**Practical : 50 Marks**

**Course Objectives:**

- To acquaint the students with the fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
- To lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor.

**Course Outcomes:**

On completion of the course, student will be able to

1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design combinational and sequential circuits.
3. Design and implement hardware circuit to test performance and application.
4. Understand the architecture and use of microcontrollers for basic operations and Simulate using simulation software.

**Course Contents****Unit I : Combinational Logic Design****(8 Hrs)**

Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD - to - 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De-multiplexers and their use in combinational logic designs, Decoders, demultiplexer trees. Introduction to Quine-McCluskey method.

**Unit II :Sequential Logic Design****(8 Hrs)**

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals,

Excitation Table for flip flops. Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous designs.

**Unit III : State Machines****(8 Hrs)**

Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequencedetector. Introduction to Algorithmic state machines- construction of ASM chart and realization forsequential circuits

**Unit IV : Digital Logic Families****(8 Hrs)**

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic , open drain output. Interfacing CMOS and TTL. Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I<sup>2</sup>L, DCTL.

**Unit V : Programmable Logic Devices and Semiconductor Memories****(6 Hrs)**

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD  
Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.

**Unit VI : Introduction to Microcontroller 8051****(7 Hrs)**

Microprocessors and Microcontrollers comparison, 8051 architecture, Pin description, addressing modes, instruction set of 8051, concepts of Counters and Timers with the help of status registers, Port Structure and Interrupts. Simple programming examples – for addition, subtraction, multiplication and delay.

**TextBooks:**

1. R.P. Jain , “Modern digital electronics” , 3rd edition , 12th reprint Tata McGraw Hill Publication, 2007.
2. M. Morris Mano, “Digital Logic and Computer Design” 4<sup>th</sup> edition, Prentice Hall of India, 2013.

**Reference:**

1. Anand Kumar, “Fundamentals of digital circuits” 1st edition, Prentice Hall of India, 2001
2. Myke Predko, “Programming and customizing the 8051 microcontroller”, Tata McGraw Hill 2003.
3. Muhammad Mazidi, Janice Mazidi and Rolin McKinlay, ‘The 8051 Microcontroller and Embedded Systems using Assembly and C’, Pearson Education, 2nd edition.

**Instructions for Laboratory Conduction**

At least six practical (on bread board) from list 1 to 8 and two practicals from list 9 to 11.

**List of Practicals**

1. Study of IC-74LS153 as a Multiplexer. (Refer Data-Sheet).  
Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table.  
Design & Implement the given 4 variable function using IC74LS153. Verify its Truth-Table.
2. Study of IC-74LS138 as a Demultiplexer / Decoder (Refer Data-Sheet). Practical) (Test Benches and FSM excluded). Design and Implement full adder and subtractor function using IC- 74LS138.  
Design & Implement 3-bit code converter using IC-74LS138.(Gray to Binary/Binary to Gray)
3. Study of IC-74LS83 as a BCD adder,(Refer Data-Sheet).  
Design and Implement 1 digit BCD adder using IC-74LS83  
Design and Implement 4-bit Binary sub tractor using IC-74LS83.
4. Study of IC-74LS85 as a magnitude comparator,(Refer Data-Sheet)  
Design and Implement 4-bit Comparator.  
Design and Implement 8-bit Comparator
5. Study of Counter ICs (74LS90/74LS93). (Refer Data-Sheet)  
Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram.  
Design and Implement MOD-N and MOD-NN using IC-74LS93 and draw Timing diagram.
6. Study of synchronous counter  
Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193. Draw Timing Diagram
7. Verify four voltage and current parameters for TTL and CMOS (IC 74LSXX, 74HCXX), (Refer Data-Sheet).
8. Study of Shift Register (74HC194/74LS95), (Refer data-Sheet)  
Design and Implement Pulse train generator using IC-74HC194/IC74LS95 (Use right shift/left shift). Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.
9. Write a assembly/C language program to perform arithmetic operations.
10. Write a assembly/C language program to perform internal and external memory transfer operations
11. Write a assembly/C language program to use port pin for simple application

**204186****Electronic Measuring Instruments and Tools****Credits: Th – 01, Pr -01****Teaching Scheme:****Theory: 01hrs/week****Practical: 02 hrs/week****Examination Scheme:****Term work : 50 Marks****Course Objective:**

- To make student competent for handling measuring instruments and to able to select right instrument for the purpose of measurement under different conditions.

**Course Outcomes:**

On completion of the course, student will be able to:

1. Understand fundamental of various electrical measurements.
2. Understand and describe specifications, features and capabilities of electronic instruments.
3. Finalize the specifications of instrument and select an appropriate instrument for given measurement.
4. Carry out required measurement using various instruments under different setups.
5. Able to compare measuring instruments for performance parameters
6. Select appropriate instrument for the measurement of electrical parameter professionally.

**Course Contents****Theory**

It is expected that operating principle, block diagram and other details shall be taught in theory sessions. Teachers will explore these instruments in detail in respective laboratory sessions. Specification sheet / functions of the instrument should be listed and attached in file/journal.

**Theory lectures shall cover following topics along-with discussion of practicals**

1. Measurement: Necessity, units, ways of measurements.
2. Performance parameters for measuring instruments.
3. Information about OIML standards.
4. Statistical analysis ( Definitions and Introductions only), sources of errors and remedies
5. Calibration and Maintenance of Instruments.
6. Techno-commercial Comparative Analysis and Ordering Information of Instruments.

**TextBooks:**

1. Instrument manuals published by respective Manufactures.
2. KalsiH.S “ Electronic Instrumentation”, Tata McGraw Hill, 2004.

**Guidelines for Laboratory Conduction**

At least eight practical must be performed.

1. Use of everyday practicing testing/measuring instruments.  
Electrical tester, cable (continuity) tester, Indicators with Neon and LEDs Megger for insulation test, open/short circuit test Digital Panel Meter (DPM)
2. Perform following using analog and digital multimeter: Measurement of DC voltage, DC current, AC (rms) voltage, AC (rms) current, resistance, capacitance. Understand the effect of decimal point of resolution. Comment on bandwidth (only for digital multimeter) to test continuity, PN junction and transistor. Calculate mean, standard deviation, average deviation and variance of measured quantity.

3. Set up Power Supply for Conduction of Laboratory experiments ( 30V / 300 V) Set up Current limit, Check Over current (CC mode) and Short circuit. Setting Individual / Dual Power Supply Series / Parallel Operation of Power Supplies
4. Perform following using CRO : Set up CRO for operation: Ground check, Probe check, Dual/ Mono/Component Tester
  - 1) Check signal coupling. Observe alternate, chop modes.
  - 2) Perform Probe check and calibration of CRO, adjust if necessaryMeasure unknown frequency and phase using XY mode. Perform locking of input signal using auto, normal, external, edge trigger modes.
5. Perform following using DSO
  - 1) Perform Roll, Average, Peak detection operations on signal, Capture transients.
  - 2) Perform FFT analysis of sine and square signals.
  - 3) Perform various math operations like add, subtract and multiplication of two waves.
  - 4) Check store and retrieval of signals. Use Print, save on disk/USB
6. Compare True RMS meter with Multi-meter  
Measure RMS, peak and average voltages for half controlled rectifier or Full controlled rectifier by varying firing angle.  
Compare readings of DMM and/or Power-scope with TRMS for analyzing why TRMS is better.
7. Signal Analysis using Logic Analyzer  
Set up logic analyzer for 8/16/32 channels. Use logic analyser in stand-alone mode or with PC / Mixed Signal Oscilloscope. Verify timing diagram for any digital circuit like counter / shift register
8. Measurements using Spectrum Analyzer. Perform harmonic analysis and Total Harmonic Distortion (THD) measurement for sine and square waves. Verify frequency response of filters& high frequency (HF) amplifier.  
Analyze Spectrum of AM & FM and to measure percent modulation and bandwidth.
9. Measurements using programmable LCR meter: Measure L, C & R in series / parallel operation, at different frequencies. Comment on readings in different connections / at different frequencies. Measure Q and Dissipation factor.
10. Set up function generator/Arbitrary waveform generator. Generate signal of required amplitude, frequency, duty cycle, offset etc. Generate special signals such as noise, ECG, sweep, burst, AM, FM, PM etc. Check generated signal on oscilloscope and verify under different attenuation.
11. Compare Frequency Counter with Oscilloscope. Carry out measurements through different modes of measurement. Measure frequency, time, ratio, events & pulse width. Measure signals using oscilloscopes and compare readings with frequency counter. Comment on bandwidth of oscilloscope and compare specifications of scope and freq. counter
12. Measure Sound / Video signal strength using db-meter. Measure signal strength before / after signal amplifier. Measure loss of signal strength in connection splitters / attenuator. Plot signal strength at different frequencies

**Audit course-I**  
**204192:Japanese Language module-I**

**About course:**

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best... suited Language!!

Japanese is the new trend of 21<sup>st</sup> century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the 'resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

**Course Objectives:**

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

**Course Outcomes:**

On completion of the course student

- will have ability of basic communication.
- will have the knowledge of Japanese script.
- will get introduced to reading , writing and listening skills
- will develop interest to pursue professional Japanese Language course.

**Course Contents**

Unit 1 : Introduction to Japanese Language.

Hiragana basic Script, colors, Days of the week

Unit 2 : Hiragana : modified Kana, double consonant, Letters combined with ya, yu, yo

Long vowels, Greetings and expressions

Unit 3 : Self Introduction, Introducing other person,

Numbers, Months, Dates, Telephone numbers, Stating one's age.

Text Book:

1. Minna No Nihongo, "Japanese for Everyone", Elementary Main Text book 1-1 (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.

**Guidelines for Conduction**

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures
- Language Lab

**Guidelines for Assessment** (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report



**Audit Course-I**  
**204192: Road Safety Management**

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory regulation has been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the World statistics; but the comparable proportion for accidents is substantially large.

