RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Electronics & Instrumentation Engineering, IV-Semester

DATA STRUCTURES

COURSE CONTENT:

Basic Concept : Data Structure and algorithm preliminaries: Definitions; Data types, Time and Space analysis of Algorithms; Time and space trade-off, Pointers and dynamic memory allocation; Recursion.

Arrays and Structure: Concepts of Linear Search, Binary Search, Evaluation of Polynomial, Polynomial representation, Polynomial Addition, Structures: Internal representation of structure, Self–referential structure, Array: Definitions of Arrays and Lists, Strings, Row/Column major representation of Arrays.

Stack and Queues: Introduction to Stack, Static and Dynamic Representation, Operation, Application of Stack, Evaluation of Expression, postfix expression, Infix, prefix, Queue, Static and Dynamic Representation, Operation, Priority Queue, Circular Queue.

Linked List and Trees: Introduction to Linked List: Singly linked list, circular linked list, doubly linked list, operations on linked list, Introduction to Tree: Definition, Terminology, Generalised tree representation, Binary tree definitions and properties, Representation, Binary Tree Traversal In order, Pre order, Post order, Introduction to Binary Search Tree.

Graphs; Searching & Sorting: Introduction to Graphs: Representation, Adjacency Matrix and List, Indegree, out degree of Graph, Graphs Operation, DFS & BFS, Spanning Tree, Shortest path. Searching and Sorting Methods: Various Searching and Sorting algorithms with complexity analysis.

REFERENCES

1. E Balagurusamy, **Data Structures Using C**, Tata McGraw Hill Education
2. N.K. Tiwari, Jitendra Agrawal, Shishir K. Shandilya, **Data Structures**, I K International Publishing House
3. Achuthsankar S. Nair & T. Mahalekshmi, **Data Structures in C**, PHI
4. R. Venkatesan & S. Lovelyn Rose, **Data Structures**, Wiley India
5. Rajesh K. Shukla, **Data Structures Using C & C++,** Wiley India
6. Langsam, Augenstein & Tenenbaum, **Data Structures Using C & C++,** Pearson
7. Dharmender Singh Kushwaha & Arun Kumar Mishra **Data Structures: A Programming Approach with C**, PHI

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Electronics & Instrumentation Engineering, IV-Semester

Analog Electronics

Low frequency analysis of RC coupled amplifiers, effect of coupling and bypass Amplifier at high frequencies, Hybrid-πmodel equivalent circuit in CE configuration, $f_\alpha, f_\beta, f_\gamma$ parameter, High frequency response of single/two stage amplifiers using BJT & FET. Gain-band width product. Effect of cascading on gain & bandwidth, Transformer coupled and Direct coupled amplifier.

Feedback Amplifier: General feedback theory, characteristics of negative feedback amplifiers, Effect of negative feedback on input and output resistance of amplifiers. Oscillators: Principle of oscillation, Barkhausen stability criterion, Audio frequency oscillator: Phase shift & Wien bridge oscillators, RF Oscillator: Colpitts & Hartley, Crystal Oscillator..

Operational amplifiers: Differential Amplifiers, swamping resistor, Constant current source and current mirror circuit, Equivalent circuit of Op-amp, Virtual ground, Offset error in voltages & currents & their temperature drift, Op-amp parameters such as CMRR, PSRR, Slew rate, frequency response of Op-Amp, Study of Op-amp ICs like 741,324,308 etc., Linear and non-linear application of Op-amp, Integrator, Differentiator, Log& antilog amplifiers, Precision rectifier, comparators, Schmitt trigger , Sample & hold circuit, Instrumentation amplifiers.

Tuned RF voltage amplifiers: Single and double tuned amplifiers, Gain and bandwidth calculations, frequency response of under coupled, critically and over coupled circuits, Introduction to RFICs, Power supplies: Review of regulators using Zener diodes, series and shunt regulators, Over current protection using current limiting fold back and crowbar protection, Regulators using ICs,

Multivibrators circuit using BJT and Op-amp, Emitter coupled binary circuit, 555 – Timer IC, application, Square wave and Triangular wave and Sawtooth wave generators, Linear Wave shaping circuits, RC high pass & low pass circuit, Effect of Tilt or sage

TEXT BOOKS

1. Robert Boylsted Electronic devices and Circuits, PHI
2. Sedra & Smith L, Electronic circuits, McGraw Hill.
3. D Choudhury Roy, Linear Integrated Circuits, New Age International

