UTTARAKHAND TECHNICAL UNIVERSITY, DEHRADUN

M TECH (VLSI-Design) Programme

2018

M. Tech. (Electronics and Telecommunication)
Curriculum Structure
Specialization: VLSI Design

Semester-I

Sr. No.	Course Type/Code	Course Name
1	Core 1/ MVLT-101	Advance VLSI Design
2	Core 2/ MVLT-102	Advance VLSI Technology
3	Prog. Specific Elective PE1	Elective I
	MVLT-111	(1) VLSI signal processing
	MVLT-112	(2) CMOS RF Design
	MVLT-113	(3) Network on chip design
4	Prog. Specific Elective PE2	Elective II
	MVLT-121	(1) Advance Optical fiber communication
	MVLT-122	(2) Designing with ASICs
	MVLT-123	(3) Adv. Digital communication
5	LAB 1/ MVLP-101	VLSI circuit Design lab
6	LAB 2/ MVLP-102	VLSI signal processing lab (MATLAB)
7		Research Methodology and IPR
8	Aud 1	Audit course 1

Semester-II

Sr. No.	Course Type/Code	Course Name
1	Core 3/ MVLT-201	CAD using VLSI system Design
2	Core 4/ MVLT-202	Algorithm for VLSI Physical Design automation
3	Prog. Specific Elective PE3	Elective III
	MVLT-231	(1) CMOS analog circuit Design
	MVLT-232	(2) Memory Technology
	MVLT-233	(3) SOC Design
4	Prog. Specific Elective PE2	Elective IV
	MVLT-241	(1) Low power VLSI Design

	MVLT-242	(2) Memory Technologies
	MVLT-243	(3) Hardware software codesign
5	LAB 3/ MVLP-401	FPGA Design Lab
6	LAB 4/ MVLP-202	TCAD Lab
7	MVLP-203	Seminar
8	Aud 2	Audit course 2

Semester-III

Sr. No.	Course Type/Code	Course Name
1	Prog. Specific Elective PE5	Elective V
	MVLT-351	(1) Testing of VLSI circuit
	MVLT-352	(2) Nano materials and Nanotechnology
	MVLT-353	(3) FPGA architecture and application
2	Open Elective / MVLT-591	1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy
3	Dissertation / MVLP-301	Dissertation Phase – I

Semester-IV

Sr. No.	Course Type/Code	Course Name
1	Dissertation / MVLP-401	Dissertation Phase – II

Audit course 1 & 2

English for Research Paper Writing

Disaster Management

Sanskrit for Technical Knowledge

Value Education

Constitution of India

Pedagogy Studies

Stress Management by Yoga

Semester-I

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Core 1/ MVLT-101	Advance VLSI Design	3	0	0	3
2	Core 2/ MVLT-102	Advance VLSI technology	3	0	0	3
3	Prog. Specific Elective PE1	Elective I	3	0	0	3
	MVLT-111	(1) VLSI signal processing				
	MVLT-112	(2) CMOS RF Design				
	MVLT-113	(3) Network on chip design				
4	Prog. Specific Elective PE2	Elective II	3	0	0	3
	MVLT-121	(1) Advance Optical fiber communication				
	MVLT-122	(2) Designing with ASICs				
	MVLT-123	(3) Adv. Digital communication				
5	LAB 1/ MVLP-101	VLSI circuit Design lab	0	0	4	2
6	LAB 2/ MVLP-102	VLSI signal processing lab (MATLAB)	0	0	4	2
7		Research Methodology and IPR	2	0	0	2
8	Aud 1	Audit course 1	2	0	0	0
9		**Total**	16	0	8	18

Semester-II

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Core 3/ MVLT-201	CAD using VLSI system Design	3	0	0	3
2	Core 4/ MVLT-202	Algorithm for VLSI Physical Design automation	3	0	0	3
3	Prog. Specific Elective PE3	Elective III	3	0	0	3
	MVLT-231	(1) CMOS analog circuit Design				
	MVLT-232	(2) Memory Technology				
	MVLT-233	(3) SOC Design				

4	Prog. Specific Elective PE2	Elective IV	3	0	0	3
	MVLT-241	(1) Low power VLSI Design				
	MVLT-242	(2) Memory Technologies				
	MVLT-243	(3) Hardware software codesign				
5	LAB 3/ MVLP-201	FPGA Design Lab	0	0	4	2
6	LAB 4/ MVLP-202	TCAD Lab	0	0	4	2
7	MVLP-203	Seminar	0	0	4	2
8	Aud 2	Audit course 2	2	0	0	0
9		**Total**	14	0	12	18

Semester-III

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Prog. Specific Elective PE5	Elective V	3	0	0	3
	MVLT-351	(1) Testing of VLSI circuit				
	MVLT-352	(2) Nano materials and Nanotechnology				
	MVLT-353	(3) FPGA architecture and application				
2	Open Elective / MVLT-391	1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy	3	0	0	3
3	Dissertation / MVLP-301	Dissertation Phase – I	0	0	20	10
		Total	6	0	20	16

Semester-IV

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Dissertation / MVLP-401	Dissertation Phase – II	--	--	32	16
		Total	--	--	32	16

Audit course 1 & 2

1. for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga

Paper Code: MVLT 101
Paper: ADVANCED VLSI DESIGN

Unit 1

Introduction : Basic principle of MOS transistor, Introduction to large signal MOS models (long channel) for digital design.

MOS Circuit Layout & Simulation and manufacturing: scaling, MOS SPICE model and simulation, CMOS Layout: design rules, Transistor layout, Inverter layout, NMOS and CMOS basic manufacturing steps.

Unit 2

The MOS Inverter : Inverter principle, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, switching characteristics, Propagation Delay, Power Consumption.

