BansilalRamnathAgarwal Charitable Trust’s

Vishwakarma Institute of Technology
(An Autonomous Institute affiliated to University of Pune)

Structure & Syllabus of
S.Y. B.Tech. (E & TC Engineering)

Pattern ‘A-14’
Academic Year 2015-16

Prepared by: - Board of Studies in Electronics Engineering
Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by

Chairman – BOS       Chairman – Academic Board
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* ONLY FOR SECOND YEAR DIRECT ADMITTED STUDENTS
### Module 5

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***Based on Microcontroller & Applications and Digital Signal Processing***
### T.Y. B.Tech E & TC Engineering Structure with effect from Academic Year 2014-15

#### Module 6

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**** Based on Power Electronics and Digital Integrated Circuits
### Semester I – Irrespective of Module

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$ Elective with tutorial
$$ Elective with Lab
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### Final Year B.Tech E & TC Engineering Structure with effect from Academic Year 2014-15

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### Final Year B.Tech Electronics Engineering Structure with effect from Academic Year 2014-15

#### Semester II – Irrespective of Module

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EC20101: SEMICONDUCTOR DEVICES AND CIRCUITS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Unit I  (9 Hrs)
Semiconductor Diode

A) Intrinsic and extrinsic semiconductors, Conduction mechanism in extrinsic semiconductors, density of states, E distance, Fermi Dirac probability function, Carrier concentrations, Excess carriers, Recombination process, Drift, diffusion, Continuity, Conductivity, Mobility, Mass action law, Einstein relationship, Potential across Graded semiconductor, Open circuited step graded junction, Energy Band diagram of p-n junction, Metallurgical junctions and Ohmic contacts, Depletion region, Barrier potential, Forward and reverse biased diode operation, V-I characteristic equation of diode, Temperature dependence of V-I characteristics, Forward and reverse dynamic resistance, Small signal and large signal diode models, junction capacitances.


Unit II  (9 Hrs)
Field Effect Transistor

A) JFET construction, Symbol, Basic operation, V-I Characteristics, Transfer Characteristics (Shockley's Equation), Cut-off & Pinch-off voltages, Transconductance, Input resistance & Capacitance. Drain to Source resistance, small signal JFET model. MIS structures, two terminal structure: MOS capacitor, concept of accumulation, depletion and inversion; four terminal structure: MOSFET, its I-V characteristics, drain current equation in terms of W/L, Channel length modulation, brief introduction to MOS scaling and scaling issues viz. short channel effects.

B) Non ideal characteristics of MOSFET such as sub threshold conduction, body bias, effect of temp.

Unit III  (6 Hrs)
Bipolar Junction Transistor

A) BJT as a device, Construction, typical junction voltages for cutoff, active and saturation regions, concept of amplification, BJT configurations(CE, CB, CC), Small signal-low frequency h-parameter model, Variation of h-parameters with operating point, small signal high frequency $\pi$ model.

B) Small signal and DC data sheet specifications for BJT
Unit IV

DC analysis of Transistors (8 Hrs)

A) DC analysis of BJT circuits, Concept of DC load line, DC biasing of BJT, Fixed bias, Voltage divider bias and its analysis for stability factors. DC analysis of JFET and MOSFET circuits, Voltage divider bias Self bias and Zero bias

B) Biasing of BJT collector to base bias. Biasing of JFET - Biasing against device variation, biasing for zero current drift

Unit V

AC analysis of Transistors (8 Hrs)

A) Analysis of CE, CC configuration for performance parameters in terms of h parameters, Comparison of performance parameters with CE, CC and CB configurations. Analysis of CS, CD, amplifiers using small signal JFET model.

B) Analysis of CB amplifier using small signal BJT model, analysis of CG amplifier using small signal JFET model

Text Books
1. Integrated Electronics, MillmanHalkias, Tata McGraw Hill
2. Electronic Devices, Thomas L. Floyd, Pearson Education

Reference Books
2. Electronic Devices, Thomas L. Floyd, Pearson Education

Course Outcomes:
The student will be able to-

1. Explain semiconductor physics and PN junction diode.
2. Describe operation, characteristics and applications of JFET and MOSFET.
3. Describe operation, characteristics and applications of BJT
4. Perform DC analysis of amplifier circuits.
5. Perform AC analysis of amplifier circuits
Laboratory Course Syllabus

EC20301:: SEMICONDUCTOR DEVICES AND CIRCUITS

Credits: 01
Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practicals
1. Clipper circuits
2. JFET characteristics
3. JFET self bias circuit
4. MOSFET as a switch
5. MOSFET Characteristics
6. BJT Characteristics
7. BJT as a switch
8. BJT CE Amplifier
9. BJT CC Amplifier

Text Books
1. Integrated Electronics, MillmanHalkias, Tata McGraw Hill
2. Electronic Devices, Thomas L. Floyd, Pearson Education

Reference Books
2. Electronic Devices, Thomas L. Floyd, Pearson Education

Course Outcomes:
The student will be able to-
1. Measure and Verify output of wave-shaping circuits.
2. Plot the V-I characteristics of JFET, BJT and MOSFET.
3. Calculate parameters of FET and BJT from V-I characteristics.
4. Measure amplifier parameters
5. Verify function of MOSFET and BJT as a switch
6. Simulate the given electronic circuit.
Tutorial Course Syllabus

SEMICONDUCTOR DEVICES AND CIRCUITS

Credits: 01
Teaching Scheme: - - Tutorial 1 Hr/Week

List of Contents

1. Semiconductor Theory
2. Semiconductor Theory
3. PN Junction Diodes
4. Diode circuits
5. Diode circuits
6. JFET/ MOSFET
7. BJT DC analysis
8. Thermal stabilization
9. JFET/MOSFET DC analysis
10. BJT AC Analysis
11. JFET AC Analysis

Text Books
1. Integrated Electronics, MillmanHalkias, Tata McGraw Hill
2. Electronic Devices, Thomas L. Floyd, Pearson Education

Reference Books
2. Electronic Devices, Thomas L. Floyd, Pearson Education
EC20102 : ANALOG COMMUNICATION

Credits: 03
Teaching Scheme: - Theory 3 Hrs/Week

Unit I
Introduction To Communication System

A. Analog Communication & Digital Communication basics; Communication System Overview; The Electromagnetic & Optical Spectrum and its usage; Types of Electronic Communication; Base band Communication – Merits, demerits, applications; Communication Channels; Noise Classification, Expressing Noise Levels, Noise in Cascaded Stages, Modulation- Need, Types
B. Spectrum Allocation & Management; Applications of Electronic Communication

Unit II
Amplitude Modulation

A. AM Concepts; Mathematical Treatment for an AM signal; Spectral Analysis; Modulation Index; Efficiency; Power Relations; DSB-FC, DSB-SC and SSB-SC Modulation Techniques – Generation Methods, BW requirements, merits, demerits & applications, Behavior of AM System in presence of noise
B. High level AM Modulator; Frequency Division Multiplexing & its applications

Unit III
Angle Modulation

A. Basic principles of FM and PM; Mathematical Representation; Modulation Index and Sidebands; Spectral Analysis; Behavior of FM/PM System in presence of noise, Noise Suppression Effects of FM; FM Generation Methods-Varactor modulator, Reactance Modulator, Indirect FM generation, and Demodulators; pre-emphasis and de-emphasis
B. NBFM and WBFM; Comparison – AM, FM, PM

Unit IV
Communication Receivers

A. Basic Principles of Signal Reproduction; TRF Receivers; Super Heterodyne Receivers; Intermediate Frequency and Image Frequency; Diode detector, DSB-SC and SSB-SC Detector
B. Dual Conversion Receivers, Automatic gain control circuits
Unit V  
(Antennas and Wave Propagation)  
(8 Hrs)

A. Antenna Fundamentals – Radio waves, Antenna operation, Antenna Reciprocity, Basic Antenna; Common Antenna Types; Propagation Mechanisms - Ground Wave, Sky Wave, Line of Sight; Calculating Received Power; Fading Mechanism

B. Types of fading mechanisms – Multipath Fading, Shadow Fading, Rayleigh Fading, Diversity system

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Course Outcomes:
The student will be able to-
1. Classify modulation techniques, communication channels, antennas & noise.
2. Analyze AM, FM signals and their spectrums.
3. Explain working of modulators, demodulators.
4. Describe propagation mechanisms and fading techniques.
Laboratory Course Syllabus

EC20302 : ANALOG COMMUNICATION

Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practical

1. Study of spectral components of time-domain signals using Digital Storage Oscilloscope (DSO)
2. Generation and detection of DSB-FC (AM) signal
3. Generation and detection of DSB-SC signal
4. Generation and detection of SSB-SC signal
5. FM Generation & demodulation
6. Measurement of Receiver Characteristics
7. Measurement of radiation pattern for an Antenna
8. Implementation of DSF-FC/ DSB-SC/ SSB/ FM modulator using MATLAB
9. Behavior of AM / FM / PM system in presence of noise using MATLAB
10. Gain and Noise Calculations of Cascaded Systems Using MATLAB

Text Books

Reference Books

Course Outcomes:
The student will be able to-
1. Observe time domain waveforms and spectrum of modulators.
2. Measure performance characteristics of super heterodyne radio receiver.
3. Plot radiation pattern of antennas (yagi, dipole, folded dipole antenna).
4. Design AM and FM modulators using MATLAB.
Tutorial Course Syllabus

ANALOG COMMUNICATION

Credits: 01  Teaching Scheme: - - Tutorial 1 Hr/Week

List of Contents

1. Fourier Analysis of signals such as sine wave, triangular wave and square wave
2. Study of various communication channels (microwave, fiber optic cable etc)
3. To measure the attenuation of transmission line
4. Study of series and parallel resonant circuits
5. Comparison of Class A, B, AB, C amplifiers
6. Study of AM Transmitter
7. PAM Generation
8. FM modulation using reactance modulator
9. Design of pre-emphasis and de-emphasis circuit for a FM modulator. Plot the necessary graphs.
10. Estimating the range of image frequency that can be interfered with commercial AM broadcasting channel.
11. Calculating overall noise factor of a three stage cascaded amplifier system.
   To study various Antenna types
   Receiving pattern of an Antenna using field strength meter

Text Books


Reference Books

## Theory Course Syllabus

### EC20103: LINEAR ALGEBRA AND STATISTICS

| Credits: 03 | Teaching Scheme: - Theory 3 Hrs/Week |

#### Unit I.
Vector Spaces and Orthogonality (6 Hrs)

A. Vector spaces, Subspaces, Strategy for choosing the basis for subspaces, change of basis, Orthogonality and least squares, applications to linear models.

B. Fourier series, application to difference equations and Markov chains.

#### Unit II.
General Matrices (6 Hrs)

A. Eigen value – Eigenvector, Quadratic form, real symmetric, Positive and Negative Definite and Semi definite matrix, singular value decomposition, Pseudo inverse and Optimal solution of a linear system of equations.

B. Iterative estimates for Eigen values, Application to differential equation, Application to image processing and statistics.