The need for stricter enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the ibid stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.

**Course Objectives:**

- Provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
- Insight into the transportation system management (TSM) techniques.
- Overview of the engineering & legislative measures for road safety.
- Discuss measures for improving road safety education levels among the public.

**Course Outcomes:**

On completion of the course, society will observe –

- Changes in awareness levels, knowledge and understanding
- A change in attitudes / behavior e.g. against drink-drive;
- Casualty Reduction;
- That remedial education for those who make mistakes and for low level offences where this is more effective than financial penalties and penalty points;
- Improving Road Safety Together

**Course Contents**

1. Existing Road Transport Scenario
2. Accident Causes & Remedies
3. Road Accident Investigation & Investigation Methods
4. Vehicle Technology – CMVR & Road Safety
5. Regulatory / Legislative Provisions for Improving Road Safety
6. Behavioral Training for Drivers for Improving Road Safety
7. Road Safety Education
8. Road Engineering Measures for Improving Road Safety

**Guidelines for Conduction** (Any one or more of following but not limited to)

- Guest Lectures
- Visits and reports
- Assist authorities like RTO for audits (e.g. Particular road safety audit as critical on-site assessment of the shortcomings in the various elements of the road)
- Mini Project

**Guidelines for Assessment**(Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

**207005****Engineering Mathematics -III**  
**Credits: Th – 04 ,Tut-01****Teaching Scheme:****Theory : 04 hr/week****Tutorial: 01 hr/week****Examination Scheme:****In-Sem(Online): 50 Marks****End-Sem (Theory):50 Marks****Term Work : 25 Marks**

**Prerequisites:** - Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

**Course Objectives:**

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

- Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
- Transforms such as Fourier transform, Z-transform and applications to Communication systems and Signal processing.
- Vector differentiation and integration required in Electro-Magnetics and Wave theory.
- Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

**Course Outcomes:**

On completion of the course, student will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Z-transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electro-Magnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

**Course Contents****Unit I: Linear Differential Equations (LDE) and Applications****(09 Hours)**

LDE of  $n^{\text{th}}$  order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of Electrical circuits.

**Unit II: Transforms****(09 Hours)**

Fourier Transform (FT): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.

Z - Transform (ZT): Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

**Unit III: Numerical Methods****(09 Hours)**

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation.

Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error,

Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4<sup>th</sup> order methods.

**Unit IV: Vector Differential Calculus****(09 Hours)**

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

**Unit V: Vector Integral Calculus and Applications****(09 Hours)**

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields.

**Unit VI : Complex Variables****(09 Hours)**

Functions of Complex variables, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Bilinear transformation, Cauchy's integral theorem, Cauchy's integral formula, Laurent's series, Residue theorem.

**Text Books:**

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9e, Wiley India.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7e, Cengage Learning.

**Reference Books:**

1. M. D. Greenberg, “Advanced Engineering Mathematics”, 2e, Pearson Education.
2. Wylie C.R. & Barrett L.C. , “Advanced Engineering Mathematics”, McGraw-Hill, Inc.
3. B. S. Grewal, “Higher Engineering Mathematics” Khanna Publication, Delhi.
4. P. N. Wartikar & J. N. Wartikar, “Applied Mathematics”, Volumes I and II, Pune VidyarthiGrihaPrakashan,.
5. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw-Hill.
6. Thomas L. Harman, James
7. Dabney and Norman Richert, “Advanced Engineering Mathematics with MATLAB”, 2e, Brooks/Cole, Thomson Learning.

**Guidelines for Tutorial and Term Work:**

- i) Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.
- ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

**204187****Integrated Circuits**  
**Credits: Th – 04, Pr -01****Teaching Scheme:****Theory: 04hrs/week****Practical: 02 hrs/week****Examination Scheme:****In-Sem(Online): 50 Marks****End-Sem (Theory) :50 Marks****Practical : 50 Marks****Term Work : 25 Marks****Course Objectives:**

- To understand characteristics of IC and Op-Amp and identify the internal structure.
- To introduce various manufacturing techniques.
- To study various op-amp parameters and their significance for Op-Amp.
- To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
- To analyse and identify linear and nonlinear applications of Op-Amp.
- To understand functionalities of PLL and its use in various applications in communication and control systems.

**Course Outcomes:**

On completion of the course, student will be able to:

1. Understand the characteristics of IC and Op-Amp and identify the internal structure.
2. Understand and identify various manufacturing techniques.
3. Derive and determine various performances based parameters and their significance for Op-Amp.
4. Comply and verify parameters after exciting IC by any stated method.
5. Analyze and identify the closed loop stability considerations and I/O limitations.
6. Analyze and identify linear and nonlinear applications of Op-Amp.
7. Understand and verify results (levels of V & I) with hardware implementation.
8. Implement hardwired circuit to test performance and application for what it is being designed.
9. Understand and apply the functionalities of PLL to Frequency synthesizer, multiplier, FM, and AM demodulators

**Course Contents****Unit I : OP-AMP Basics****(6 Hrs)**

Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations using 'r' parameters, Need and types of level shifter, current mirror circuits. Voltage series and voltage shunt feedback amplifier and its effect on  $R_i$ ,  $R_o$ , bandwidth and voltage gain.

