

**SHADAN WOMEN'S COLLEGE OF ENGINEERING & TECHNOLOGY**  
**Khairatabad, Hyderabad**  
**(An Autonomous Institution)**  
**VLSI SYSTEM DESIGN**  
**APPLICABLE FOR ACADEMIC YEAR 2023-24 ADMITTED BATCH**  
**R23 COURSE STRUCTURE AND SYLLABUS**

**II YEAR I – SEMESTER**

Course Code	Course Title	L	T	P	Credits
5857BD	1. Advanced Computer Architecture	3	0	0	3
5857BE	2. Nanomaterials & Nanotechnology	3	0	0	3
5857BF	3. Hardware Security	3	0	0	3
Open Elective	Open Elective	3	0	0	3
585706	Dissertation Work Review – II	0	0	12	6
	<b>Total Credits</b>	<b>6</b>	<b>0</b>	<b>12</b>	<b>12</b>

**II YEAR II - SEMESTER**

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review - III	0	0	12	06
Dissertation	Dissertation Viva-Voce	0	0	28	14
	<b>Total</b>	<b>0</b>	<b>0</b>	<b>40</b>	<b>20</b>

**Open Electives:**

1. 5802ZA -Business Analytics
2. 5802ZB-Industrial Safety
3. 5802ZC-Operations Research
4. 5802ZD-Cost Management of Engineering Projects
5. 5802ZE -Composite Materials

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**DEPARTMENT OF ECE, M.TECH.- II YEAR- I SEMESTER**  
**VLSI SYSTEM DESIGN**  
**ADVANCED COMPUTER ARCHITECTURE (PE - V)**

**Course Objectives:**

1. To understand the fundamental of computer design
2. To know the pipelines and parallelism concepts
3. To know the issues in interconnect networks

**Course Outcomes:** At the end of the course, students will be able to:

1. Familiarize the instruction set, memory addressing of Computer
2. Handle the issues in pipelining and parallelism
3. Familiarize the practical issues in inter network

**UNIT - I**

**Fundamentals of Computer Design:** Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, measuring and reporting performance, quantitative principles of computer design, Amdahl's law. Instruction set principles and examples- Introduction, classifying instruction set- memory addressing- type and size of operands, operations in the instruction set.

**UNIT - II**

**Pipelines:** Introduction, basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe line for RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties.

**Memory Hierarchy Design:** Introduction, review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.

**UNIT - III**

**Instruction Level Parallelism the Hardware Approach:** Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo's approach, Branch prediction, high performance instruction delivery- hardware based speculation.

**ILP Software Approach:** Basic compiler level techniques, static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues -Hardware verses Software.

**UNIT - IV**

**Multi Processors and Thread Level Parallelism:** Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – memory architecture, Synchronization.

**UNIT - V**

**Inter Connection and Networks:** Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters.

**Intel Architecture:** Intel IA- 64 ILP in embedded and mobile markets Fallacies and pit falls

**TEXT BOOK:**

1. John L. Hennessy, David A. Patterson, “Computer Architecture: A Quantitative Approach”, 3rdEdition, Elsevier.

**REFERENCE BOOKS:**

1. John P. Shen and Miikko H. Lipasti, “Modern Processor Design: Fundamentals of Super Scalar Processors”, 2002, Beta Edition, McGraw-Hill
2. Kai Hwang, Faye A.Brigs., “Computer Architecture and Parallel Processing”, Mc Graw Hill.
3. DezsoSima, Terence Fountain, Peter Kacsuk, “Advanced Computer Architecture - A DesignSpace Approach”, Pearson Education.

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**VLSI SYSTEM DESIGN**  
**NANOMATERIALS AND NANOTECHNOLOGY (PE –V)**

**Course Objectives:**

1. To know the characteristics of nano materials and their utility
2. To understand the basic science behind the design and fabrication of nano scale systems.
3. To know the basic principle of working of MEMS and its applications

**Course Outcomes:** At the end of the course, students will be able to:

1. Formulate new engineering solutions for current problems and competing technologies for future applications.
2. Made inter disciplinary projects applicable to wide areas by clearing and fixing the boundaries in system development.
3. Gather detailed knowledge of the operation of fabrication and characterization devices to achieve precisely designed systems

**UNIT - I**

Introduction of nano materials and nanotechnologies, Features of nanostructures, Applications of nano materials and technologies, Nano dimensional Materials 0D, 1D, 2D structures , Size Effects, Fraction of Surface Atoms, Specific Surface Energy and Surface Stress, Effect on the Lattice Parameter, Phonon Density of States, the General Methods available for the Synthesis of Nanostructures, precipitative, reactive, hydrothermal/solvo thermal methods, suitability of such methods for scaling , potential Uses.