#### Unit III.
Elements of calculus and Vector calculus (9 Hrs)

A. Sequences and Limits, Differentiability, The Derivative Matrix, Level sets and Gradients, Vector function, Partial Derivatives, Directional Derivatives, Tangent Planes and Normal Planes, Divergence and Curl, Green’s Theorem, Divergence Theorem, Stokes Theorem.

B. Zeros and Poles, Residues and Residue Theorem.

#### Unit IV.
Probability and Random variables (9 Hrs)

A. Probability: Axiomatic definition of probability, Conditional probability, Baye’s theorem, Random variables, distribution and probability density functions (pdf),multiple random variables, Joint distribution and densities, Joint moments, covariance and correlation, Central Limit Theorem.

B. Vector-space representation of random variables, linear independence, inner product, Schwarz Inequality, Elements of estimation theory: linear minimum mean-square error and orthogonality principle in estimation.
Unit V.

Random Process  
(10 Hrs)

A. Random process: Characterization and classification of random process, some important random processes, power spectral density, response of linear system to random input.

B. Fourier transform of random process, Fourier series and KL expansion.

Text Books


Reference Books


Course Outcomes:
The student will be able to-

1. Calculate the bases and dimension of vector spaces.
2. Apply least square solution for curve fitting.
3. Calculate the derivatives and integrals of vector functions.
4. Calculate statistical properties of the random variable.
5. Classify the different random processes.
Unit I  
**Introduction To Signals And Systems**  
(8 Hrs)  
A. Introduction to Signals and Systems; Definitions; Classification of Signals; Signal Operations; Systems-Definitions, Classification  
B. Test Signals

Unit II  
**Time domain representation of Linear Time-Invariant Systems**  
(8 Hrs)  
A. Fundamentals of LTI system; Convolution Sum; Convolution Integral; LTI system with and without memory; Invertibility, Causality of LTI Systems; Stability of LTI system  
B. Properties of Convolution

Unit III  
**Fourier Analysis of Signals**  
(8 Hrs)  
A. Fourier Series (F.S.); Types of F.S; Fourier Transforms (F.T.); Frequency response of LTI systems  

Unit IV  
**Correlation, Energy Spectral Density And Power Spectral Density**  
(8 Hrs)  
A. Correlation and Correlogram; Autocorrelation; Cross correlation; Applications of Correlation; Energy Spectral Density; Power Spectral Density; Correlation and Fourier Series  
B. Correlation, ESD, PSD : Properties & Relationships

Unit V  
**Laplace Transform**  
(8 Hrs)  
A. Unilateral Laplace Transform; Bilateral Laplace Transform; Region of Convergence; Inverse Laplace Transform; Analysis of LTI system using L.T.  
B. Properties of Laplace Transform
Text Books

Reference Books

Course Outcomes:
The Student will be able to -
1. Solve problems of shifting, scaling, convolution and sampling.
2. Classify various signals and systems.
3. Analyze analog signals in frequency domain.
4. Measure correlation between signals.
Theory Course Syllabus

EC21102:: ELECTRICAL MACHINES
Credits: 02
Teaching Scheme: - Theory 2 Hrs/Week

Unit I
Transformers 6 Hrs

B) Special purpose transformers: CT and PT, Ferrite core transformers, phase shift transformer.

Unit II
DC Machines -1 5 Hrs

A) DC amchines - Construction and working principle, commutator, emf equation, types.
B) Types of armature windings.

Unit III
DC Machines -2 5 Hrs

A) DC motors - Working principle, role of commutator, back emf, torque equation, types, motor characteristics, speed control methods, numerical problems, selection and applications of DC motors.
B) Different starters of DC motors.

Unit IV
AC Motors – 1 5Hrs

A) Three phase Induction Motors- Construction, RMF, working principle, operation, types, slip and torque equations, max torque, starting torque, full load torque, condition for max torque, torque-slip characteristics.
B) Different starters of induction motors.

Unit V
AC Motors – 2 5Hrs

B) Stepper motors and servo motors.

Text Books:
1. Electrical Technology – Edward Hughes.
### Reference Books:

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<tr>
<th>No.</th>
<th>Book Title</th>
<th>Author(s)</th>
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<tbody>
<tr>
<td>1</td>
<td>Electric Machinery, TMH (Sixth Edition)</td>
<td>Fitzgerald</td>
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<tr>
<td>2</td>
<td>Electrical Machines, Drives &amp; Power systems</td>
<td>Theodore Wildi</td>
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<tr>
<td>3</td>
<td>Electric Machines, TMH</td>
<td>Nagrath Kothari</td>
</tr>
<tr>
<td>4</td>
<td>Electrical Machines and transformers</td>
<td>Irving Kosow</td>
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### Course Outcomes:

The student will be able to:

1. Understand the importance of magnetic circuit in different electrical machines.
2. Find losses and efficiency of single phase transformer.
3. Understand construction and working of DC generator and solve numerical problems.
4. Understand construction and working of DC motor and solve numerical problems on speed control.
5. Understand construction and working of Induction motor and the T-S characteristic.
6. Solve numerical problems on torque equation of three phase induction motor and understand working of single phase induction motor.
EC21301:: ELECTRICAL MACHINES

Credits: 01  

Teaching Scheme: - Laboratory 2 Hrs/Week

List of experiments:

1. Direct load test on transformer.
2. Speed control of DC shunt motor.
3. Load test on DC shunt motor.
4. Load test on DC series motor.
5. Study of DC motor starters.
7. Study of induction motor starters.
8. Study of single phase induction motor.
10. Study of servo motor.
11. Making of a DC regulated power supply.
12. Study of CT and PT.
13. Study of ferrite core transformer.