**Unit II : Linear Applications of OP-AMP (8 Hrs)**

Inverting and Non-inverting amplifier, voltage follower. Summing, averaging scaling amplifier, difference amplifier, Ideal integrator, practical integrator with frequency response, Ideal differentiator, practical differentiator with frequency response. Instrumentation amplifiers.

**Unit III : Non-linear Applications of OP-AMP (8 Hrs)**

Comparator, characteristics of comparator, applications of comparator, Schmitt trigger (symmetrical/asymmetrical), clippers and clampers, voltage limiters, Square wave generator, triangular wave generator, Need of precision rectifier, Half wave, Full wave precision rectifiers, peak detectors, sample and hold circuits.

**Unit IV : Converters using OP-AMP (6 Hrs)**

V-F, I-V and V-I converter, DAC: types of DAC, characteristics, specifications, advantages and disadvantages of each type of DAC, ADC: types of ADC, characteristics, specifications, advantages and disadvantages of each type of ADC.

**Unit V : Phase Locked Loop & Oscillators (8 Hrs)**

Block diagram of PLL and its function, PLL types, characteristics/parameters of PLL, and different applications of PLL. Oscillators principle, types and frequency stability, design of phase shift, wein bridge, Quadrature, voltage controlled oscillators.

**Unit VI : Active filters (8 Hrs)**

Design and frequency scaling of First order and second order Active LP, HP, BP and wide and narrow band BR Butterworth filters and notch filter. All pass filters.

**TextBooks:**

1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill, India 2008

**Reference:**

1. George Clayton and Steve Winder, "Operational Amplifiers", 5th Edition Newnes.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill.
3. Bali, "Linear Integrated Circuits", Mc Graw Hill 2008.
4. Gray, Hurst, Lewis, Meyer, "Analysis & Design of Analog Integrated Circuits", Wiley Publications.

### **Instructions for Laboratory Conduction**

1- 8 experiments are compulsory and should be conducted on bread board.

#### **List of Practical's**

1. Measure Op-Amp parameters and compare with the specifications.  
Input bias current, input offset current and input offset voltage. slew rate , CMRR  
Compare the result with datasheet of corresponding Op-Amp.
2. Design, build and test integrator for given frequency  $f_a$ .
3. Design, build and test three Op-Amp instrumentation amplifiers for typical application
4. Design, build and test precision half & full wave rectifier.
5. Design, build and test Schmitt trigger and plot transfer characteristics.
6. Design, build and test PLL.
7. 2 bit DAC and 2 bit ADC.
  - A) Design and implement 2bit R-2R ladder DAC.
  - B) Design and implement 2bit flash type ADC.
8. Design, build and test square & triangular wave generator.

#### **Optional Experiments:**

1. Verify and understand practically virtual ground and virtual short concept in inverting and non-inverting configuration.
2. Plot DC transfer characteristics of emitter coupled differential amplifier.
3. Study effect of emitter resistance and constant current source on figure of merit (CMRR) of emitter coupled differential amplifier.
4. Design and implement V-I converter.
5. Any experiment based on application of Op-Amp.



**204188****Control Systems**  
**Credits: Th – 03****Teaching Scheme:**  
**Theory : 03 hr/week****Examination Scheme:**  
**In-Sem(Online): 50 Marks**  
**End-Sem(Theory): 50 Marks****Course Objectives:**

- To introduce the elements of control system and their modelling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems.
- To introduce the concept of root locus, Bode plots, Nyquist plots.
- To introduce the state variable analysis method.
- To introduce concepts of PID controllers and digital and control systems.
- To introduce concepts programmable logic controller.

**Course Outcomes:**

On completion of the course, student will be able to:

1. Determine and use models of physical systems in forms suitable for use in the analysis and design of control systems.
2. Determine the (absolute) stability of a closed-loop control system.
3. Perform time domain and frequency domain analysis of control systems required for stability analysis.
4. Perform time domain and frequency domain correlation analysis.
5. Apply root-locus, Frequency Plots technique to analyze control systems.
6. Express and solve system equations in state variable form.

**Course Contents****Unit I :Control System Modeling****(6 Hrs)**

Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph

**Unit II :Time Response Analysis****(6 Hrs)**

Standard input signals, Time response analysis of First Order Systems, Time response analysis of second order systems, Steady state errors and error constants, design specifications for second order systems.

**Unit III : Stability Analysis****(6 Hrs)**

Concept of Stability, Routh-Hurwitz Criterion, Relative Stability, Root Locus Technique, Construction of Root Locus, Dominant Poles, Application of Root Locus Diagram.

**Unit IV :Frequency Response Analysis (6 Hrs)**

Frequency domain Versus Time domain analysis and its correlation, Bode Plots, Polar Plots and development of Nyquist Plots. Frequency Domain specifications from the plots, Stability analysis from plots.