REFERENCE BOOKS

1. John D. Ryder, Electronics fundamentals & Applications, PHI
2. Milliman and Grabel, Microelectronics, TMH
3. Johns and Martin, Analog Integrate Circuits design, Wiely.
4. Milliman& Halkias Integrated Electronics, McGraw Hill
5. Gayakwad R.A OpAmp 7 Linear Integrated Circuits, PHI

List of Experiments

1. Study of RC coupled CE amplifier and plot its frequency response.
2. Study of RC phase shift Oscillator and measure its frequency response.
3. Study of inverting and Non-inverting amplifier using OP-AMP 741/LM324.
4. Study of integrator and Differentiator using OP-AMP 741/LM324.
5. Study of instrumentation amplifier using OP-AMP 741/LM324.
6. Study of voltage regulator using IC723 and find its line and load regulation.
7. Study of Astable multivibrator using IC555 and measure its Duty cycle.
8. Study of high pass and low pass filter and measure its cut-off frequency.
9. Study of ALL-pass filter and calculate phase shift of it.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Electronics & Instrumentation Engineering, IV-Semester

Sensors and Transducers

Role of transducers in instrumentation- Transducers construction, classification and characteristics. Principles of operation and characteristics, interfacing of transducers and signal conditioning

Transducers for measurement of displacement, strain, velocity, acceleration etc. Potentiometer, LVDT, Strain gauge, capacitance gauge, piezoelectric transducers and accelerometers.

Force and pressure measurement:
Force: Standards and Calibration, Basic methods of force measurement (Spring, beam, diaphragm) Strain gauge: basic principal, gauge factor, types of strain gauge, materials and their properties, bonding material compensation techniques, bridge configuration, Rosettes, Tactile sensors, Piezoelectric sensors, LVDT as secondary sensor.
Pressure: Standards and calibration Units and relations.
Positive Pressure Sensors:
Manometers – U tube, Well type, inclined tube, Ring balance, Micro manometer, use of seal pots, range of measurement
Elastic – Bourdon, Diaphragm, Bellows and their types, materials and their properties, range of measurement
Electronic – LVDT, Strain gauge, Capacitive, Piezoelectric, Thin film, Variable reluctance, Vibrating element (Diaphragm and Wire),
High Pressure Measurement – Bulk modulus cell, Bridgeman type
Differential Pressure Measurement: Force balance, Motion balance, Capacitance delta cell, Ring balance DP cell.
Vacuum measurement
McLeod gauge, Thermal Conductivity (Pirani, Thermocouple), hot cathode ionization gauge, Molecular momentum (Knudsen) gauge, Cold Cathode ionization (Penning) gauge.
Calibrating Instruments – Dead Weight Tester (Pressure, Vacuum).

Temperature measurement:
Temperature Scales, Standards and Units and relations, Classification of temperature sensors.
Mechanical: Bimetallic Thermometer – Working Principle, Various types, Filled system thermometers – SAMA classifications, Sources of errors and their remedies, Dip effect.
Electrical: Resistance Temperature Detectors – Principle, materials and their properties, Types and ranges, different sources of errors and compensations.
Thermistor: Types (NTC, PTC), Measuring Circuits
Thermocouple: Terminology, Types (B, E, J, K, R, S, T), determination of polarity, Characteristics, Laws of thermoelectricity, Study of thermocouple tables (calculation of intermediate temperature and voltage), Lead wire compensation, Cold junction compensation techniques, Protection (Thermo well), EMF Measurement methods, Thermopiles
Non-contact Types: Pyrometers: Total Optical, Infrared.

Transducers for measurement of flow and level. Turbo magnetic, Electromagnetic and other flow meters. Various methods of level measurements, Ultrasonic level gauge. Measurement of humidity and moisture. Various sensors employed in instrumentation, introduction to MEMS, wireless sensors, finger print sensors.

Text Books:

1. Nakra B.C. & Choudhory K.K., Instrumentation, Measurement & Analysis, TMH.

Reference Books:

1. Patranabis D., Principles of Industrial Instrumentation. TMH.
2. Murthy, Transducers.

List of Experiments:-

1. Study and characteristics of various active & passive transducers
2. Study and characteristics of LVDT & to measure the displacement using LVDT
3. Study of strain gauge & determine its characteristics & gauge factor.
4. Study and characteristics of Thermistor ,thermocouple &IC temperature sensor for measurement of temperat
5. Study of potentiometer and draw its characteristics.
6. Study of capacitive transducer and determine its characteristics.
7. Study of resistive transducer and determine its characteristics.
8. Study of Inductive transducer and determine its characteristics
9. Study LDR, photodiode & LED and other optical sensor and determine the characteristics.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Electronics & Instrumentation Engineering, IV-Semester

Digital Electronics

Minimization Techniques And Logic Gates

Minimization Techniques: Boolean postulates and laws – De-Morgan's Theorem -Principle of Duality - Boolean expression - Minimization of Boolean expressions-Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map Minimization – Don't care conditions - Quine-McCluskey method of minimization.

Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NORImplementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. TTL and CMOS Logic and their characteristics – Tristate gates

Combinational Circuits

Design procedure – Half adder – Full Adder – Half subtractor – Full subtractor – Parallel binary adder, parallel binary Subtractor – Fast Adder - Carry Look Ahead adder – Serial Adder/Subtractor - BCD adder – Binary Multiplier – Binary Divider - Multiplexer/ Demultiplexer – decoder - encoder – parity checker – parity generators – code converters - Magnitude Comparator.

Sequential Circuits

Latches, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation–Application table – Edge triggering – Level Triggering – Realization of one flip flop using other flip flops – serial adder/subtractor- Asynchronous Ripple or serial counter –Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Programmable counters – Design of Synchronous counters: state diagram- State table –State minimization –State assignment - Excitation table and maps-Circuit implementation - Modulo–n counter, Registers – shift registers - Universal shift registers– Shift register counters – Ring counter – Shift counters - Sequence generators.

Memory Devices

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM –EAPROM, RAM – RAM organization – Write operation – Read operation. Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell – Dynamic RAM cell. Implementation of combinational logic circuits using ROM, PLA, PAL.

Synchronous Sequential Circuits: General Model – Classification – Design – Use of Algorithmic State Machine.

Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits.

TEXT BOOKS RECOMMENDED:

1. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 /
2. Pearson Education (Singapore) Pvt. Ltd., New Delhi.
3. S. Salivahanan and S. Arivazhagan, Digital Circuits and Design.

REFERENCE BOOKS:

1. John F.Wakerly, Digital Design, Fourth Edition, Pearson/PHI
2. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications.
3. William H. Gothmann, Digital Electronics.

List of Experiments:

1. Study of various basic gates(IC 7400,7402,7404,7486,7408 etc.) & to verify its truth table.
2. Verify the operation of NAND and NOR gates as universal gates.
3. Study of half and full adder / half and full subtractor & verify its truth table.
4. Study of 4:1 and 8:1 MUX and verify its truth table.
5. Study of 2x4 and 4x8 DEMUX and verify its truth table.

6. Verify truth table of SR, JK, T and D flip-flops using IC 7473, IC 7474 and IC7476.
7. Study the decade counter using IC7490 and verify its operation using truth table.
8. Study the 4-bit ripple counter using IC7493 and verify its operation. Plot the waveform at output of each flip-
9. Study of RAM, ROM, PROM, and EPROM and determine their parameters.
10. Study of Mealy and Moore machine and to design state diagram and state table.

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Choice Based Credit System

Electronics & Instrumentation Engineering, IV-Semester

Material Science

Course Objectives and desired Learning Outcomes:

1. Predict approximate physical and mechanical behavior of a material based on the type of bonding present (covalent, ionic, metallic, and/or van der Waals) and the presence of any of the several types of defects common in condensed matter.
2. Use knowledge of the crystal structure (BCC, FCC, and HCP) of a metal to make general predictions about the metalís ability to plastically deform.
3. Calculate the extent of diffusion-driven composition changes based upon composition, time, and temperature.
4. Predict the equilibrium microstructure of a material comprised of two constituents (e.g., Fe and C or Al and Cu) given the binary phase diagram and thermal history of the material.
5. Select materials for different applications based on the constraints of the given applications.

COURSE CONTENT

Atomic structure, molecules and general bonding principles, crystal system and structure , Miller indices, Bravais lattice, Bragg's law, crystal structure for metallic elements, structural imperfections, dielectric parameters, polarsation, static dielectric constant of solids, ferroelectric materials, piezoelectricity, compex dielectric constant, dipolar relaxation, Debye equation , dielectric loss, insulating materials and their properties, composite materials

Magnetism: fundamental concepts pertaining to magnetic fields, magnetic dipole movement of current loops, orbital magnetic dipole movement and angular momentum of simple atomic model, classification of magnetic materials, spin magnetic moment, paramagnetism, ferromagnetism, spontaneous magnetization and Curie-Weiss law, ferromagnetic domains, magnetic anisotropy, magnetostriction, antiferromagnetism, ferrites and its applications, magnetic resonance

Conductors: introduction, atomic interpretation of Ohm's law, relaxation time, collision time, mean free path , electron scattering, resistivity of metals, Linde's rule, Joule's law, thermal conductivity of metals, high conductivity materials, high resistivity materials, solder and electrical contact materials, carbon brushes, fuses, superconductivity-The free electron model, thermodynamics and properties of superconductors, meissner effect, classification of superconductors

Semiconductors: chemical bonds in Ge and Si, carrier density, extrinsic semiconductor, n-type , p-type semiconductor, Hall effect, mechanism of current flow, drift current, diffusion current, Einstein relation, materials for fabrication of semiconductor devices, fabrication technology , continuity equation, capacitance of junction barrier, junction transistors, thermistor, variastors

Optical properties of materials: introduction, electromagnetic radiation spectrum, refractive index, reflection, Birefringence, Translucency, colourcentres, dispersion, absorption, excitons, photoelectric emission, electroluminescence , photoconductivity, photoelectric cells, lasers, ruby lasers, Nd-YAG laser, carbon dioxide laser, optical fibres, fibre materials, mechanism of refractive index variations, fabrication of fibre, fibre cables, solar cell, fuel cell, MHD generators.

TEXT BOOKS:-

1. Banerjee-Electrical & Electronics Material,PHI.

2. S. O. Kasap-Priniciple of Electronics Material &Device,TMH.

3. Jones- Material Science for Electrical & Electronics Enginnering,Oxford.

4. V.Raghvan Material science&engineering,PHI.

REFERENCE:-

1.J.Allison ElectronicsEnginnering, Material &Device,TMH.

2.Gilmore: Material Science, Cengage Learnings.

3.Gupta & Gupta Advance Electrical & Electronics Material,Wieley India.

4.James F.Shackelford-Introduction Material Science for Enginnering Pearson.

5.V.Rajendran - Material science,TMH.

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Electronics & Instrumentation Engineering, IV-Semester

Systems Engineering

COURSE OBJECTIVE

This course in systems engineering examines the principles and process of creating effective systems to meet application demands. The course is organized as a progression through the systems engineering processes of analysis, design, implementation, and deployment with consideration of verification and validation throughout.

COURSE CONTENT

What is System Engineering, Origin, Examples of Systems requiring systems engineering,Systems Engineer Career Development Model, Perspectives of Systems Engineering, Systems Domains, Systems Engineering Fields, SystemEngineering Approaches.

Structure of Complex Systems, System Building Blocks and Interfaces, Hierarchy of Complex Systems, System Building Blocks, The System Environment, Interfaces and Interactions, Complexity in Modern Systems.

Concept Development and Exploration, Originating a New System, Operations Analysis, Functional Analysis, Feasibility, System Operational Requirements, Implementation of Concept Exploration.

Engineering Development, Reducing Program Risks, Requirements Analysis, Functional Analysis and Design, Prototype Development as a Risk Mitigation Technique, Development Testing, Risk Reduction.

Integration and Evaluation, Integrating, Testing, And Evaluating The Total System, Test Planning And Preparation, System Integration, Developmental System Testing, Operational Test And Evaluation, Engineering For Production, Transition From Development To Production, Production Operations.

COURSE OUTCOME

After successful completion of the course, students would be able to Plan and manage the systems engineering process and examine systems from many perspectives (such as software, hardware, product, etc.) Students can distinguish critical functions, diagnose problems, and apply descoping strategies and judge the complexity of production and deployment issues.

EVALUATION

Evaluation will be a continuous and integral process comprising classroom and external assessment.

REFERENCES:

1. Alexander Kossiakoff, William N Sweet, “System Engineering Principles and Practice, Wiley India
2. Blanchard Fabrycky, Systems engineering and analysis, Pearson
3. Dennis M. Buede, William D.Miller, “The Engineering Design of Systems: Models & Methods” Wiley India
4. JeffreyL Whitten, Lonnie D Bentley, “System Analysis and Design Methods”
5. Richard Stevens, Peter Brook,” System Engineering – Coping with complexity, Prentice Hall

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

Choice Based Credit System

Electronics & Instrumentation Engineering, IV-Semester

Programming Tools

List of Experiments

1. Study of SPICE commands and Simulate basic analog circuits using SPICE tools.
2. Write SPICE programme for half and Full wave rectifier and simulate using SPICE simulator.
3. Write SPICE programme for Clipper and Clamper and Simulate using SPICE simulator.
4. Write SPICE programme for CE amplifier and Simulate using SPICE simulator.
5. Study of XILINX tool flow and simulate basic digital circuits using VHDL.
6. Write basic VHDL code for MUX/DEMUX and simulate using XILINX simulator.
7. Write VHDL code for Synchronous counter and simulate it.
8. Study of MATLAB tool and implement basic electronics circuits.