Text Books:

5. Electrical Technology – Edward Hughes.

Reference Books:

7. Electric Machines, TMH - Nagrath Kothari.
8. Electrical Machines and transformers - Irving Kosow.

Course Outcomes:
The student will be able to-

1. Perform load tests on a transformer, dc and ac motors.
2. Control the speed of a dc motor using armature voltage and field control methods.
3. Start a motor selecting a proper starter for it.
4. Operate different special purpose machines used in automation systems.
5. Design and fabricate a dc regulated power supply.

FF No. : 654 D
Project Course Syllabus

EC27401: Miniproject

Credits: 2  Teaching Scheme: 4 Hours / Week

Guidelines:

Mini Project will be based on all subjects of that Semester except GP.

1. The Semester Mini Project will be for a group of 3 to 5 students. Head of Department to appoint Mini Project Guides. 2 credits will be awarded to the candidate after the viva voce and project demonstration at the End of Semester.

2. Group formation, discussion with faculty advisor/guide, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the Semester. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.

3. The Assessment Scheme will be:

   (a) Continuous Assessment 50 marks (based on regular interaction, circuit development)
   (b) End Semester 50 marks (based on implementation, testing, results, poster presentation, and demonstration)

Course Outcomes:
The student will be able to –

1. Planning and implementation of hardware/software project
2. Prepare the budget for hardware requirement
3. Demonstrate the project.
4. Work as a team member.
EC21101: CONTROL SYSTEMS

Credits:3

Teaching Scheme: - Theory 3 Hrs/Week

Unit I
Introduction

A) Definition of control system, Open loop, closed loop, Feedback and Feed-Forward control, Mathematical modeling of a physical system, Laplace transforms, Differential equations of a physical system and concept of transfer function. Block Diagram Algebra, Signal flow graph – Mason’s Gain formula.

B) Study of different control system.

Unit II
Time Domain Analysis and Design


B) Effect of addition of Poles and Zeros on Stability.

Unit III
Root Locus and Stability Analysis


B) Analysis of systems with Dead-time

Unit IV
Frequency Domain Analysis

A) Concept of frequency response, frequency domain specifications, Bode plots gain margin, phase margin, design of lead/lag compensators using Bode plots. Introduction to Polar Plots and Nyquist plots.

B) Correlation between time and frequency response, comparison of time domain and frequency domain specifications.

Unit V
State Variable Analysis and Design
A) Concept of state, state variables and state model, State models for continuous time systems (SISO, MIMO) – derivation of transfer function from state models and vice versa, Solution of state equations – state transition matrix.

B) Controllability and Observability, State feedback controller using pole placement, Observers

**Text Books**


“Modern Control Engineering”, Ogata Katsuhiko, 4th Edition, PHI

**Reference Books**


“Control System”, Les Frnical, CENGAGE Learning, India.

**Course Outcomes:**
The student will be able to-

1. Model a given system into transfer function and state model.
2. Find steady state and transient response of control systems from basic principles.
3. Analyse given system for stability.
4. Learn various techniques of sinusoidal frequency analysis.
5. Get introduced to modern control systems approach.
Tutorial Course Syllabus

CONTROL SYSTEMS

Credits: 01

Teaching Scheme: - - Tutorial1Hr/Week

List of Contents

1. System representation
2. Block diagram reduction
3. Signal flow graph
4. Transient response
5. Hurwitz Criteria and Routh Array
6. Root locus
7. Root locus
8. Bode plot
9. Bode plot
10. Polar plot
11. Nyquist plot
12. State variable

Text Books


Reference Books

2. “Control System”, Les Frnical, CENGAGE Learning, India.
Theory Course Syllabus

EC 20105: DIGITAL ELECTRONICS

Credits: 03

Teaching Scheme: - Theory 3 Hrs/Week

Unit I (8 Hrs)

Binary arithmetic & logic simplification
A. Binary, Hexadecimal number systems, Inter conversions, 1’s complement, 2’s complement arithmetic, Binary Coded Decimal codes, Excess-3 Code, Gray code, Standard logic gates, Universal logic gates, Derived gates, Simplification of logic function using Boolean algebra, De Morgan’s Theorem, Sum-of-Products and Product-of-Sums forms of Boolean function, NAND and NOR implementation, Canonical and Standard forms, Karnaugh map up to 4 variables.
B. EBCDIC Code, ASCII code, problems on k-map

Unit II (8 Hrs)

Combinational logic design
B. Code conversion, Comparator IC-7485.

Unit III (8 Hrs)

Sequential logic design
A. Latches and Flip-flops: SR, D, JK, Master-Slave JK, and T, use of preset and clear terminals, schematic symbol, truth table and excitation table, conversion of flip flops, design and analysis of asynchronous and synchronous counters, up/down counters, modulo counters, concept of propagation delay, set up time, hold time, Johnson and Ring counters, application of counters, lock out condition, clock skew, clock jitter, sequence generators, shift registers: SISO, SIPO, PISO, PIPO, bi-directional shift registers, Pseudo Random Binary Sequence (PRBS) generator.
B. Counter IC7490, IC 7493, IC 74191, Shift Register IC 7495.

Unit IV (8 Hrs)

Finite state machines
A. Introduction to state machine, Basic Design steps for these sequential circuits using
state diagram, State Table, State assignment, finite state machine, Mealy machine and Moore machine representation and implementation, sequence detector, Designing state machine using state diagram.

B. Design problems based on finite state machine.

Unit V  
\textbf{Pld, logic families and semiconductor memories}  \hspace{1cm} (8 Hrs)

\textbf{A.} Programmable logic devices: architecture, Study of PAL, PLA, Designing combinational circuits using PLDs, Introduction to logic families.