**Unit V :State Variable Analysis (6 Hrs)**

State space advantages and representation, Transfer function from State space, physical variable form, phase variable forms: controllable canonical form, observable canonical form, Solution of homogeneous state equations, state transition matrix and its properties, computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability.

**Unit VI :Controllers And Digital Control Systems (6 Hrs)**

Introduction to PLC: Block schematic, PLC addressing, any one application of PLC using Ladder diagram. Introduction to PID controller: P, PI, PD and PID Characteristics and concept of Zeigler-Nicholas method.

Digital control systems: Special features of digital control systems, Necessity of sample and hold operations for computer control, z-transform and pulse transfer function, Stability and response of sampled-data systems.

**TextBooks:**

N. J. Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2009.

**Reference:**

1. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition, 1995.
2. M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
3. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
4. John J. D'Azzo & Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.
5. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

**204189****Analog Communications****Credits: Th – 03, Pr -01****Teaching Scheme:****Theory: 03hrs/week****Practical: 02 hrs/week****Examination Scheme:****In-Sem(Online): 50Marks****End-Sem (Theory): 50 Marks****Practical : 50 Marks****Course Objectives:**

The students are expected to demonstrate the ability to:

- Describe and analyze the mathematical techniques of generation, transmission and reception of amplitude modulation (AM), frequency modulation (FM) and phase modulation (PM) signals.
- Evaluate the performance levels (Signal-to-Noise Ratio) of AM, FM and PM systems in the presence of additive white noise.
- Convert analog signals to digital format and describe Pulse and digital Modulation techniques.

**Course Outcomes:**

On completion of the course, student will be able to:

1. Understand and identify the fundamental concepts and various components of analogcommunication systems.
2. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
3. Describe analog pulse modulation techniques and digital modulation technique.
4. Develop the ability to compare and contrast the strengths and weaknesses of variouscommunication systems.

**Course Contents****Unit I :AM Transmission****(8 Hrs)**

Base band & Carrier communication, Generation of AM (DSBFC) and its spectrum, Power relations applied to sinusoidal signals, DSBSC – multiplier modulator, Nonlinear generation, switching modulator, Ring modulator & its spectrum, Modulation Index. SSBSC, ISB & VSB, their generation methods & Comparison, Block Diagram of AM Transmitter and Broadcast technical standards.

**Unit II :AM Reception****(8 Hrs)**

Block diagram of TRF AM Receivers, Super Heterodyne Receiver, Dual Conversion Super heterodyne Receiver, Concept of Series & Parallel resonant circuits for Bandwidth & Selectivity. Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection and IFRR. Tracking, Mixers. AM Detection: Rectifier detection, Envelope detection; Demodulation of DSBSC: Synchronous detection; Demodulation of SSBSC: Envelope detection

**Unit III : FM Transmission (8 Hrs)**

Instantaneous frequency, Concept of Angle modulation, frequency spectrum & Eigen Values, Narrow band & wide band FM, Modulation index, Bandwidth, Phase Modulation, Bessel's Function and its mathematical analysis, Generation of FM (Direct & Indirect Method), FM stereo Transmitter, Two way FM Radio Transmitter, Comparison of FM and PM.

**Unit IV : FM Reception (6 Hrs)**

Block diagram of FM Receiver, FM Stereo Receiver , Two way FM Radio Receiver, FM detection using Phase lock loop(PLL) ,Slope detector, Balanced Slope detector etc.

**Unit V :Noise (6 Hrs)**

Sources of Noise, Types of Noise, White Noise, Thermal noise, shot noise, partition noise, Low frequency or flicker noise, burst noise, avalanche noise, Signal to Noise Ratio, SNR of tandem connection, Noise Figure, Noise Temperature, Friss formula for Noise Figure, Noise Bandwidth, Behavior of Baseband systems and Amplitude modulated systems i.e.DSBSC and SSBSC in presence of noise.

**Unit VI : Pulse Analog Modulation (6 Hrs)**

Band limited & time limited signals, Narrowband signals and systems, Sampling theorem in time domain, Nyquist criteria, Types of sampling- ideal, natural, flat top, Aliasing & Aperture effect. PAM PWM & PPM. Introduction to Pulse Code Modulation.

**TextBooks:**

1. George Kennedy, "Electronic Communication Systems" 5th Edition, McGraw-Hill.
2. Dennis Roddy &Coolen, "Electronic Communication",4th Edition, Prentice Hall.

**Reference:**

1. B. P. Lathi, "Modern Digital and Analog. Communication Systems", 3rd Edition, Oxford University Press.
2. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons.
3. Taub& Schilling, "Principles of Communication Systems", Tata McGraw-Hill.
4. Frenzel, "Principles of Electronic Communication Systems"3rd Edition, Tata McGraw-Hill.