Combinational MOS Logic Design : Static MOS design, Ratioed logic, Pass Transistor logic, complex logic circuits.

Unit 3

Sequential MOS Logic Design

Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Astable Circuits. Memory Design: ROM & RAM cells design

Dynamic MOS design : Dynamic logic families and performances.

Clock Distribution Clock Distribution. Input and Output Interface circuits.

Unit 4

Subsystem design

Design styles, design concepts: Hierarchy, Regularity, Modularity, Locality. CMOS Sub system design:
Adders, Multipliers.

Text Books

S. Kang & Y. Leblebici "CMOS Digital IC Circuit Analysis & Design"- McGraw Hill, 2003.

J. Rabaey, "Digital Integrated Circuits Design", Pearson Education, Second Edition, 2003.

Reference Books

Neil Weste and David Harris :" CMOS VLSI design" Pearson Education 2009.

Paper Code: MVLT 102

Paper: VLSI Technology

Unit 1

Cleanroom technology - Clean room concept – Growth of single crystal Si, surface contamination, Chemical Mechanical Polishing, wafer preparation, DI water, RCA and Chemical Cleaning. Processing considerations: Chemical cleaning, getting the thermal Stress factors etc.

Epitaxy : Physical Vapour Deposition, Vapors phase Epitaxy Basic Transport processes & reaction kinetics, doping & auto doping, equipments, & safety considerations, epitaxial defects, molecular beam epitaxy, equipment used, film characteristics, SOI structure.

Unit 2

Oxidation :Growth mechanism & kinetics, Silicon oxidation model, interface considerations, orientation dependence of oxidation rates thin oxides. Oxidation technique & systems dry & wet oxidation. Masking properties of SiO2.

Diffusion :Diffusion from a chemical source in vapor form at high temperature, diffusion from doped oxide source, Ion Implantation, Annealing and diffusion from an ion implanted layer.

Unit 3

Lithography

Optical Lithography: optical resists, contact & proximity printing, projection printing, electron lithography: resists, mask generation. Electron optics: roster scans & vector scans, variable beam shape. X-ray lithography: resists & printing, X ray sources & masks. Ion lithography.

Unit 4

Etching

Reactive plasma etching, AC & DC plasma excitation, plasma properties, chemistry & surface interactions, feature size control & apostrophic etching, ion enhanced & induced etching, properties of etch processing. Reactive Ion Beam etching, Specific etches processes: poly/polycide. Trench etching. Metallisation - Different types of metallization, uses & desired properties

Text Books

S.M. Sze, " VLSI Technology", John Wiley & Sons, 2000.

Reference Books

[1]B.G. Streetman, "Solid State Electronics Devices", Prentice Hall, 2002.

Wai-Kai Chen,"VLSI Technology" Wiley, March 2003.

Paper Code: MVLT 111
Subject: ADVANCED VLSI SIGNAL PROCESSING

Unit I
Discrete Time Signals and Systems, Frequency Domain Representation, Z-Transforms, Discrete Fourier Transforms, Impulse Response and Transfer functions, Convolution and Correlation.

Unit II
IIR Filter Design: Filter Approximation, Impulse Invariant Method, Bi-linear Transformation method filter structures, Finite word length effects, limitations of IIR filters. FIR Filter Design: Linear phase response, Windowing technique, Gibb's Phenomenon,Frequency Sampling Method, FIR Filter structures.

Unit III

Frequency Domain Realization of Digital Filters, Radix-2 FFT Algorithm. Introduction to Multirate digital signal processing

Unit IV

Power Spectrum Estimation, Classical Spectral Estimation, Parametric Modeling - AR, MA, ARMA methods, Minimum variance spectral estimations. Principles of DSP Architecture.

Text:
G. J. Proakis and D. G. Manolakis, "Digital Signal Processing, Principles, algorithms and applications", 4th ed. Pearson Education.
S. K. Mitra, " Digital Signal Processing" 3rd ed. TMH.

Reference:
1.A.V. Oppenheim and R.W. Schafer "Discrete Time Signal Processing", PHI 1992.
2.Steven M. Kay "Modern Spectral Estimation", PHI 1988.
3. Clark Cory.L, "Lab view DSP and Digital comm.", TMH 2005.
4.Roman Kuc "Introduction to Digital Signal Processing", McGraw Hill 1988

Paper Code No : MVLT 112

Paper : CMOS RF DESIGN

Unit 1

Introduction : RF systems – basic architectures, Transmission media and Reflections, Maximum power transfer. Passive RLC Networks: Parallel RLC tank, Q , Series RLC networks, matching Pi match, T match. Passive IC Components: Interconnects and skin Effect, Resistors, capacitors Inductors Review of MOS device.

Unit 2

Distributed Systems: Transmission lines, reflection coefficient, The wave equation,Lossy transmission lines, Smith charts – plotting gamma. High frequency Amplifier design :Bandwidth estimation using open-circuit time constants Bandwidth estimation using short-circuit time constants Risetime, delay and bandwidth Zeros to enhance bandwidth Shunt-series amplifiers, tuned amplifiers Cascaded amplifiers.

Unit 3

Noise :Thermal noise, flicker noise review Noise figure. LNA Design: Intrinsic MOS noise parameters, Power match versus noise match Large signal performance, design examples & Multiplier based mixers
Mixer Design : Subsampling mixers. RF Power amplifier design :Class A, AB, B, C amplifiers, Class D, E, F amplifiers RF Power amplifier.

Unit 4

VCO : Resonators Negative resistance oscillators. PLL Design : Linearized PLL models, Phase detectors, charge pumps, Loop filters, Frequency synthesis and oscillators : Frequency division, integer-N synthesis, Fractional frequency Synthesis. Phase noise: General considerations. Radio architectures: GSM radio architectures, CDMA, UMTS radio architectures

Text Books

[T1] The Design of CMOS Radio-Frequency Integrated Circuits by Thomas H. Lee. Cambridge University Press, 2004.
[T2]RF Microelectronics by Behzad Razavi. Prentice Hall, 1997.

Reference Books:

[R1] B. Razavi “RF Microelectronics” PHI, 1998.
[R2] R. Jacob Baker, H.W. Li, D.E. Boyce “ CMOS Circiut Design, layout and Simulation” PHI,1998.
[R3] Y.P. Tsividis “Mixed Analog and Digital Devices and Technology”, TMH 1996.

Paper Code No : MVLT 113

Paper : NETWORK ON CHIP DESIGN

Unit 1

Basic Concepts of Network-on-Chip [T1] : Introduction to interconnection networks, Walk through of a simple network, Topology basics, Constraints and measures, Butterfly networks, Cube networks. Concentration and slicing, Non-blocking topologies, Topology overflow and wrapup, Routing basics and taxonomy, Oblivious routing. Adaptive routing, Routing mechanics

Unit 2

Flow Control and Deadlock T1]: Flow control basics. Resources and allocation strategies, Circuit switching. Store and forward. Dropping flow control. Misrouting. Cut through. Wormhole flow control, Virtual channels. Deadlock and livelock. Principles of deadlock. Buffer deadlock and channel deadlock. Deadlock in cyclic networks. Inter-dimension deadlock. Avoiding deadlock with virtual channels. The turn models.

Unit 3

Router Micro-architecture [T1]: Basic router. Input buffers and buffer organization. Internal switch organization: crossbars, dimension-ordered, and multistage, Router datapath components, router pipelining, router delay Models, Allocators. Arbiters. The allocation problem - allocating VCs to packets and bandwidth to flits. Bipartite matching. Naïve allocation. Separable allocators. Wavefront allocation.

Unit 4

Network Performance Analysis and Reliability [T1]: Network performance analysis, Analysis of networks with dropping flow control. Analysis of blocking, The effects of buffers, Simulation vs. analysis, The effect of traffic patterns, Load balance and route diversity, Definition of Reliability and Availability, Failure mechanisms and fault models, Path diversity, Pragmatics and self-healing

Text Books:

[T1] William J Dally, Principles and Practices of Interconnection Networks (The Morgan Kaufmann Series in Computer Architecture and Design) , Morgan Kaufmann; 1 edition (January 1, 2004)

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Reference Books:

[R1] Sao-Jie Chen , Ying-Cherng Lan , Wen- Chung Tsai ,Yu-Hen Hu, Reconfigurable Networks-on-Chip, Springer; 2012 edition (December 15, 2011)
[R2] Tim Kogel, Rainer Leupers , Heinrich Meyr , Integrated System-Level Modeling of Network-on-Chip enabled Multi-Processor Platforms, Springer, 1st ed. 2006 edition (November 19, 2010)
[R3] Giovanni De Micheli , Luca Benini , Networks on Chips: Technology and Tools (Systems on Silicon), Morgan Kaufmann; 1 edition (August 3, 2006)

Paper Code : MVLT 121

Paper: Advance optical fiber communication

Unit 1

Introduction to optical communication: principle of transmission, optical fiber modes and configuration mode theory for circular waveguides, single mode fiber, multimode fiber, numerical aperture , mode field diameter, fiber fabrication techniques.

Unit 2

Optical source LED, LASER Diodes**,** modal reflection noise, power launching and coupling, populations, fiber splicing, optical connector, photo detector PIN, Avalanche detector, response time, avalanche multiplication noise

Unit 3

Signal degradation in optical fiber, attenuation losses, signal distortion optical waveguide dispersion, chromatic dispersion, and pulse broadening in graded index fibers, mode coupling advanced fiber design, dispersion shifted, dispersion compensating fiber, design optimization of single mode fibers.

Unit 5

Coherent optical fiber communication, modulation techniques, misalignment, fiber to fiber joints, optical fiber link design, rise time budget and link power budget, long haul system, bit error rate, line coding : NRZ, RZ, Block code, error code, error corrections.

Unit 6

WDM concepts and components, operation, fiber granting, hologram, tunable filter, directional couple, dispersion managements, optical amplifier –EDFA ,photonic switching, optical network – SONET / SDH, optical interference, ring topology, star architecture.

REFRENCES:-

- G.Keiser , "optical fiber communication (3rd edition)",McGraw Hill.2000
- D.Mynbav and Scheiner , "fiber optical communication technology ", PHI.
- Ghatak and Thyangaajan , "introduction to fiber optics ", Cambridge university press , 1998.

Paper Code No : MVLT-122

Paper –DESIGNING WITH ASICS

Types of ASICs – Design flow – Economics of ASICs – ASIC cell libraries – CMOS logic cell data path logic cells – I/O cells – cell compilers.

ASIC Library design: Transistors as resistors – parasitic capacitance – logical effort programmable ASIC design software: Design system – logic synthesis – half gate ASIC

Low level design entry: Schematic entry – low level design languages – PLA tools – EDIF – An overview of VHDL and verilog. Logic synthesis in verilog and & VHDL simulation.

ASIC Construction – Floor planning & placement – Routing.

Text / References:

1. J.S. Smith, "Application specific Integrated Circuits", Addison Wesley, 1997.

Paper Code: MVLT-123
Paper: Advance Digital Communication System

Unit 1: Modulation Techniques

Digital Modulation Techniques :- Analysis, Generation and Detection (Block Diagram), Spectrum and Bandwidth of Amplitude Shift Keying (ASK), Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Offset and Non-offset Quadrature Phase Shift Keying (QPSK), M-ary PSK, Binary Frequency Shift Keying (BFSK), M-ary FSK, Minimum Shift Keying, Quadrature Amplitude Modulation (QAM), Comparison of digital modulation techniques on the basis of probability of error, Matched Filter.

Unit 2: Pulse Modulation

Sampling of Signal, Sampling Theorem for Low Pass and Band Pass Signals, Aliasing, Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM), Channel Bandwidth for PAM-TDM Signal, Types of Sampling, Instantaneous, Natural and Flat Top Sampling, Aperture Effect, PPM and PDM techniques, Pulse Code Modulation (PCM), Signal-to-Noise Ratio in PCM, Companding, Data Rate and Bandwidth of Multiplexed PCM Signal, Inter-symbol Interference, Eye Diagram, Line Coding NRZ, RZ, Biphase,, Differential PCM (DPCM), Delta Modulation (DM), and Adaptive Delta Modulation (ADM), Slope Overload Error ,Granular Noise ,Comparison of various system in terms of Bandwidth and Signal-to-Noise Ratio.

Unit 3: Random Processes

Concept of Probability, Relative Frequency and Probability Conditional Probability and Independent Events, Random Variables, Discrete Random Variables, Cumulative Distribution Function(CDF), Probability Density Function(PDF),Statistical Averages (Means), Chebyshevs Inequality, Central Limit Theorem

Unit 4: Spread Spectrum Modulation

Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum with coherent binary phase shift keying, signal space dimensionality and processing gain, probability of error, frequency hop spread spectrum, maximum length and Golay codes.

Text Books:
[T1] B. Sklar, Digital Communication, Pearson Education.
[T2] Tomasi: Advanced Electronics Communication Systems, 6th Edition, PHI
References:
[R1] Taub & Schilling, Principles of Communication system, TMH.
[R2] Lathi B.P., Modern Analog and Digital Communication systems, Oxford Uni. Press.
[R3] Haykin Simon, Digital Communication, Wiley Publication.
[R4] Proakis, Digital communication, McGraw Hill
[R5] Schaum‟s Outline series, Analog and Digital Communication.
[R6] Singh and Sapre: Communication System, TMH
[R7] Couch: Digital and Analog Communication, Pearson Education
[R8] David Smith: Digital Transmission Systems, Springer- Macmillan India Ltd

Paper Code: MVLT-201

Paper: CAD using VLSI system Design

UNIT 1

(i) **Introduction:** Evolution of design automation; CMOS realization of basic gates.
(ii) **Circuit and system representation:** Behavioral, structural and physical models, design flow.

UNIT 2

(i) **Modeling techniques:** Type of CAD tools, introduction to logic simulation and synthesis.
(ii) **HDL:** syntax, hierarchical modeling, verilog construct, simulator directives, instantiating modules, gate level modeling.

UNIT 3

(i) **DELAY MODELING:** Event based and level sensitive timing control memory initialization, conditional compilation time scales for simulation.
(ii) **Advanced modeling techniques:** Static timing analysis, delay, switch level modeling, user defined primitive (UDP), memory modeling.

UNIT 4

(i) **Logic synthesis:** Logic synthesis of HDL, constructs, cell library, design constraints, synthesis design flow.
(ii) **Advanced verification techniques:** Traditional verification flow, Architectural modeling Assertion checking, formal verification.

UNIT 5

(i) **FPGAs based system design:** Commercial FPGA architecture LUT and routing architecture, FPGA CAD flow.

Name of Authors/Books/Publishers

(1) Weste, N.and Eshraghian, k., "Principles of CMOS VLSI Design- A Systems Perspective", 2nd Ed. Addison Wesley.
(2) Wolf, w., "Modern VLSI Design: System on chip" 2nd Ed., Prentice Hall of India.

Paper Code: MVLT-202
MTVL051 –ALGORITHMS FOR VLSI DESIGN AUTOMATION

VLSI physical design automation and Fabrication VLSI Design cycle, New trends in VLSI design, Physical design cycle, Design style, Introduction to fabrication process, design rules, layout of basic devices

VLSI automation Algorithms Partitioning: Problem formulation, classification ofpartitioning algorithms, Group migration algorithms, simulated annealing.

Floor planning & pin assignment: Problem formulation, classification of floorplanning algorithms, constraint based floor planning, floor planning algorithms for mixedblock& cell design, chip planning, pin assignment, problem formulation, classificationof pin assignment algorithms, General & channel pin assignment Placement Problemformulation, classification of placement algorithms, simulation base placementalgorithms, recent trends in placement

Global Routing and Detailed routing: Problem formulation, classification of global routingalgorithms, Maze routing algorithm, line probe algorithm, Steiner Tree based algorithms,performance driven routing Detailed routing problem formulation, classification ofrouting algorithms, introduction to single layer routing algorithms, two layer channelrouting algorithms, greedy channel routing, switchbox routing algorithms.

Over the cell routing & via minimization: Two layers over the cell routers,constrained& unconstrained via minimization

Compaction: Problem formulation, classification of compaction algorithms, onedimensionalcompaction, two dimension based compaction, hierarchical compaction

Reference Books :

1.NaveedShervani, "Algorithms for VLSI physical design Automation", KluwerAcademic Publisher, Second edition.
2.ChristophnMeinel& Thorsten Theobold, "Algorithm and Data Structures for VLSIDesign", Kluwer Academic Publisher.
3.R. Drechsler, "Evolutionary Algorithm for VLSI CAD", Kluwer Academic Publication.

Paper Code: MVLT-231
MTVL033 –CMOS ANALOG CIRCUIT DESIGN

UNIT I
Basic MOS Device Physics: General Considerations, MOSFET as a Switch, MOSFET Structure, MOS Symbols, MOS I/V Characteristics, Threshold Voltage, Derivation of I/V Characteristics, Second-Order Effects, MOS Device Models, MOS Device Layout, MOS Device, MOS Small-Signal Model, MOS SPICE models, NMOS versus PMOS Devices, Long-Channel versus Short-Channel Devices.

UNIT II
Single-Stage Amplifiers, Basic Concepts , Common-Source Stage, Common-Source Stage with Resistive Load ,CS Stage with Diode-Connected Load, CS Stage with Current-Source Load, CS Stage with Triode Load, CS Stage with Source Degeneration, Source Follower, Common-Gate Stage, Cascode Stage, Folded Cascode, Choice of Device Models.

UNIT III
Differential Amplifiers, Single-Ended and Differential Operation. Basic Differential Pair, Qualitative Analysis, Quantitative Analysis, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell, Passive and Active Current Mirrors, Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors, Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties

UNIT IV
Frequency Response of Amplifiers, General Considerations, Miller Effect, Association of Poles with Nodes, Common-Source Stage, Source Followers, Common-Gate Stage, Cascode Stage, Differential Pair **Feedback** General Considerations, Properties of Feedback Circuits, Types of Amplifiers, Feedback Topologies, Voltage-Voltage Feedback, Current-Voltage Feedback, Voltage-Current Feedback, Current-Current Feedback, Effect of Loading, Two-Port Network Models, Loading in Voltage-Voltage Feedback, Loading in Current-Voltage Feedback, Loading in Voltage-Current Feedback, Loading in Current-Current Feedback, Summary of Loading Effects, Effect of Feedback on Noise

UNIT V
Operational Amplifiers, General Considerations , Performance Parameters, One-Stage Op Amps, Two-Stage Op Amps , Gain Boosting , Comparison , Common-Mode Feedback . Input Range Limitations, Slew Rate, Power Supply Rejection. Stability and Frequency Compensation General Considerations, Multipole Systems, Phase Margin, Frequency Compensation, Compensation of Two-Stage Op Amps, Slewing in Two-Stage Op Amps, Other Compensation Techniques.

Reference Books:
1. B. Razavi, “Design of Analog CMOS Integrated Circuits”, McGraw Hill Publications/
17
2. P. R. Gray & R. G. Meyer, “Analysis and Design of Analog Integrated Circuits”, John
Wiley Publications.
3. R. Gregorian and Temes, “Analog MOS Intgrated Circuits for Signal Processing”, Wiley
Publications.
4. Ken Martin, “Analog Integrated Circuit Design”, Wiley Publications.
5. Sedra and Smith, “Microelectronic Circuits”, Oxford Publications.
6. B.Razavi, “Fundamentals of Microelectronics”, Wiley Publications.

Paper Code: MVLT-232

Paper – MEMORY TECHNOLOGIES

Random Access Memory Technologies: Static Random Access Memories (SRAMs), SRAM Cell Structures, MOS SRAM Architecture, MOS SRAM Cell and Peripheral Circuit, Bipolar SRAM, SOl, Advanced SRAM Architectures, Application Specific SRAMs; DRAMs, MOS DRAM Cell, BiCMOS DRAM, Error Failures in DRAM, Advanced DRAM Design and Architecture, Application Specific DRAM.

Non-Volatile Memories: High Density ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Nonvolatile SRAM, Flash Memories.

Memory Fault Modeling Testing and Memory Design for Testability and Fault Tolerance: RAM Fault Modeling, Electrical Testing, Pseudo Random Testing, Megabit DRAM Testing, Nonvolatile Memory Modeling and Testing, IDDQ Fault Modeling and Testing, Application Specific Memory Testing.

Semiconductor Memory Reliability and Radiation Effects: General Reliability Issues, RAM Failure Modes and Mechanism, Nonvolatile Memory, Reliability Modeling and Failure Rate Prediction, Reliability Screening and Qualification. Radiation Effects, SEP, Radiation Hardening Techniques. Process and Design Issues, Radiation Hardened Memory Characteristics, Radiation Hardness Assurance and Testing.

Advanced Memory Technologies and High-density Memory Packing Technologies: Ferroelectric Random Access Memories (FRAMs), Gallium Arsenide (GaAs) FRAMs, Analog Memories, Magneto Resistive Random Access Memories (MRAMs), Experimental Memory Devices. Memory Hybrids (2D & 3D), Memory Stacks, Memory Testing and Reliability Issues, Memory Cards, High Density Memory Packaging, Future Directions, Introduction to digital tablet PC, LCD, DVD player etc.

Reference Books:

1. Ashok K. Sharma, “Semiconductor Memories: Technology, Testing and Reliability", Prentice- Hall of India Private Limited.
2. Ashok K Sharma, “Advanced Semiconductor Memories: Architectures, Designs and Applications”, Wiley Interscience Publication.
3. Wen C. Lin, “Handbook of Digital System Design”, CRC Press.
4. KiyooItoh, “VLSI memory chip design”, Springer International Edition.
5. Chenming C Hu, “Modern Semiconductor Devices for Integrated Circuits”, Prentice Hall.

Paper Code: MVLT-233
MTVL011 –SOC DESIGN

Motivation for SoC Design - Review of Moore's law and CMOS scaling, benefits of system-on-chip integration in terms of cost, power, and performance. Comparison on System-on-Board, System-on-Chip, and System-in-Package. Typical goals in SoC design – cost reduction, powerreduction, design effort reduction, performance maximization. Productivity gap issues and the ways to improve the gap – IP based design and design reuse.

System On Chip Design Process: A canonical SoC Design, SoCDesignflow, waterfall vs spiral, top down vs bottom up, Specification requirement, Types of Specification, System Design Process, System level design issues, Soft IP vs Hard IP, IP verification and Integration,

Hardware-Software codesign, Design for timing closure, Logic design issues, Verification strategy, On chip buses and interfaces, Low Power, Hardware Accelerators in Soc.

Embedded Memories –cache memories, flash memories, embedded DRAM. Topics related to cache memories. Cache coherence.MESI protocol and Directory-based coherence.

Interconnect architectures for SoC. Bus architecture and its limitations. Network on Chip (NOC) topologies.Mesh-based NoC.Routing in anNoC.Packet switching and wormhole routing.

MPSoCs: What, Why, How MPSoCs, Techniques for designing MPSoCs, Performance and flexibility for MPSoCs design

Case Study: A Low Power Open Multimedia Application Platform for 3G and 4G Wireless Communication Technology.

Text Books:

1. SudeepPasricha and NikilDutt,"On-Chip Communication Architectures: System on Chip Interconnect", Morgan Kaufmann Publishers.
2. Rao R. Tummala, MadhavanSwaminathan, "Introduction to system on package sop-Miniaturization of the Entire Syste", McGraw-Hill Publication.
3. James K. Peckol, "Embedded Systems: A Contemporary Design Tool", Wiley Student Edition.
4. Michael Keating, Pierre Bricaud, "Reuse Methodology Manual for System on Chip designs", Kluwer Academic Publishers, 2nd edition, 2008.
5. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits", Tata McGraw-Hill Publication.

Paper Code: MVLT-241

MTVL101 –LOW POWER VLSI DESIGN

UNIT I: LOW POWER DESIGN, AN OVER VIEW: Introduction to low- voltage low power design, limitations, Silicon-on-Insulator.

UNIT II: MOS/BiCMOS PROCESSES: Bi-CMOS processes, Integration and Isolation considerations, Integrated Analog/Digital CMOS Process.

UNIT III: LOW-VOLTAGE/LOW POWER CMOS/ BICMOS PROCESSES: Deep submicron processes, SOI CMOS, lateral BJT on SOI, future trends and directions of CMOS/Bi-CMOS processes.

UNIT IV: DEVICE BEHAVIOR AND MODELING: Advanced MOSFET models, limitations of MOSFET models, Bipolar models. Analytical and Experimental characterization of sub-half micron MOS devices, MOSFET in a Hybrid mode environment.

UNIT V: CMOS AND Bi-CMOS LOGIC GATES: Conventional CMOS and Bi-CMOS logic gates, Performance Evaluation.

UNIT VI: LOW- VOLTAGE LOW POWER LOGIC CIRCUITS: Comparison of advanced Bi-CMOS Digital circuits. ESD-free Bi-CMOS, Digital circuit operation and comparative Evaluation.

UNIT VII: LOW POWER LATCHES AND FLIP FLOPS: Evolution of Latches and Flip flops-quality measures for latches and Flip flops, Design perspective.

UNIT VIII: SPECIAL TECHNIQUES: Power Reduction in Clock Networks, CMOS Floating Node, Low Power Bus, Delay Balancing, Low Power Techniques for SRAM.

Text Books:

1.Yeo Rofail/ Gohl, CMOS/BiCMOS ULSI low voltage, low power, PearsonEducation.
2.Gary K. Yeap, Practical Low Power Digital VLSI Design, KAP.
3.Douglas A.Pucknell& Kamran Eshraghian, Basic VLSI Design, PHI Publication.
4.J.Rabaey, Digital Integrated circuits, PHI Publication.
4.Sung-mo Kang and Yusuf Leblebici, CMOS Digital ICs, TMH Publication .
5.IEEE Trans Electron Devices, IEEE J.Solid State Circuits, and other National and International Conferences and Symposia.

Paper Code: MVLT-243
Paper: HARDWARE/SOFTWARE CODESIGN

Unit 1

Introduction [T1]: Motivation hardware & software co-design, system design consideration, research scope overviews. Hardware Software back ground: Embedded systems, models of design representation, the virtual machine hierarchy, the performance3 modeling, Hardware Software development.

Unit 2

Hardware Software co-design research[T1]: An informal view of co-design, Hardware Software tradeoffs, crosses fertilization, typical co- design process, co-design environments, limitation of existing approaches, ADEPT modeling environment. Co-design concepts: Functions, functional decomposition, virtual machines, Hardware Software partitioning, Hardware Software partitions, Hardware Software alterations, Hardware Software trade offs, co-design.

Unit 3

Methodology for co-design[T1]: Amount of unification, general consideration & basic philosophies, a framework for co-design. Unified representation for Hardware & Software : Benefits of unified representation, modeling concepts. An abstract Hardware & Software model : Requirement & applications of the models, models of Hardware Software system, an abstract Hardware Software models, generality of the model.

Unit 4

Performance evaluation[T1]: Application of t he abstract Hardware & Software model, examples of performance evaluation .Object oriented techniques in hardware design: Motivation for object oriented technique, data types, modeling hardware components as classes, designing specialized components, data decomposition, Processor example.

Text Books:

[T1] Sanjaya Kumar, James H. Ayler "The Co-design of Embedded Systems: A Unified Hardware Software Representation", Kluwer Academic Publisher, 2002.

Reference Books:

[R1] H. Kopetz, Real-time Systems, Kluwer, 1997.
[R2] R. Gupta, Co-synthesis of Hardware and Software for Embedded Systems, Kluwer 1995.
[R3] S. Allworth, Introduction to Real-time Software Design, Springer-Verlag, 1984.
[R4] Peter Marwedel, G. Goosens, Code Generation for Embedded Processors, Kluwer Academic Publishers,1995.

Paper Code: MVLT-351

MTVL022 –Testing of VLSI Circuits

UNIT I - BASICS OF TESTING AND FAULT MODELING

Introduction- Principle of testing - types of testing - DC and AC parametric tests - fault modeling - Stuck-at fault - fault equivalence - fault collapsing - fault dominance - fault simulation -

UNIT II - TESTING AND TESTABILITY OF COMBINATIONAL CIRCUITS

Test generation basics - test generation algorithms - path sensitization - Boolean difference – D-algorithm – PODEM - Testable combinational logic circuit design.

UNIT III - TESTING AND TESTABILITY OF SEQUENTIAL CIRCUITS

Testing of sequential circuits as iterative combinational circuits - state table verification - test generation based on circuit structure - Design of testable sequential circuits - Ad Hoc design rules - scan path technique (scan design) - partial scan - Boundary scan

UNIT IV - MEMORY, DELAY FAULT AND IDDQ TESTING

Testable memory design - RAM fault models - test algorithms for RAMs – Delay faults - Delay test- IDDQ testing - testing methods - limitations of IDDQ Testing

UNIT V - BUILT-IN SELF-TEST

Test pattern generation of Built-in Self-Test (BIST) - Output response analysis – BIST architectures.

Reference Books:

1. P. K. Lala, “Digital Circuit Testing and Testability”, Academic Press.
2. M.L. Bushnell and V.D. Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Kluwar Academic Publishers.
3. N.K. Jha and S.G. Gupta, “Testing of Digital Systems”, Cambridge University Press.
4. ZainalabeNavabi, “Digital System Test and Testable Design: Using HDL Models and Architectures”, Springer.

Elective IV

Paper Code: MVLT-352

Paper: Nano materials and Nanotechnology

Course Outcomes:

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

CO1: To understand the basic science behind the design and fabrication of nano scale systems.

CO2: To understand and formulate new engineering solutions for current problems and competing technologies for future applications.

CO3:To be able make inter disciplinary projects applicable to wide areas by clearing and fixing the boundaries in system development.

CO4: To gather detailed knowledge of the operation of fabrication and characterisation devices to achieve precisely designed systems.

Syllabus Contents:

Unit 1: Nanomaterials in one and higher dimensions,

Unit 2: Applications of one and higher dimension nano-materials.

Unit 3: Nano-lithography, micro electro-mechanical system (MEMS) and nano-phonics.

Unit 4:carbon nanotubes – synthesis and applications

Unit 5 and 6: Interdisciplinary arena of nanotechnology.

References:

1.Nanoscale Materials in Chemistry edited by Kenneth J. Klabunde and Ryan M. Richards, 2nd edn, John Wiley and Sons, 2009.

2.Nanocrystalline Materials by A I Gusev and A ARempel, Cambridge International Science Publishing, 1st Indian edition by Viva Books Pvt. Ltd. 2008.

3.Springer Handbook of Nanotechnology by Bharat Bhushan, Springer, 3rdedn, 2010.

4.Carbon Nanotubes: Synthesis, Characterization and Applications by Kamal K. Kar, Research Publishing Services; 1stedn, 2011, ISBN-13: 978-9810863975..

Paper Code: MVLT-353

Paper–FPGA ARCHITECTURE & APPLICATIONS

UNIT-I

Programmable Logic ROM, PLA, PAL, PLD, PGA–Features, programming and applications using complex programmable logic devices Altera series–Max 5000/7000 series and Altera FLEX logic–10000 series CPLD, AMD's–CPLD (Mach 1 to 5); Cypress FLASH 370 Device Technology, Lattice PLST's Architectures–3000 Series–Speed Performance and in system programmability.

UNIT-II

FPGAs Field Programmable Gate Arrays–Logic blocks, routing architecture, Design flow, Technology Mapping for FPGAs.

UNIT-III

Case Studies Xilinx XC4000 & ALTERA's FLEX 8000/10000 FPGAs: AT &T–ORCA's

(Optimized Reconfigurable Cell Array): ACTEL's–ACT-1,2,3 and their speed performance. UNIT-IV
Finite State Machines (FSM)-I Top-down Design–State Transition Table, state assignments for FPGAs,Problem of initial state assignmentfor one hot encoding. Derivations of state machine charges. Realization of state machine charts with a PAL.

UNIT-V

Finite State Machines (FSM)-IIAlternative realization for state machine chart using microprogramming.Linked state machines,One–Hot statemachine, Petrinetes for statemachines– basic concepts, properties, Extended petrinetes for parallelcontrollers. Finite State Machine–Case Study, Meta Stability,Synchronization.

UNIT-VI

FSM Architectures and Systems Level Design Architectures centered around non-registered PLDs,State machine designs centered around shift registers,One –Hot design method,Use of ASMs in One –Hot design. K Application of One –Hot method, System level design controller, data path and functional partition.

UNIT-VII

Digital front end Digital Design Tools for (FPGAs & ASICs) using Cadence EDA Tool ("FPGA Advantage") –Design Flow Using FPGAs.

UNIT-VIII

Guidelines and Case Studies Parallel adder cell, parallel adder sequential circuits, counters, multiplexers, parallel controllers.

Reference Books:
1. P.K.Chan& S. Mourad, Digital Design using Field ProgrammableGate Array, Prentice Hall.
2. S.Trimberger, Edr., Field Programmable Gate Array Technology,Kluwer Academic Pub.
3. J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley& Sons, Newyork.
4.S.Brown,R.Francis, J.Rose, Z.Vransic, Field Programmable GateArray,Kluwer Pub.
5.Richard FJinder , "Engineering Digital Design,"Academic press

(Dissertation) Dissertation Phase – I (MVLP 301) and Phase – II (MVLP 401)	
Teaching Scheme: Lab 20 and 30 Hrs/Week	

Course Outcomes:

At the end of this course, students will be able to

Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.

Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.

Ability to present the findings of their technical solution in a written report.Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

Relevance to social needs of society

Relevance to value addition to existing facilities in the institute

Relevance to industry need

Problems of national importance

Research and development in various domain

Literature survey Problem Definition

Motivation for study and Objectives

Preliminary design / feasibility / modular approaches

Implementation and Verification

Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

Experimental verification / Proof of concept.

Design, fabrication, testing of Communication System.

The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II at M. Tech. (Electronics):

As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.

The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.

Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.

Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of

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OPEN ELECTIVES

Business Analytics

Teaching scheme

Lecture: - 3 h/week

Course Code	
Course Name	**Business Analytics**
Credits **Prerequisites**	

Total Number of Lectures: 48

Course objective
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. Mange 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.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	9
Unit 2: 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.	8
Unit 3: 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,	9

Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	
Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, 10 Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	
Unit 5: Decision Analysis: Formulating Decision Problems, Decision 8 Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	
Unit 6: Recent Trends in : Embedded and collaborative business intelligence, 4 Visual data recovery, Data Storytelling and Data journalism.	

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.	

Reference:

Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

Business Analytics by James Evans, persons Education.

OPEN ELECTIVES
Industrial Safety

Teaching scheme

Lecture: - 3 h/week

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electricalhazards, 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 reductionmethods, 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 treeconcept, need andapplications, 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:

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

OPEN ELECTIVES
Operations Research

Teaching Scheme
Lectures: 3 hrs/week

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

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

Syllabus Contents:

Unit 1:
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3:
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4

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

Unit 5

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

References:

H.A. Taha, Operations Research, An Introduction, PHI, 2008

H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008

Hitler Libermann Operations Research: McGraw Hill Pub. 2009

Pannerselvam, Operations Research: Prentice Hall of India 2010

Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Open Elective
Cost Management of Engineering Projects

Teaching scheme
Lecture: - 3 h/week

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.

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 non-technical 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

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.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.

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

References:

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

Open Elective
Composite Materials

Teaching scheme
Lecture: - 3 h/week

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 glassfibers, 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 isostaticpressing.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 andprepregs – 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, maximumstrain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

Hand Book of Composite Materials-ed-Lubin.

Composite Materials – K.K.Chawla.

Composite Materials Science and Applications – Deborah D.L. Chung.

Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Open Elective
Waste to Energy

Teaching scheme
Lecture: - 3 h/week

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forestresidue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors**Unit-II:** Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for

thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs,Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technologyand status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.

Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.

Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

Understand that how to improve your writing skills and level of readability
Learn about what to write in each section
Understand the skills needed when writing a Title

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
	Clarifying Who Did What, Highlighting Your Findings, Hedging 4 and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
	skills are needed when writing the Methods, skills needed when 4 writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	
6	useful phrases, how to ensure paper is as good as it could possibly 4 be the first- time submission	

Suggested Studies:

Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .
Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

AUDIT 1 and 2: DISASTER MANAGEMENT

Course Objectives: -Students will be able to:

learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

Syllabus

Units	CONTENTS	Hours
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
	Repercussions Of Disasters And Hazards: Economic Damage, Loss 4Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

SUGGESTED READINGS:

R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

To get a working knowledge in illustrious Sanskrit, the scientific language in the world
Learning of Sanskrit to improve brain functioning
Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit	***Content***	***Hours***
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	8
2	Order Introduction of roots Technical information about Sanskrit Literature	8
3	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

"Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

"Teach Yourself Sanskrit" PrathamaDeeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

"India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

Understanding basic Sanskrit language
Ancient Sanskrit literature about science & technology can be understood
Being a logical language will help to develop logic in students

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives

Students will be able to

1**.**Understand value of education and self- development

2. Imbibe good values in students

3. Let the should know about the importance of character

Syllabus

Unit	*Content*	*Hours*
1	Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements	4
2	Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature ,Discipline	6
3	Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity oflabour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature	6
4	Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively	6

Suggested reading

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course outcomes

Students will be able to

1.Knowledge of self-development

2.Learn the importance of Human values

3.Developing the overall personality

AUDIT 1 and 2: CONSTITUTION OF INDIA

Course Objectives:

Students will be able to:

Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus

Units	Content	Hours
History	**History of Making of the Indian Constitution:** Drafting Committee, (Composition& Working)	4
Preamble	**Philosophy of the Indian Constitution:** Salient Features	4
3	**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.	4
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4

5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	4
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

The Constitution of India, 1950 (Bare Act), Government Publication.
Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
Discuss the passage of the Hindu Code Bill of 1956.

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives:

Students will be able to:

Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
Identify critical evidence gaps to guide the development.

Syllabus

Units	Content	Hours
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.	4

2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	2
3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes	4
5	**Research gaps and future directions** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.	2

Suggested reading

Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

To achieve overall health of body and mind

To overcome stress

Syllabus

Unit	*Content*	*Hours*
1	Definitions of Eight parts of yog. (Ashtanga)	8
2	Yam and Niyam. Do`s and Don'ts in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8

Suggested reading

‘Yogic Asanas for Group Tarining-Part-I” : Janardan Swami YogabhyasiMandal, Nagpur

“Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

Develop healthy mind in a healthy body thus improving social health also

Improve efficiency

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

To learn to achieve the highest goal happily

To become a person with stable mind, pleasing personality and determination

To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality Verses- 19,20,21,22 (wisdom) Verses- 29,31,32 (pride & heroism) Verses- 26,28,63,65 (virtue) Verses- 52,53,59 (dont’s) Verses- 71,73,75,78 (do’s)	8

2	Approach to day to day work and duties. ShrimadBhagwadGeeta : Chapter 2-Verses 41, 47,48, Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, Chapter 18-Verses 45, 46, 48.	8
3	Statements of basic knowledge. ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63	8

Suggested reading

"Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

The person who has studied Geeta will lead the nation and mankind to peace and prosperity

Study of Neetishatakam will help in developing versatile personality of students.