\textbf{B.} Classification and characteristics of memories RAM, SRAM and DRAM, ROM, PROM, EPROM, EEPROM.

\textbf{Text Books}

1. Donald P Leach, Albert P Malvino, ‘Digital Principles and Applications’  
(TMGH), 6th Edition

2. M. Morris Mano, Digial Design - 3\textsuperscript{rd} Edition (Pearson)

\textbf{Reference Books}


\textbf{Course Outcomes:}
The student will be able to-

1. Carry out inter-conversion between various number systems and logic simplification.

2. Design combinational circuits.

3. Design sequential circuits.

4. Design finite state machine for the given circuit.

5. Compare the performances of basic programmable logic devices.
Laboratory Course Syllabus

EC 20303 : DIGITAL ELECTRONICS

Credits: 01  Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practicals

1. Truth table verification of logic gates
2. Code Conversion using logic gates
3. Design & implement comparator using IC 7485
4. Design & implement BCD Adder using IC 7483
5. Design & implement combinational logic circuit using multiplexer & de-multiplexer
6. Design & implement 3 bit bidirectional shift register using D flip-flop
7. Design & implement pulse train generator using IC 7495
8. Design & implement 3 bit up-down ripple counter using flip-flop
9. Verification of mod-n counters using IC 7490, IC 7493 & IC 74191
10. Design & implement sequence generator

Text Books

Reference Books

Course Outcomes:
The student will be able to-
1. Verify digital logic gates functionality.
2. Implement combinational and sequential circuits for verification of results.
Tutorial Course Syllabus

DIGITAL ELECTRONICS

Credits: 01  Teaching Scheme: - Tutorial 1 Hr/Week

List of Tutorials

1. Binary Arithmetic
2. Simplification and implementation of a Boolean function using canonical and standard forms
3. Simplification and implementation of a Boolean function using k-map
4. Multiplexer and Demultiplexer.
5. Encoder and decoder
6. Flip-flop conversion
7. Up/Down Counters
8. Pulse Train Generator
9. Mealy Machine
10. Mealy Machine
11. Moore Machine
12. Moore Machine

Text Books


Reference Books

Theory Course Syllabus

EC20106: DATA STRUCTURES AND ALGORITHMS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Unit I  
Analysis of Algorithms and Fundamentals of Data Structures (8 +1 Hrs)
A) Analysis of algorithm, Performance Consideration, Time and Space Complexity, Asymptotic notation, Data Type, Data Object and Data Structure, Abstract Data Type (ADT). Types of Data Structures, Searching and Sorting Techniques: merge, quick, radix, selection, heap. Hashing, concept of collision and analysis of collision resolution techniques.

B) Analysis of all Sorting and searching methods.

Unit II  
Linear Data Structures (8 + 1 Hrs)
A) Concept of sequential organization and Ordered List, Linear Data Structured using\'Linked organization: Dynamic Memory Management, Types of Linked List Concept of stack, stack as ADT , Representation of Stack using Array and Linked List Concept of queue, Queue as ADT, Representation of Queue using Array and Linked List

B) Dictionaries: skip-lists

Unit III  
Applications of Linear Data Structures (6 + 1 Hrs)
A) Generalized Linked List, Polynomial Manipulations, Infix to Postfix Conversion and Evaluation, Validity of Parenthesis, Types of queue - Circular Queue,

B) Priority Queue

Unit IV  
NonLinear Data Structures – Trees (10 + 1Hrs)
A) Basic Terminology of Trees, Concept of Binary Tree, Concept of Binary Search Tree, Construction and Traversal of BT, operations on BT, Threaded Binary Tree, Hauffman tree. Priority Queue and Heap, heap sort.

B) Trees and red-black trees
Unit V  
**Graphs**  
(8 + 1 Hrs)

A) Basic Terminology of Graphs, Types of Graphs, Graph Representation, Elementary Graph Operation and Graph Traversal, Directed acyclic graphs: topological sort and longest path, OBST, Spanning Tree – Kruskal’s and Prim’s Algorithm Shortest path algorithm. – Dijkstra’s Shortest Path Algorithm.

B) Shortest and longest paths in directed acyclic graphs.

**Text Books**
1. Tenenbaum A M & Langsam Y: Data Structure Using C. Prentice Hall Of India New Del

**Reference Books**
2. Kakde O G & Deshpande, ”Data Structures And Algorithms”. Indian Society For Technical E

**Course Outcomes:**
The student will be able to-
1. Apply appropriate constructs of C language in coding.
2. Use appropriate data structure for problem solving and programming.
3. Apply suitable operations on various data structures.
4. Calculate time complexity using Big-O notation.
Laboratory Course Syllabus

EC20304: DATA STRUCTURES AND ALGORITHMS

Credits: 01  Teaching Scheme: - Laboratory 2Hrs/Week

List of Practicals

1. Implement the following searching algorithms
   i. Binary Search
   ii. Linear search
2. Implement the following sorting algorithms
   i. Bubble Sort
   ii. Insertion Sort
   iii. Quick Sort
   iv. Merge Sort.
3. Create and manipulate database using structures.
4. Create and manipulate database using Singly Linked List
5. Implement
   i. Doubly Linked List
   ii. Circular Linked List
6. Implement Stack
   i. using array and
   ii. linked list
7. Implement Queue
   i. using array and
   ii. linked list
8. Write a program to add two polynomials
9. Write a program to convert expression in infix form to postfix form
10. Write a program to create binary tree and perform operations on it.
11. Write a program to create graph using adjacency list/matrix
12. Write a program to find shortest path using Dijkstra’s Algorithm