**Instructions for Laboratory Conduction**

Perform any 8 experiments from following

**List of Practical**

1. Design, Build & Test class C tuned amplifier for AM Generation / Simulate using desirable Software
2. AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal.
3. Envelope Detector - Practical diode detector, Observe effect of change in RC time constant which leads to diagonal and negative clipping
4. Generation of DSB-SC with the help of Balanced Modulator IC1496/1596 & its detection
5. SSB modulator using Filter method/ phase shift method & its detection
6. Frequency modulator & demodulator using IC 565 (PLL based), calculation of modulation index & BW of FM.
7. Frequency modulator & demodulator using Varicap/Varactor Diode and NE 566 VCO.
8. Study of AM & FM Spectrum: Observe Spectrum of AM & FM on Spectrum Analyzer, Compare & comment on AM & FM spectrum. Observe Effect of Eigen values on carrier power in FM.
9. Measurement of Performance Characteristics of Receiver: Sensitivity, Selectivity, Fidelity
10. Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain. Following can be performed using suitable software (Any One)
11. Generate AM and FM waveform for given modulation index, signal frequency and carrier Frequency using suitable software.
12. Prove sampling Theorem. Reconstruct the analog signal from its samples. Observe aliasing effect by varying sampling frequency.
13. SNR and PSD of any system (Baseband or AM) (Kit based/Simulated)

Note: Visit to Broadcasting Station is desirable.

**204190****Object Oriented Programming****Credit:Th-03,Pr-02****Teaching Scheme:****Theory:** 3 Hrs/ Week**Practical :** 4 Hr/Week**Examination Scheme:****Online:** 50 Marks**Paper:** 50 Marks**Oral :** 50 Marks**Course Objectives:**

- Make the students familiar with basic concepts and techniques of object oriented programming in C++ & Java.
- Develop an ability to write programs in C++ and Java for problem solving.

**Course Outcomes:**

Upon successful completion of this course, students should be able to:

1. Describe the principles of object oriented programming.
2. Apply the concepts of data encapsulation, inheritance in C++.
3. Understand basic program constructs in Java
4. Apply the concepts of classes, methods and inheritance to write programs Java.
5. Use arrays, vectors and strings concepts and interfaces to write programs in Java.
6. Describe and use the concepts in Java to develop user friendly program,

**UNIT I: Introduction to Object Oriented Programming****(6L)**

Principles of OOP: Software crisis, Software evolution, OOP paradigm, Basic Concepts of OOP, Benefits & applications of OOP.

Beginning with C++: What is C++, Applications of C++, A Simple C++ Program, More C++ statements.

Moving from C to C++: Declaration of variable, Reference variables, Scope resolution operator, Member dereferencing operator, memory management operators.

Functions in C++: Function prototyping, Call by reference.

**Unit II: Concepts of Object Oriented Programming with C++****(6L)**

Classes & Objects: Specifying a class, Defining member functions, A C++ program with class, Making

an outside function inline, Nesting of member function, Private member function, Arrays within class, Member allocation for objects, Arrays of objects, Objects as function arguments.

Constructors & Destructors: Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments.

Operator overloading concept: Use of operator overloading, defining operator overloading, Binary operator overloading.

Introduction to Inheritance: Concept and types of Inheritance, Defining derived classes, Single inheritance, Making a private member inheritable, multilevel inheritance.

### **UNIT III: Java Fundamentals**

**(6L)**

Evolution of Java, Comparison of Java with other programming languages, Java features, Java Environment, Simple Java Program, Java Tokens, Java Statements, Constants, variables, data types. Declaration of variables, Giving values to variables, Scope of variables, arrays, Symbolic constants, Typecasting, Getting values of variables, Standard default values, Operators, Expressions, Type conversion in expressions, Operator precedence and associativity, Mathematical functions, Control statements- Decision making & branching, Decision making & looping.

### **UNIT IV: Classes, Methods & Objects in Java**

**(6L)**

Class Fundamentals, Declaring Objects, Assigning Object reference variables, Methods, Constructors, The This keyword, Garbage collection, finalize method, Overloading methods, using objects as parameters, Argument passing, returning objects, Recursion, access control, static, final, arrays, strings class, Command line arguments.

### **UNIT V: Inheritance, Packages and Interfaces**

**(6L)**

Inheritance basics, Using Super, Creating Multilevel hierarchy, Constructors in derived class, Method overriding, Dynamic method dispatch, Using Abstract classes, Using final with inheritance, Object class, Packages, Access protection, Importing packages, Interfaces: Define, implement and extend. Default interface methods, Use static method in interface.

### **UNIT VI: Multithreading, Exception handling & Applets**

**(6L)**

Introduction to multithreading: Introduction, Creating thread and extending thread class.

Concept of Exception handling: Introduction, Types of errors, Exception handling syntax, Multiple catch statements.

I/O basics, Reading console inputs, Writing Console output.

Applets: Concepts of Applets, differences between applets and applications, life cycle of an applet, types of applets, creating a simple applet.

### **Text Books:**

1. E Balagurusamy, Programming with C++, Tata McGraw Hill, 3<sup>rd</sup> Edition.
2. Herbert Schildt, Java: The complete reference, Tata McGraw Hill, 7th Editon.

### **Reference Books:**

1. Robert Lafore, “Object Oriented Programming in C++”, Sams Publishing, 4<sup>th</sup> Edition.
2. T. Budd, Understanding OOP with Java, Pearson Education.
3. Matt Weisfeld, “The Object-Oriented Thought Process”, Pearson
4. Cox Brad, “Object –Oriented Programming: An Evolutionary Approach”, Addison –Wesley
5. E Balagurusamy, Programming with Java A Primer, Tata McGraw Hill, 3<sup>rd</sup> Edition.

### **List of Practical:**

**(Perform any 4 from group I and any 12 from group II)**

#### **Group I**

1. Write a program in C++ to implement database of persons having different profession e.g. engineer, doctor, student, laborer etc. using the concept of multiple inheritance. The objective of this assignment is to learn the concepts of inheritance.
2. Write a program in C++ to sort the numbers in an array using separate functions for read, display, sort and swap. The objective of this assignment is to learn the concepts of input, output, functions, call by reference in C++.
3. Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide, Complex conjugate. Design the class for complex number representation and the operations to be performed. The objective of this assignment is to learn the concepts classes and objects
4. Write a program in C++ to implement Stack. Design the class for stack and the operations to be



performed on stack. Use Constructors and destructors. The objective of this assignment is to learn the concepts classes and objects, constructors and destructors.

5. Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide. Use operator overloading for these operations. The objective of this assignment is to learn the concepts operator overloading.

## **Group II**

6. Write some simple programs in Java such as
  - i) To find factorial of number.
  - ii) To display first 50 prime numbers.
  - iii) To find sum and average of N numbers.
7. Write a program in Java to implement a Calculator with simple arithmetic operations such as add, subtract, multiply, divide, factorial etc. using switch case and other simple java statements. The objective of this assignment is to learn Constants, Variables, and Data Types, Operators and Expressions, Decision making statements in Java.
8. Write a program in Java with class Rectangle with the data fields width, length, area and colour. The length, width and area are of double type and colour is of string type. The methods are get\_length(), get\_width(), get\_colour() and find\_area(). Create two objects of Rectangle and compare their area and colour. If the area and colour both are the same for the objects then display “ Matching Rectangles”, otherwise display “ Non-matching Rectangle”.
9. Write Programs in Java to sort
  - i) List of integers
  - ii) List of names. The objective of this assignment is to learn Arrays and Strings in Java
10. Write a Program in Java to add two matrices. The objective of this assignment is to learn Arrays in Java
11. Write a program in Java to create a player class. Inherit the classes Cricket\_player, Football\_player and Hockey\_player from player class. The objective of this assignment is to learn the concepts of inheritance in Java.
12. Write a Java program which imports user defined package and uses members of the classes contained in the package.
13. Write a Java program which implements interface.
14. Create an applet with three text Fields and four buttons add, subtract, multiply and divide. User will enter two values in the Text Fields. When any button is pressed, the corresponding

operation is performed and the result is displayed in the third Text Fields.

15. Write a java program which use try and catch for exception handling.
16. Implement Java program to implement a base class consisting of the data members such as name of the student, roll number and subject. The derived class consists of the data members subject code, internal assessment and university examination marks. The program should have the facilities. i) Build a master table ii) List a table iii) Insert a new entry iv) Delete old entry v) Edit an entry vi) Search for a record. Use virtual functions.
17. Write a program to implement stack or any other data structure in Java
18. Write a program to create multiple threads and demonstrate how two threads communicate with each other.
19. Write a program to implement addition, subtraction and multiplication of two complex numbers in Java
20. A Mini project in Java: A group of 4 students can develop a small application in Java.

**204191****EMPLOYABILITY SKILL DEVELOPMENT****Credits:Th – 02, Pr -01****Subject Code:****Teaching Scheme****Theory / Week : 2 Hrs****Practical /Week : 2Hrs.****Examination Scheme****Term Work: 50 Marks****Course Objectives:**

1. To develop analytical abilities
2. To develop communication skills
3. To introduce the students to skills necessary for getting, keeping and being successful in a profession.
4. To expose the students to leadership and team-building skills.

**Course Outcomes:** On completion of the course, student will be able to:

1. Have skills and preparedness for aptitude tests.
2. Be equipped with essential communication skills (writing, verbal and non-verbal)
3. Master the presentation skill and be ready for facing interviews.
4. Build team and lead it for problem solving.

**Unit I :Soft Skills & Communication basics****(4Hrs)**

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills. Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing

**Unit II: Arithmetic and Mathematical Reasoning****(4 Hours)**

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, remainder theorem)

**Unit III: Analytical Reasoning and Quantitative Ability****(4 Hours)**

Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy)

**Unit IV: Grammar and Comprehension****(4 Hours)**

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

**Unit V: Skills for interviews****(4Hours)**

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.

**Unit VI: Problem Solving Techniques****(4 Hours)**

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

**Text Books:**

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, "Soft Skills- An integrated approach to maximize personality", ISBN: 987-81-265-5639-7, First Edition 2016, Wiley.
2. Wren and Martin, "English grammar and Composition", S. Chand publications.
3. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.