**UNIT- II**

Fundamentals of nanomaterials, Classification, Zero-dimensional nanomaterials, One-dimensional, nanomaterials, Two-dimensional nanomaterials, Three dimensional nanomaterials, Low-Dimensional Nanomaterials and its Applications, Synthesis, Properties, and Applications of Low-Dimensional Carbon-Related Nanomaterials.

**UNIT- III**

Micro- and Nanolithography Techniques, Emerging Applications, Introduction to Micro electro mechanical Systems (MEMS), Advantages and Challenges of MEMS, Fabrication Technologies, Surface Micromachining, Bulk Micromachining, Molding, Introduction to Nano Phonics.

**UNIT- IV**

**CNTs:** Introduction, Synthesis of CNTs - Arc-discharge, Laser-ablation, Catalytic growth, Growth mechanisms of CNT's, Multi-walled nanotubes, Single-walled nanotubes, Optical properties of CNT's, Electrical transport in perfect nanotubes, Applications as case studies, Synthesis and Applications of CNT's.

**UNIT - V**

Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane based application, polymer based application.

**TEXT BOOKS:**

1. I Gusev and A A Rempel, "Nanocrystalline Materials", Cambridge International Science Publishing, 1 st Indian edition by Viva Books Pvt. Ltd. 2008.
2. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath, James Murday, "Nanoscience and Nanotechnology", Tata McGraw Hill Education 2012.

**REFERENCE BOOKS**

1. Kenneth J. Klabunde and Ryan M. Richards, "Nanoscale Materials in Chemistry", 2 edition, John Wiley and Sons, 2009.
2. Bharat Bhushan, "Springer Handbook of Nanotechnology", Springer, 3<sup>rd</sup> edition, 2010.
3. Kamal K. Kar, "Carbon Nanotubes: Synthesis, Characterization and Applications", Research Publishing Services; 1 st edition, 2011, ISBN-13: 978-9810863975.

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**VLSI SYSTEM DESIGN**  
**DESIGNHARDWARE SECURITY (PE - V)**

**Course Objectives:**

1. To initiate students to hardware attacks (side channel, faults, probing)
2. To give possible counter measures and more secure system designs
3. To the passive and active bus probing
4. To know the injecting forged data on communication links

**Course Outcomes: Students will be able to**

1. Design a more secure systems by knowing countermeasures of various hardware attacks
2. Experiment the impressive efficiency of hardware attacks
3. Monitor computation time or power consumption to reveal secrets
4. Design a secure systems which lead to privilege escalation and compromise

**UNIT - I**

**Introduction to Hardware Security:** Overview of the computing system, Layers of computing system, Hardware security vs hardware trust, Attacks, Vulnerabilities and counter measures, Conflict between security and Test/Debug, Evolution of Hardware security, Birds eye view, Common hardware security primitives, Performance reliability vs security, Security architecture

**UNIT - II**

**Hardware Trojans:** Introduction, SoC design flow, Hardware Trojans, Hardware Trojans in FPGA designs, Hardware Trojans taxonomy, Trust benchmarks, Countermeasures against Hardware Trojans, Software induced hardware trojan attacks,

**UNIT - III**

**Side-Channel Attacks:** Introduction, Background on side-channel attacks, Power analysis attacks, Electromagnetic side-channel attacks, Fault injection attacks, Timing attacks, Covert channels, Side channel resistant design, Software induced side channel attacks.

**UNIT - IV**

**Test Oriented Attacks:** Introduction, Scan based attacks, JTAG based attacks, Pre-silicon security and trust assessment for SoCs, Post-silicon security and trust assessment for SoCs.

**UNIT - V**

**Physical Attacks and Counter Measures:** Introduction, Reverse engineering, Probing attacks, Invasive fault injection attack, Security issues in IP based SoC design, Security issues in FPGA, PCB security challenges and attack modes.