Text Books

1. Tenenbaum A M & Langsam Y: Data Structure Using C. Prentice Hall Of India New Del

Reference Books

Krule R L, Leung B P & Tondo C L: Data Structure And Programming Design In C. Prentice Hall Of India Pvt.Ltd.
Kakde O G & Deshpande ,” Data Structures And Algorithms”. Indian Society For Technical E
Course Outcomes:
The student will be able to-
1. Implement searching and sorting algorithms.
2. Create and manipulate database using static and dynamic memory allocation methods.
3. Perform different operations on linear and non-linear data structures.
Theory Course Syllabus

EC20107: Networks and Lines

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Unit 1: Networks Theorems and Network Topology (9 HRS)

**Part A:** Network Theorems: Superposition, Thevenin’s, Norton’s and Maximum Power transfer Theorems. Concept of Network Topology, Terms used in Topology, Relation between Twigs and Links Properties of a Tree in a Graph, Formation of Incidence Matrix $[A_i]$, number of tree in Graph, Tie-Set Matrix, Cut-Set Matrix

**Part B:** Self-Study: - Network Equilibrium Equation.

Unit 2: TwoPort Network Parameters and Network Functions (8 HRS)

**Part A:** Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Interrelation of Parameters, interconnection of parameters. Network functions for one port and two port networks.

**Part B:** Self-Study: - Pole-zeros of network functions and network stability.

Unit 3: Filters and Attenuators (9 HRS)

**Part A:** Properties of symmetrical Network: Symmetrical Networks (T and Π only). $Z_0$ and $\gamma$ in terms of circuit components, open and short circuit parameters. Filter fundamentals, Constant $K$ –LPF, Constant $K$-HPF and m-derived LPF, m-derived HPF. Introduction to Neper and Decibel, Relation between Neper and Decibel, Symmetrical T and Π type attenuators, Lattice attenuator.

**Part B:** Self-Study: - Properties of Asymmetrical Networks. Constant $K$ – BSF and BPF, Bridge T-attenuator.

Unit 4: Resonance (7 HRS)

**Part A:** Series Resonance: Impedance, Voltage and current variation with frequency, Bandwidth and selectivity. Quality Factor, Magnification factor.

**Part B:** Self-Study: - Parallel resonance: General case: Resistance present in both branches.

Unit 5: Transmission Line Theory (7 HRS)

**Part A:** Types of Transmission lines, Equivalent circuits, Primary and Secondary line constants, Transmission Line Equation Terminations of transmission lines.

**Part B:** Self-Study: - VSWR and Reflection Coefficient.
Text Books:

Reference Books:
1. “Network Analysis”, Van Valkenberg, PHI

Course Outcomes:
The student will be able to-
1. Simplify different networks and circuits using network theorems and Graph theory.
2. Analyze different networks and circuits.
3. Find network parameters and Network functions.
4. Design Attenuators and Filters.
5. Derive the transmission line equation and solve the numerical based on it.
Theory Course Syllabus

EC21103: ELECTRONIC INSTRUMENTATION & MEASUREMENT

Credits: 02          Teaching Scheme: - Theory 2 Hrs/Week

Unit I

Measurement and Error

A. Definitions: Accuracy, Precision, Sensitivity, Resolution, Error. Comparison of Accuracy and Precision
   Significant Figures, Types of Error, Statistical Analysis, Probability of Error, Limiting Error, Problems

B. Standards of Measurement

Unit II

Ammeters

A. Basic meter movement, DC Ammeter. Multirange Ammeters, Aryton Shunt, Extending of Ammeter Ranges

B. RF Ammeter

Unit III

Voltmeters and Multimeters

A. DC Voltmeter: Basic circuit, Multirange Voltmeter, Voltmeter Sensitivity, Loading Effect, Problems. Ohm Meter: Series Type and Shunt Type, it’s Calibration, Multirange Ohmmeter. Typical Multimeter Circuit, Operating Instructions
   Types of DVM, basic Principle, Specifications.

B. AC Voltmeter Using Rectifiers.

Unit IV

Q Meter And Signal Generator

A. Basic Q Meter Circuit, Measurement Methods, Sources of Error, Problems.
   Function of Signal Generator, Front Panel Description,

B. Capacitance Measurement

(5 Hrs)
Unit V
Oscilloscope and Digital Frequency Meter

A. Block Diagram of CRO, Delay Line, Various Controls, Dual Beam and Dual Trace
CRO, Specifications, Probes for CRO. Principle of Digital Frequency Meter, Basic
Circuit, Time Base Selector, Measurement of Time, Ratio and Period.

B. Universal Counter, Decade Counter

Text Books
1. Modern Electronic Instrumentation And Measurement Techniques by
Albert D. Helfrick, William D. Cooper, PHI Publication

Reference Books
1. Electronic Instrumentation by H.S. Kalsi, Tata McGraw Hill Publication

Course Outcomes:
The student will be able to-
1. Describe different terminology related to measurements.
2. Understand the principles of various instruments
3. Solve the numerical on LCRQ Meter and Ohm meter.
4. Differentiate dual beam and dual trace C.R.O.
Laboratory Course Syllabus

EC21302: ELECTRONIC INSTRUMENTATION & MEASUREMENT

Credits: 01  
Teaching Scheme: - Laboratory 2Hrs/Week

List Of Practicals

1. To measure resistance, current, voltage and test the components using DMM
2. To measure voltages using two DMM of different resolution
3. To measure Frequency, Voltage on CRO
4. To measure L, C, R and Q using LCR-Q Meter
5. To measure Voltage, Frequency, Time period, Duty Cycle using DSO
6. FFT Analysis, addition and Subtraction of signals using DSO
7. To measure Distortion using DFM
8. To Use Frequency Counter in frequency, time period, frequency ratio and totalising mode.
9. To measure Harmonics of Waveform on Spectrum Analyzer
10. Filter Analysis Using Spectrum Analyzer

Text Books
1. Modern Electronic Instrumentation And Measurement Techniques by Albert D. Helfrick, William D. Cooper, PHI Publication

Reference Books
1. Electronic Instrumentation by H.S. Kalsi, Tata Mcgraw Hill Publication

Course Outcomes:
The student will be able to-
1. Measure voltage, current, frequency and calibrate voltmeter.
3. Measure distortion in the Waveforms.
4. Analyze the waveform in frequency domain and time domain.
5. Analyze LC Filters.
Project Course Syllabus

EC27402: Miniproject

Credits:2  Teaching Scheme: 4Hours / Week

Guidelines:

Mini Project will be based on all subjects of that Semester except GP.

4. The Semester Mini Project will be for a group of 3 to 5 students. Head of Department to appoint Mini Project Guides. 2 credits will be awarded to the candidate after the viva voce and project demonstration at the End of Semester.

5. Group formation, discussion with faculty advisor/guide, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the Semester. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.

6. The Assessment Scheme will be:

   (a) Continuous Assessment 50 marks *(based on regular interaction, circuit development)*
   (b) End Semester 50 marks *(based on implementation, testing, results, poster presentation, and demonstration)*

Course Outcomes:
The student will be able to –

1. Planning and implementation of hardware/software project
2. Prepare the budget for hardware requirement
3. Demonstrate the project.
4. Work as a team member.
Laboratory Course Syllabus

EC24301: APPLIED ELECTROMECHANICS FOR ROBOTICS

Credits: 01  
Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practicals

1. Introduction to basic components- identification and selection( IR sensors, Diodes, LEDs, Potentiometer, Controller, Driver)
2. In circuit operation of above components
3. Introduction to electromechanical devices- Relays, Position switchesDC Motors etc.
4. Introduction to power supplies- Rectifier module, filter, regulator
5. Speed control and direction reversal of motor
6. PCB soldering technique and PCB assembly
7. PCB soldering technique and PCB assembly
8. Algorithm for Robot maneuvering
9. Mechanical assembly and Testing
10. Mechanical assembly and Testing

Course Outcomes:
The student will be able to-

1. Understand basic components of electromechanical system.
2. Assemble and test the hardware for desired results.
Laboratory Course Syllabus

EC24303: MATLAB FUNDAMENTALS AND PROGRAMMING TECHNIQUES

Credits: 01  Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practicals

1. Basic commands of Matlab
2. Various data types, storage & retrieval
3. Matrix manipulation
4. Matrices Generation
5. Basic Plotting
6. Various waveform Generators
7. String Handling
8. Control statements
9. Reading & storing Image Files
10. Operations on Images
11. GUI
12. GUI

Reference Books

1. Getting Started with MATLAB: Version 7 by RudraPratap

Course Outcomes:

The student will be able to-

1. Use MATLAB to solve basic problems in mathematics and engineering.
2. Apply programming concepts like variables, control statements, functions, scripts, GUI etc to solve more complex technical problems.
Laboratory Course Syllabus

EC24304: ELECTRONICS HARDWARE WORKSHOP

Credits: 01
Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practical

1. Study of Passive and Active components
2. Study of Dual trace oscilloscope, Signal generator, power supply and Digital multimeter
3. Soldering of circuit on general purpose PCB.
4. Artwork design for analog circuit
5. Preparation of PCB 1
6. Preparation of PCB 2
7. Drilling of PCB
8. Soldering of PCB
9. Mini Project

Course Outcomes:
The student will be able to-

1. Identify active and passive components with their ratings.
2. Operate instruments such as CRO, Signal Generator, power supply, multimeter.
3. Prepare PCB for given circuit diagram.
Laboratory Course Syllabus

EC24306:: C++ PROGRAMMING

Credits: 01  Teaching Scheme: - Laboratory 2 Hrs/Week

List of practicals:

1. Programs to understand difference between C and Basic C++ -
   Write a program for Basic arithmetic operations calculator.
2. Basic C++ concepts-
   Write a program to calculate volume of cube, cylinder and rectangular box using
   Function Overloading.
3. Object Oriented Programming basics-
   Write a program to create Student Result database using array of Objects.
4. OOP basics-
   Write a program to add 2 Complex numbers using-
   All types of Constructors
   Destructor
5. Compile Time Polymorphysm- Operator Overloading
   Write a program to overload operators –
   + : to concatenate two strings
   == : to compare two strings for equality
6. Inheritance –
   Write a program to create Student result system using Single Inheritance,
   Base Class – Student Information
   Derived Class – Student Result
7. Run Time Polymorphism –
   Write a program to calculate area of Circle, Traingle, Rectangle using Virtual
   Function
8. Home Assignment -Inheritance Types
   Design and program a computer system using one of the Inheritance type. Use
   concepts like constructor, destructor, polymorphism in your program.

Reference books

1. The Complete Reference C++: by Herbert Schildt
2. Object Oriented Programming using C++: by Robert Lafore
3. Obejct Oriented Programming using C++: E.Balagurusamy
4. Let us C++ :YashwantKanetkar
Course Outcomes:
The student will be able to-

1. Implement algorithms using objects, classes and object oriented constructs like inheritance, polymorphism etc.
2. Develop structured and effective applications using C++.
EC24308: PSpice BASED CIRCUIT SIMULATIONS

Credits: 01  Teaching Scheme: - Practical 2 Hrs/Week

List of practicals:
1. Introduction to WinSpice
2. DC analysis of resistor network
3. Characteristics of p-n junction diode
4. Half wave rectifier
5. Clamper circuit
6. I/O characteristics of BJT
7. BJT CE amplifier
8. Input and output characteristics of JFET
9. JFET CS amplifier
10. RC Low pass filter and High pass filter

References:
1. Winspice manual

Course Outcomes:
The student will be able to-
1. Demonstrate simulation steps in SPICE.
2. Simulate analog circuits using SPICE.
3. Analyze analog circuits using SPICE.
Laboratory Course Syllabus

EC24310: EVENT DRIVEN CIRCUIT SIMULATION

| Credits: 01 | Teaching Scheme: - Practical 2Hrs/Week |

List of practicals:

1. Introduction to IRSIM-switch level simulator
2. Design and simulation of CMOS inverter using IRSIM
3. Design and simulation of CMOS NAND gate using IRSIM
4. Design and simulation of CMOS NOR gate using IRSIM
5. Design and simulation of CMOS combinational circuit -1
6. Design and simulation of CMOS combinational circuit -2
7. Design and simulation of CMOS combinational circuit -3
8. Design and simulation of CMOS combinational circuit -4
9. Design and simulation of CMOS combinational circuit -5
10. Design and simulation of CMOS combinational circuit -6

References
- IRSIM manual

Course Outcomes:
The student will be able to-
1. Demonstrate the simulation steps in IRSIM software.
2. Simulate digital logic gates and combinational circuits.
3. Analyze digital circuits.
Laboratory Course Syllabus

<table>
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<tr>
<th>Credits: 01</th>
<th>Laboratory Scheme: - Laboratory 2Hrs/Week</th>
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</table>

**EC24312: FUNDAMENTALS OF ENGINEERING MATHEMATICS**

**Contents:**

3. Formulae of derivatives and integrations.
7. Complex Numbers: Argand diagram,
8. Complex Numbers: De Moivre’s Theorem.
10. Probability and Random Variables: Basic concepts of probability
11. Probability and Random Variables: Mean and Variance of distributions.
12. Some standard probability distributions.

**Text Books**


**Reference Books**


**Course Outcomes:**

Student will be able to

1. Calculate the bases and dimension of vector spaces.
2. Calculate the limits, derivatives and integrals of continuous functions.
3. Calculate Eigen vectors and Eigen values.
Laboratory Course Syllabus

EC24313: INTRODUCTION TO LINUX

Credits: 01 Laboratory Scheme: - Laboratory 2Hrs/Week

Contents:

1. Pre-Test & LMS Overview
2. Introduction to Linux OS
3. Getting Help in Linux
4. Linux Basic Commands
5. Editor Commands
6. Text Processing Commands
7. Working With Permissions
8. Sorting Files and Folders
9. Linux Process Management
10. Archiving Files
11. Aliasing Commands in Linux
12. File System Management
13. Searching Files and Folders
14. Using SSH
15. Comparing Files
16. Linux Environment Variables
17. Users & Groups
18. Handling Software
19. Run Levels in Linux
20. IP Addressing
21. Misc Commands
22. Shell Scripting

Text Books
1. Any basic book on Linux or Unix
Course Outcomes:
The student will be able to
1. Explain structure of Linux OS.
2. Make use of Linux shell commands.
Laboratory Course Syllabus

HS20108 :: TECHNICAL WRITING

Credits: 01

Teaching Scheme: - Lab2Hrs/Week

Unit I
[A] Definition, Structure and types of reports.
[B] Home Assignments related to the above topics.

(4 + 2 = 6Hrs)

Unit II
[A] Importance of references, glossary and bibliography. How to write and insert them in reports.
[B] Home Assignments related to the above topics.

(5 + 2 = 7Hrs)

Unit III
[A] Use and types of charts and illustrations in report writing
[B] Home Assignments related to the above topics (minimum 25 sentences on each topic).

(5 + 2 = 7Hrs)

Unit IV
[A] Various report writing techniques
[B] Home Assignments related to the above topics.

(5 + 2 = 7Hrs)

Unit V
[A] A detail study of any report (non technical and technical)
[B] Home Assignments related to the above topics.

(5 + 2 = 7Hrs)

Text Books

Reference Books

Course Outcomes:
The student will be able to

1. Understand the concept of report writing, various structures and layouts.
2. Analysis technical report critically and show area of importance if applicable.
3. Will know the correct standardized sequence of technical report writing.
4. Do the correct format for compiling the mini project report.
Laboratory Course Syllabus

**HS20307 :: GENERAL SEMINAR II**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of the Experiment</th>
<th>Mode of Conduct</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Introductory Session</td>
<td>Student activities in groups: Each student must present any technical topic for 15 min followed by an evaluation by the teacher for 10 min using evaluation criterion. All other non-participating must attend and can give suggestions. Each student will give minimum of two presentations per semester.</td>
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<tr>
<td>2.</td>
<td>Presentations by 4 – 5 students (1\textsuperscript{st} Topic)</td>
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**Text Books**

2. “Speaking and writing for effective business communication “Francis Sounderaraj 2009 , Mcmilan Publishers India ltd, delhi

**Reference Books**

Course Outcomes:
The student will be able to
1. Write an appropriate resume as required by the industry.
2. Perform well in the interview because of mock interview.
3. Know how to gather activities of various MNC’s who come for placements in VIT.
4. Be able to give an effective technical presentation.