**Reference Books:**

1. Philip Carter, "The Complete Book Of Intelligence Test", John Willey & Sons Ltd.
2. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page
3. Eugene Ehrlich, Daniel Murphy, "Schaum's Outline of English Grammar", McGraw Hills.
4. David F. Beer, David A. McMurrey, "A Guide to Writing as an Engineer", ISBN : 978-1-118-30027-5 4th Edition, 2014, Wiley.

**List of Practical:**

1. Every student should collect five questions of each type
  - a. Number sequence
  - b. Mental arithmetic
  - c. Square, square roots
  - d. LCM, HCF
  - e. Speed calculations

**Note:** Teacher should distribute the question set randomly amongst the students.

2. Write up on
  - a. Blooms taxonomy
  - b. Multiple intelligence theory
  - c. Every student should identify his/her strength and weaknesses
  - d. Action plan to improve the weaknesses
3. Every student should collect five questions of each type
  - a. Matching
  - b. Selection
  - c. Arrangements
  - d. Verifications

**Note:** Teacher should distribute the question set randomly amongst the students.

4. Every student should collect five questions of each type
  - a. Verbal aptitude
  - b. Synonym
  - c. Antonym
  - d. Analogy

**Note:** Teacher should distribute the question set randomly amongst the students.

5. Solve exercises from book (Wren and Martin, "English grammar and Composition") based on
  - a. English sentences and phrases
  - b. Paragraph writing
  - c. Story writing
  - d. Letter writing
6. Formulate suitable assignment to solve a real problem using problem solving techniques
7. Practice tests (aptitude, analytical abilities, logical reasoning)
8. Extempore, group discussions and debate.
9. Technical report writing and Seminar Presentation.
10. Mock interviews.

**Audit course-II**  
**204193:Japanese Language module II**

**About course:**

With changing times, the competitiveness has gotten into the nerves and 'Being the Best' at all times is only the proof of it. Nonetheless, 'being the best' differs significantly from 'Communicating the best'! The best can merely be communicated whilst using the best... suited Language!!

Japanese is the new trend of 21<sup>st</sup> century. Not only youngsters but even the professionals seek value in it. It is the engineer's companion in current times with an assertion of a thriving future. Pune has indisputably grown to become a major center of Japanese Education in India while increasing the precedence for Japanese connoisseurs.

Japanese certainly serves a great platform to unlock a notoriously tough market & find a booming career. While the companies prefer candidates having the knowledge of the language, it can additionally help connect better with the native people thus prospering in their professional journey. Learning Japanese gives an extra edge to the 'resume' since the recruiters consciously make note of the fact it requires real perseverance and self-discipline to tackle one of the most complex languages.

It would be easy for all time to quit the impossible; however it takes immense courage to reiterate the desired outcomes, recognize that improvement is an ongoing process and ultimately soldier on it.

The need of an hour is to introduce Japanese language with utmost professionalism to create awareness about the bright prospects and to enhance the proficiency and commitment. It will then prove to be the ultimate path to the quest for professional excellence!

**Course Objectives:**

- To meet the needs of ever growing industry with respect to language support.
- To get introduced to Japanese society and culture through language.

**Course Outcomes:**

On completion of the course student

- will have ability of basic communication.
- will have the knowledge of Japanese script.
- will get introduced to reading , writing and listening skills
- will develop interest to pursue professional Japanese Language course.

**Course Contents**

Unit 1 : Katakana basic Script, Denoting things ( nominal & pronominal demonstratives )

Purchasing at the Market / in a shop / mall (asking & stating price)

Unit 2 : Katakana : Modified kana, double consonant, letters with ya, yu, yo,

Long vowels

Describing time, describing starting & finishing time ( kara ~ made )

Point in time (denoting the time when any action or the movement occurs)

Unit 3 : Means of transport (Vehicles), Places, Countries,

Stating Birth date, Indicating movement to a certain place by a vehicle

**Text Book:**

1.Minna No Nihongo, “Japanese for Everyone”, (Indian Edition), Goyal Publishers & Distributors Pvt. Ltd.

**Guidelines for Conduction**

(Any one or more of following but not limited to)

- Guest Lectures
- Visiting lectures
- Language Lab

**Guidelines for Assessment** (Any one of following but not limited to)

- Written Test
- Practical Test
- Presentation
- Paper
- Report

<b>Audit course-II</b> <b>204193: Cyber Crime and law</b>
<b>Introduction to Cyber Crime and law:</b>  Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000
<b>Introduction to Cyber Crime Investigation</b> Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Worms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks
<b>Guidelines for Conduction</b>  (Any one or more of following but not limited to)  <ul style="list-style-type: none"><li>• Guest Lectures</li><li>• Visiting lectures</li></ul>
<b>Guidelines for Assessment</b> (Any one of following but not limited to)  <ul style="list-style-type: none"><li>• Written Test</li><li>• Practical Test</li><li>• Presentation</li><li>• Paper</li><li>• Report</li></ul>