**TEXT BOOKS:**

1. Swarup Bhunia, Mark Tehranipoor, "Hardware Security A hands on learning approach", Morgan Kaufmann Publisher, An Imprint of Elsevier.
2. Douglas R Stinson, "Cryptography: Theory and practice", CRC Press

**REFERENCE BOOKS:**

1. Alfred J Menezes, Paul C Van Oorschot, Vanstone, A. Scott "Handbook of applied Cryptography", CRC Press
2. Stefan Mangard, Elisabeth Oswald, Thomas Popp, "Power analysis attacks: Revealing thesecrets of smart cards", Springer-Verlag.

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**VLSI SYSTEM DESIGN**  
**BUSINESS ANALYTICS (Open Elective)**

**Prerequisite:** None

**Course objectives:**

- Understand the role of business analytics within an organization.
- Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
- To become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/Operations research techniques.
- Manage business process using analytical and management tools.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

**Course Outcomes:**

- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights.

**UNIT- I**

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

**UNIT- II**

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

**UNIT- III**

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

**UNIT- IV**

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carlo Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

**UNIT- V**

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

**TEXT BOOKS:**

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.



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**VLSI SYSTEM DESIGN**  
**INDUSTRIAL SAFETY (Open Elective)**

**Course Objectives:**

- To provide information regarding different elements of industrial water pollution and Methods of treatment.
- To expose to the various industrial applications, maintenance, preventive measures taken against wear and tear.

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

- Know how to take safety measures in executing works
- Identify the need for maintenance (or) replacement of equipment
- Understand the need for periodic and preventive maintenance

**UNIT- I**

**Industrial safety:** Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

**UNIT- II**

**Fundamentals of maintenance engineering:** Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**UNIT- III**

**Wear and Corrosion and their prevention:** Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications,

- i. Screw down grease cup,
- ii. Pressure grease gun,
- iii. Splash lubrication,
- iv. Gravity lubrication,
- v. Wick feed lubrication
- vi. Side feed lubrication,
- vii. Ring lubrication,

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**UNIT- IV**

**Fault tracing:** Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like,

- i. Any one machine tool,
- ii. Pump
- iii. Air compressor
- iv. Internal combustion engine,
- v. Boiler,
- vi. Electrical motors, Types of faults in machine tools and their general causes.

**UNIT- V**

**Periodic and preventive maintenance:** Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of:

- i. Machine tools,
- ii. Pumps,
- iii. Air compressors,
- iv. Diesel generating (DG) sets,

Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance

**REFERENCE BOOKS:**

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

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**VLSI SYSTEM DESIGN**  
**OPERATIONS RESEARCH (Open Elective)**

**Prerequisite:** None

**Course Outcomes:** At the end of the course, the student should be able to

- Students should be able to apply the dynamic programming to solve problems of discrete and continuous variables.
- Students should be able to apply the concept of non-linear programming
- Students should be able to carry out sensitivity analysis
- Student should be able to model the real-world problem and simulate it.

**UNIT- I**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

**UNIT- II**

Formulation of a LPP - Graphical solution revised simplex method - duality theory – dual simplex method- sensitivity analysis - parametric programming

**UNIT- III**

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem – max flow problem - CPM/PERT

**UNIT- IV**

Scheduling and sequencing - single server and multiple server models – deterministic inventory models- Probabilistic inventory control models - Geometric Programming.

**UNIT- V**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

**TEXT BOOKS/ REFERENCE BOOKS:**

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

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**VLSI SYSTEM DESIGN**  
**COST MANAGEMENT OF ENGINEERING PROJECTS (Open Elective)**

**Prerequisite:** None

**UNIT- I**

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

**UNIT- II**

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre-project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

**UNIT- III**

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

**UNIT- IV**

Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

**UNIT- V**

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

**TEXT BOOKS/ REFERENCE BOOKS:**

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

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**VLSI SYSTEM DESIGN**  
**COMPOSITE MATERIALS (Open Elective)**

**Prerequisite:** None

**UNIT – I**

**INTRODUCTION:** Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

**UNIT – II**

**REINFORCEMENTS:** Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

**UNIT – III**

**Manufacturing of Metal Matrix Composites:** Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. **Manufacturing of Ceramic Matrix Composites:** Liquid Metal Infiltration – Liquid phase sintering. **Manufacturing of Carbon – Carbon composites:** Knitting, Braiding, Weaving. Properties and applications.

**UNIT – IV**

**Manufacturing of Polymer Matrix Composites:** Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

**UNIT – V**

**Strength:** Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

**TEXT BOOKS/ REFERENCE BOOKS:**

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K. K. Chawla.
5. Composite Materials Science and Applications – Deborah D. L. Chung.  
Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi