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MJCET only

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2024-2025)

and

Syllabus

M.E. I to IV Semester

of

Two Year Post Graduate Degree Programme

in

Electronics and Communication Engineering

Specialization in Embedded System and VLSI Design

(With effect from the academic year 2024– 2025)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad –500007

2024

CHAIRMAN
BOARD OF STUDIES
Dept. of Electronics & Commn. Engg
Osmania University,
Hyderabad-500 007

SCHEME OF INSTRUCTION & EXAMINATION
M.E.(Electronics and Communication Engineering) I–Semester
Specialization in Embedded System and VLSI Design

S. No.	Course Type/Code	Course Name	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	Core	Program Core–I	3	1	-	4	30	70	3	4
2	Core	Program Core–II	3	-	-	3	30	70	3	3
3	Elective	Professional Elective–I	3	-	-	3	30	70	3	3
4	Elective	Professional Elective–II	3	-	-	3	30	70	3	3
5	MC or OE	Mandatory Course/Open Elective*	3	-	-	3	30	70	3	3
6	Audit	Audit Course– I	2	-	-	2	30	70	3	0
Practical/Laboratory Courses										
7	Lab-I	Laboratory– I	-	-	2	2	50	-	3	1
8	PC3154EV	Seminar	-	-	2	2	50	-	3	1
		Total	**17**	**01**	**04**	**22**	**280**	**420**		**18**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and Social Science

L:Lecture **T**:Tutorial **P**:Practical **D**:Drawing

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination(Univ. Exam)

Note:

1. Each contact hour is a Clock Hour.
2. The practical class can be of two and half hour (clock hours)duration as per the requirement of a Particular laboratory.
3. *If the Mandatory Course is offered in I-Semester ,the Open Elective course should be offered in II-semester. If Open Elective course is offered in I-Semester, then the Mandatory Course should be offered in II- semester.
4. **Open Elective Subject is not offered to the students of ECE Department.

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SCHEME OF INSTRUCTION & EXAMINATION
M.E.(Electronics and Communication Engineering) II–Semester
Specialization in Embedded System and VLSI Design

S. No.	Course Type/Code	Course Name	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	Core	Program Core–III	3	1	-	4	30	70	3	4
2	Core	Program Core–IV	3	1	-	4	30	70	3	4
3	Elective	Professional Elective–III	3	-	-	3	30	70	3	3
4	MC or OE	Mandatory Course/Open Elective	3	-	-	3	30	70	3	3
5	Audit	Audit Course– II	2	-	-	2	30	70	3	0
Practical/Laboratory Courses										
6	Lab-II	Laboratory– II	-	-	2	2	50	-	3	1
7	Lab-III	Laboratory– III	-	-	2	2	50	-	3	1
8	PC3155EV	Mini Project with Seminar	-	-	4	4	50	-	3	2
		Total	**14**	**02**	**08**	**24**	**300**	**350**		**18**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L:Lecture **T**:Tutorial **P**:Practical **D**:Drawing

CIE: Continuous Internal Evaluation **SEE:** Semester End Examination(Univ. Exam)

Note:

1. Each contact hours is a Clock Hour.
2. The practical class can be of two and half hour(clock hours)duration as per the requirement of a Particular laboratory.
3. **Open Elective Subject is not offered to the students of ECE Department.

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List of subjects of Professional Core

S. No.	Course Code	Course Title
1	PC3101EV	Microcontrollers for Embedded System Design
2	PC3102EV	VLSI System Design
3	PC3103EV	Real Time Operating System
4	PC3104EV	VLSI Design Verification and Testing

List of subjects of Professional Electives I to V

S. No.	Course Code	Course Title
1	PE3116DS	Advanced Digital Design with Verilog HDL
2	PE3131EV	Analog and Mixed Signal IC Design
3	PE3118DS	Speech Signal Processing
4	PE3132EV	Advanced Communication and Computer Network
5	PE3121DS	Wireless Mobile Communication Systems
6	PE3122DS	Wireless Channel Coding Techniques
7	PE3133EV	IOT and its Application
8	PE3134EV	Hardware Software Core Design
9	PE3135EV	CPLD and FPGA Architectures
10	PE3136EV	VLSI for Signal Processing
11	PE3137EV	SoC Design
12	PE3138EV	Medical Image Techniques
13	PE3139EV	Low Power VLSI Design
14	PE3140EV	Machine Learning with Artificial Neural Networks
15	PE3321DS	Optical Fibre Communication Systems

List of Mandatory Courses

S. No.	Course Code	Course Title
1	MC 5161 ME	Research Methodology & IPR

List of Open Electives

S. No.	Course Code	Course Title
1	OE9101CE	Cost Management of Engineering Projects
2	OE9102CS	Business Analytics
3	OE 9103EC**	Embedded System Design
4	OE 9104EE	Waste to Energy
5	OE9105ME	Industrial Safety

Note:**Open Elective Subject is not offered to the students of ECE Department.

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Course Code	Course Title						Core/Elective
PC3101EV	**Microcontrollers for Embedded System Design**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	4

Course Objectives

- Detailed overview of important concepts of Embedded system
- Analyse PIC microcontroller, its features and programming
- Describe ARM Microcontroller architectural details and instruction set
- Understand ARM Memory management
- Learn the techniques to develop an embedded system and case studies

Course Outcomes

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

1. Define an embedded system with an overview of important concepts and trends in the design process along with the challenges faced in the embedded systems design.
2. Understand the architecture of PIC18 Microcontroller, its features, and programming.
3. Understand ARM Design Philosophy, architectural details, instruction set, and ARM Memory Management.
4. Analyze and compare the utility and effectiveness of various debugging tools and techniques.
5. Design a real-time based embedded system in the area of communication, automotive, etc.

UNIT I

Introduction to Embedded Systems: Overview of Embedded System Architecture, Challenges & Trends of Embedded Systems, Hardware Architecture, Software Architecture. Application areas of Embedded Systems and Categories of Embedded Systems. Embedded System Design and Co-Design issues and Design Cycle Process.

UNIT II

PIC 18: Family Overview, Architecture, Instruction Set, Addressing modes. Timers, interrupts of PIC 18, Capture/Compare and PWM modules of PIC 18.

UNITIII

ARM Architecture: ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

UNIT IV

ARM Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instruction

Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions. Exception and interrupt handling.

***ARM Memory Management*:** Cache Architecture, Policies, Flushing and Caches, MMU, Page Tables, Translation Access Permissions, Context Switch.

UNIT V

Embedded Software Development Tools: Host and Target Machines, Linkers/Locators for Embedded Software, Getting Embedded Software into the Target System. Debugging Techniques.

Case Studies: Design of Embedded Systems using Microcontrollers for applications in the area of communication and automotive. (GSM/GPRS, CAN, ZigBee)

Suggested Readings:

1. Raj Kamal, *Embedded Systems – Architecture, Programming and Design*, 2nd Edition, TMH, 2008.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, *ARM Systems Developer's Guides – Designing & Optimizing System Software*, Elsevier, 2008.
3. Mazidi, MCKinlay and Danny Causey, *PIC Microcontrollers and Embedded Systems*, Pearson Education, 2007.
4. David E. Simon, *An Embedded Software Primer*, 1st Edition, Pearson Education, 1999.
5. Jonathan W. Valvano, *Embedded Microcomputer Systems, Real Time Interfacing*, Thomas Learning, 1999.

Online Resources: NTPEL: https://onlinecourses.nptel.ac.in/noc20_cs15/preview
https://onlinecourses.nptel.ac.in/noc20_cs15/preview

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Course Code	Course Title						Core/Elective
PC3102EV	**VLSI System Design**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	1	-	-	30	70	4

Course Objectives

- To understand the VLSI design flow
- To understand different CMOS logic families and their circuit layout.
- To understand various VLSI design methodologies.

Course Outcomes

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

1. Explain the different levels of abstraction and issues with the technology
2. Analyse static and dynamic circuits performances
3. Design strategies and full custom design
4. Design of sub systems
5. Work and exploring case studies of CMOS Systems

UNIT I

Introduction to VLSI System design: Hierarchical design, design abstraction, different levels of abstraction and domains. Computer-aided design VLSI design flow, technology implications and economics, issues connected with technology defect densities, yield and die size, components of chips cost.

UNIT II

Static and dynamic CMOS circuits, circuit characterizations, and performance estimation: Resistance, Capacitance, and Inductance. Delay estimations, power dissipation (static and dynamic), design margining, and reliability issues.

UNIT III

CMOS design methods: Structured design strategies—Hierarchy, regularity, modularity, chip design options: Programmable logic, logic structures, gate arrays, Sea-of-gate and gate array design, standard cell-based designs, standard cell libraries, design reuse—full custom mark design.

UNIT IV

CMOS subsystem design: Adders and Subtractors, fast adders like carry bypass, carry select, and carry look-ahead adders. Multipliers, array and fast multipliers, Parity Generators, Zero-One Detectors, Binary Counters, Multiplexers, shifters, and memory elements. Overview of ALU

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UNIT V

Analog VLSI Design: Small signal model of MOSFETs, Simple CMOS current mirror, Common Source Amplifier, Source follower, Common Gate Amplifier, Source-degenerated current mirror, Cascode and Wilson current mirrors, Op-Amp Design, and 6-Bit Flash A/D converter—high-speed comparators and thermometer code converter.

SUGGESTED READING:

1. Weste Kamran Eshraghian, *Principles of CMOS VLSI Design - A Systems Perspective*, by NEILHE, Pearson Education Series, Asia, 2002.
2. Wolf, *Modern VLSI Design*, Pearson Education Series, 2002.
3. Jean M. Rabey, *Digital Integrated Circuits*, Prentice Hall India, 2003.
4. Kamran Eshraghian, Douglas A. Pucknell, *Essentials of VLSI Circuits and Systems*, PHI, 2005 Edition.
5. Wayne Wolf, *Modern VLSI Design*, Pearson Education, 3rd Edition, 1997.

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Course Code	Course Title						Core/Elective
PC3103EV	**REAL TIME OPERATING SYSTEMS**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

- To learn basics of Operating Systems.
- To get acquainted with UNIX and POSIX.
- To get familiarized with RTOS concepts.
- To get acquainted with various commercial RTOS.

Course Outcomes:

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

1. Understand the fundamental structure of Operating System.
2. Compare between Hard and Soft Real time systems and analyze real time scheduling algorithms.
3. Analyze the concept of Real Time Kernel and implementation of Inter Process Communication.
4. Analyze the features of VxWorks and compare the commercially available.
5. Explore the features of UNIX operating system and differentiate between UNIX and POSIX.

UNIT–I

Brief Review of Unix Operating Systems (Unix Kernel – Filesystem, Concepts of – Process, Concurrent Execution & Interrupts. Process Management – forks & execution. Programming with system calls, Process Scheduling. Shell programming and filters). Portable Operating System Interface (POSIX) – IEEE Standard 1003.13 & POSIX realtime profile. POSIX versus traditional Unix signals, overheads, and timing predictability.

UNIT–II

Hard versus Soft Real-time systems – examples, Jobs & Processors, Hard and Soft timing constraints, Hard Real-time systems, Soft Real-time systems. Classical Uni-processor Scheduling. Algorithms – RMS, Preemptive EDF, Allowing for Preemptive and Exclusion Condition

UNIT–III

Concept of Embedded Operating Systems, Differences between Traditional OS and RTOS. Real time System Concepts, RTOS Kernel & Issues in Multitasking – Task Assignment, Task Priorities, Scheduling, Inter-task Communication & Synchronization – Definition of Context Switching, Foreground ISRs and Background Tasks. Critical Section – Reentrant Functions, Interprocess Communication (IPC) – IPC through Semaphores, Mutex, Mailboxes, Message Queues, or Pipes and Event Flags.

UNIT–IV

Vx Works – POSIX Real Time Extensions, time out features, Task Creation, Semaphores (Binary Counting), Mutex, Mailbox, Message Queues, Memory Management–Virtual to Physical Address Mapping. Comparison of RTOS–Vx Works, µC/OS-II and RT Linux for Embedded Applications.

UNIT–V

Debugging Tools and Cross Development Environment – Software Logic Analyzers, ICEs. Comparison of RTOS – VxWorks, µC/OS-II, and RT Linux for Embedded Applications.

Suggested reading:

1. JaneW.S.Liu, *RealTimeSystems*,PearsonEducation,Asia,2001.
2. Wind River Systems, *VxWorksProgrammers Guide*,Wind River Systems Inc.1997.
3. ShibuK.V.,*Introductiontoembeddedsystems*,MCGraw-HillInc.,1997.
4. Tanenbaum,*ModernOperatingSystems*,3rdedition,PearsonEdition,2007. Jean.J.Labrosse, *MicroC/OS-II*, TheCMP Books,
5. C.M.KrishnaandG.Shin,*RealTimeSystem*,McGrawHillInternationalEditions,1997

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Course Code	Course Title						Core/Elective
PC3104EV	**VLSI Design Verification and Testing**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	-	-	**30**	**70**	**4**

Course Objectives

- To Develop Structural, Dataflow and Behavioral Modeling of Verilog HDL.
- To Know Basics of System Verilog
- To Familiarize with Object Oriented Programming
- To Explore Randomization and Threads in System Verilog
- To Know Test Coverage in System Verilog

Course Outcomes

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

1. To Realize and Verify Combinational and Sequential Circuits in Verilog HDL
2. To Construct User Defined Data Types in System Verilog
3. To Create Object Oriented Programming Environment
4. To Demonstrate Randomization and Coverage Concepts of System Verilog.
5. To Propose Efficient Testable Digital Systems in System Verilog .

UNIT–I

Introduction to Verilog

Verilog Basics: Modules and Ports, Data Flow, Behavioral and structural Modeling, Tasks and Functions, Logic Synthesis, Timing Delays.

Static timing analysis: Setup time & hold time violations and clock skew, Test bench creation, Significance of Verification and Verilog for verification.

UNIT–II

Introduction to System Verilog

System Verilog Basics: Advantages over Verilog, Verification process. Data Types: Built-in data types, Fixed and dynamic Arrays, Queues, Associative Arrays and Enumerated data types.

Statements and Functions: Procedural statements, Tasks and Functions, Time values, Test bench and DUT.

UNIT- III

Introduction to Object Oriented Programming (OOP)

OOP: Object Oriented Programming significance and advantages, classes, objects, object handles,methods, Static and Global Variables, using one class inside another class, Dynamic objects, Copying objects, Public Vs Local and Building a test bench. Inheritance, Overriding, Data Hiding

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and Encapsulation, Abstract Classes and Virtual Methods. Scope Resolution Operator, Classes Extern Methods, type def classes.

UNIT- IV

Verification using System Verilog

Randomization: Significance of Randomization, randomization in system Verilog, Constraint randomization, Random number generation, constraint tips and techniques.

Threads: Threads, Inter process communication, Events, Semaphores and Mailboxes virtual methods

UNIT- V

Advanced System Verilog

Callbacks, Parameterized Classes, Static and Singleton Classes Coverage: Introduction to Coverage, Coverage Types, Functional Coverage Strategies and cover group.

Universal Verification Methodology: Case study using Universal Verification Machine (UVM)

Suggested Readings:

1. Ming-Bo Lin., *Digital System Designs and Practices Using Verilog HDL and FPGAs*, Wiley India, 2008.
2. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, Pearson Education, 2005.
3. Christ Spear and Greg Tumbush, System Verilog for Verification, 3rd ed., Springer, 2012.

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Course Code	Course Title						Core/Elective
PE3116DS	**Advanced Digital Design with Verilog HDL**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Describe modeling styles of Verilog HDL
- Design modeling of Combinational and Sequential Logic modules
- Learn synthesis and synthesizers
- Understand verification methods and timing analysis
- Demonstrate case studies using Verilog HDL

Course Outcomes

After completing this course, the student will be able to:

1. Describe different modeling styles in Verilog HDL
2. Design Verilog codes of Combinational and Sequential Logic modules
3. Understand the design flow of ASICs and FPGA
4. Learn concept of functional verification and timing analysis
   Design arithmetic and signal processing modules.

UNIT I

Review of Verilog HDL, Modeling styles: Behavioral, Dataflow, and Structural Modeling, gate delays, switch-level Modelling, Hierarchal structural modelling.

UNIT II

Modelling of basic MSI Combinational Logic modules and Sequential Logic modules. Finite State Machine modelling.

UNIT III

Synthesis: Design flow of ASICs and FPGA based system, design environment and constraints logic synthesizers, Language structure synthesis, coding guidelines for clocks and reset.

UNIT IV

Verification: Functional verification, simulation types, Test Bench design, Dynamic timing analysis, static timing analysis, value change dump (VCD) files. FPGA based design flow- a case study.

UNIT V

Design Examples: Adders and Subtractors, Multiplication and Division Algorithms, ALU, Digital Signal Processing modules: FIR and IIR Filters, Bus structures, Synchronous & Asynchronous data transfer, UART, baud rate generator. A simple CPU design.

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Suggested Readings:

1. Ming-Bo Lin., *Digital System Designs and PracticesUsingVerilogHDLandFPGAs*.Wiley,2008.
2. Michael D.Ciletti, *AdvancedDigitalDesignwiththeVerilogHDL*",PHI,2005.
3. Samir Palnit kar, "*Verilog HDL: A Guide to Digital Design and Synthesis*", Pearson Education,2005.
4. Bhasker J., *Verilog HDL Primer Hardcover*, 2nd Edition, Star Galaxy Publishing,1999. India,2000

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Course Code	Course Title						Core/Elective
PE3131EV	**Analog And Mixed Signal IC Design**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. Describe the concepts of advanced current mirrors and band-gap reference circuits.
2. Discuss the applications of OP Amp: comparator and oscillator.
3. Explain the switched capacitor based circuits.
4. Distinguish between the features of mixed signal circuits and other circuits.
5. Analyze mixed signal circuits like switched capacitor circuits, data converters etc., starting from fundamentals.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the basic concepts of CMOS circuits, analyze and design current sources/sinks/mirrors
2. Understand the concepts of OPAMPs and its characteristics and analyze the operation of comparators and various oscillators.
3. Explore the concepts of switched capacitor circuits
4. Comprehend the features of sample and hold circuits and apply them to design Nyquist rate
5. data converter circuits.
   Analyze and design oversampling rate data converter circuits.

UNIT I

Small Signal Model and Current Mirrors: Brief review of Small Signal and Large Signal Model of BJTs and MOSFETs. Current Mirrors and Single Stage Amplifiers – Simple CMOS current mirror, common source amplifier, source follower, common gate amplifier, cascode amplifiers. Source degenerated current mirrors. High out impedance – current mirrors, cascode gain stage Wilson current mirror, MOS differential pair and gain stage. Differential pairs with current mirror loads MOS and bipolar widlar current sources, Band gap reference circuits.

UNIT II

Operational Amplifiers: Basic two stage MOS Operational amplifier–Characteristic parameters, two stage MOS Op-Amp with Cascodes. MOS Telescopic-cascode Op- Amp. MOS Folded cascode op-amp. MOS Active Cascode Op-Amp. Fully differential folded cascode op-amp. Current feedback op-amps. Stability and frequency compensation of op- amps. Phase margin in op-amps.

UNIT III

Comparators: Op-Amp Based Comparators, Charge Injection Errors – Latched Comparators – CMOS and BiCMOS Comparators .Switched capacitor circuits: Basic building blocks; basic operation and analysis, inverting and non-inverting integrators, signal flow diagrams, first order filter.Sample and hold circuits - Performance requirements, MOS sample and hold basics, clock feed through problems,

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UNIT IV

Data Converters-I: S/H using transmission gates, high input impedance S/H circuits, improved S/H circuits from the point of slewing time, clock feed through cancellations. Data converter fundamentals - performance characteristics, ideal D/A and A/D converters, quantization noise. Nyquist rate D/A converters – decoder based converter, binary-scaled converters. Thermometer code converters, current mode converters.

UNIT V

Data Converters-II: Nyquist rate A/D Converters: Integrated converters – successive approximation converters, cyclic A/D converters, Flash or parallel converters, Two step A/D converters, pipelined A/D converters. Over sampling converters. Over sampling without noise shaping over sampling and with noise shaping, system architecture – digital decimation filters.

Suggested Readings:

1.

2. Paul. R. Gray & Robert G. Major, Analysis and Design of Analog Integrated Circuits, John Wiley & sons. 2004
3. David Johns, Ken Martin, Analog Integrated Circuit Design, John Wiley & sons. 2004
4. Behzad Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill. 2002

Jacob Baker. R. et.al., CMOS Circuit Design, IEEE Press, Prentice Hall, India, 2000.

Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition.

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Course Code	Course Title						Core/Elective
PE3118DS	**Speech Signal Processing**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Describe speech production and perception and modeling
- Analyze speech signal and computation
- Represent speech with models
- Represent speech with coders, encoders, and decoders
- Learn Automatic Speech Recognition

Course Outcomes:

After completing this course, the student will be able to:

1. Understand production mechanisms, acoustic phonetics, and digital models of speech, along with its perceptions.
2. Understand different approaches to speech signal estimation, transformation, and interpretation techniques.
3. Analyze different digital models and modulation techniques, and various prediction approaches.
4. Understand different synthesis and enhancement approaches, and the concept of re-synthesis methods.
5. Understand automatic speech recognition techniques, using different algorithms and features that distinguish speakers.

UNIT-I

The process of speech production: Production Mechanism and acoustic phonetics. Digital models for speech signals: Vocal Tract, Radiation, Excitation and complete model speech. **perception:** Loudness, Bark Scale, masking, perception and Psychoacoustics.

UNIT-II

Short-time Period analysis: Short-time energy, Average magnitude, zero crossing, Speech vs Silence discrimination and zero crossing rate, Pitch period estimation using parallel processing approach. Autocorrelation function, Pitch period estimation using Auto correlation function, The average magnitude function, median smoothing. Short time Fourier Analysis: Fourier transform interpretation, linear filtering interpretation, sampling rates in time and frequency, Filter banks, Spectrograms, pitch detection. Cepstral analysis, Complex and real cepstrum, pitch detection and Formant estimation.

UNIT-III

Digital Models for Speech Signals: Review of PCM, adaptive PCM, differential PCM, delta

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modulation. Linear Predictive coding (LPC) analysis: Basic principles, autocorrelation and covariance methods, Computation of LP coefficients, Cholesky decomposition, Durbin's recursive solution, Frequency domain interpretation of LPC, CELP.

UNIT-IV

Analysis by Synthesis: Phase vocoder, suband coding, Formant /homomorphic vocoder, cepstral vocoder, vector quantizer coder, Speech enhancement techniques: Spectral subtraction, enhancement by resynthesis.

UNIT-V

Automatic speech recognition: Basic pattern recognition approaches, evaluating the similarity of speech patterns, Dynamic Time Warping (DTW), HMM's for speech recognition, forward, backward algorithmsand parameter estimation. Speaker recognition, Features that distinguish speakers.

Suggested Readings:

1. Rabiner, L. R., & Schafer, R. W., *Digital Processing of Speech Signals*, Pearson Education, 2004.
2. Deller, J. R., Hansen, J. H. L., &Proakis, J. G., *Discrete-Time Processing of Speech Signals*, IEEE Press, 2000.
3. Rabiner, L. R., &Juang, B. H., *Fundamentals of Speech Recognition*, Prentice Hall, 1993.
4. O'Shaughnessy, D., *Speech Communication: Human and Machine*, 2nd edition, University Press, Hyderabad, 2001.

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Course Code	Course Title						Core/Elective
PE3132EV	**Advanced Communication And Computer Network**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	**3**

Course Objectives

Overview of communication computer networks, internet, and foundation of basics.
Study of Routing and Congestion control at the network layer.
Learn Protocols in Network layer and multi cast routing in internetworking and also analyze of protocols Transport layer, and Application Layer.

Course Outcomes

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

Understand advanced concepts in Communication Networking.
Design and develop protocols for Communication Networks.
Understand the mechanisms in Quality of Service in networking.
Optimize the Network Design.
Analyze protocols multicast routing in internetworking.

UNIT- I

Data Communications concepts: Data Communications Model Communication Tasks, Networks and Networking configurations and Internet.
Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing.

UNIT- II

Data Link Control protocol: Flow Control, Sliding Window Flow Control, Error control, CRC, ARQ Protocols, Data Link Control, Bit stuffing, HDLC Operation.
Local Area Networks: LAN Architecture. Topologies, Choice of Topology, Ring and Star Usage, MAC and LLC, Generic MAC Frame Format, Multiple Access Protocols, LAN Addresses and ARP, Ethernet, Hubs, Bridges and Switches.

UNIT- III

Switching and multiplexing: Circuit Switching networks and Packet Switching: Packet Switching Principles, Datagram and Virtual Circuit switching, Wide Area Routing: Path Selection Algorithms-Dijkstra's Algorithm, Bellman-Ford Algorithm, Packet Flooding and Deflection Routing Algorithm.

UNIT- IV

Network layer: Congestion Control at the Network Layer
Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6
Multi cast Routing and Protocols: Basic Definitions and Techniques, Internet Group Management Protocol (IGMP).

UNIT- V

Transport and End-to-End Protocols: User Data gram Protocol (UDP), Transmission Control Protocol (TCP), TCP Congestion Control.
With effect from Application Layer: The Web and HTTP
File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS).

Suggested Readings:

1. William Stallings, "Data and Computer Communications", Eigth Edition, Pearson Prentice Hall, 2007.
2. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, Tata Mc Graw Hill, 2007.
3. Douglas E. Comer, "Internetworking with TCP/IP", Pearson Education, 6thEdition.
4. Prakash and C. gupta "Data communications and computer networks" second Edition, Pearson, PHI learning, 2014

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Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3121DS	**Wireless Mobile Communication Systems**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

- Understand the evolution of cellular networks and review cellular concepts
- Learn large-scale outdoor and indoor propagation models
- Familiarize with small-scale fading, multipath, and multiple access techniques
- Learn modulation techniques for mobile radio
- Understand wireless networking, systems, and standards

Course Outcomes

After completing this course, the student will be able to:

1. Understand the method of selection and reuse of a set of frequency channels, base station requirements, signals required for communication, and handover between base stations.
2. Appreciate and understand the methods of electromagnetic wave propagation in cellular communication, including the evaluation of electromagnetic energy reaching the mobile unit.
3. Identify factors influencing small-scale fading, parameters of the mobile multipath channel, and understand different multiple access techniques.
4. Understand different spread spectrum techniques like DSSS and FHSS.
5. Understand traffic routing in wireless networks, wireless data services, and learn about wireless systems and standards such as AMPS, PTACS, GSM, and AIN.

UNIT I

Modern Wireless CommunicationSystems:1G,2G,2.5G,3G,4G and 5G technologies.

Cellular Concept: Frequency reuse, Channel assignment strategies, Handoff strategies. Interference and system capacity. Trunking and Grade of service, Improving coverage and capacity in cellular systems

UNIT II

Mobile radio propagation : Large scale propagation free space propagation model. Outdoor propagation models: longely Rice model, Durkin's model, A case study, okumura model, Hata model, PCS Extension to Hata model.

Indoor propagation models: partition losses (same floor), partition losses (between floors), log distance path loss model, ericsson multiple breakpoint model, attenuation factor model, signal penetration into buildings.

UNITIII

Small scale fading & multipaths: Factors influencing small scale fading, small scale multipath measurements, parameters of mobile multipath channel. Types of small scale fading.

Multiple Access techniques: FDMA,TDMA,CDMA.

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Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34.

UNIT IV

Modulation techniques for mobile radio: Constant envelop modulation.

Spread Spectrum Modulation Techniques: PN Sequences. Direct Sequence Spread Spectrum (DS-SS), Frequency hopped Spread Spectrum (FH-SS). Performance of Direct Sequence Spread Spectrum. Performance of Frequency hopped Spread Spectrum.

UNIT V

Wireless Networking: Traffic Routing in Wireless Networks, Wireless Data Services. Common Channel Signalling (CCS), ISDN, Broadband ISDN and ATM. Signalling System No 7.SS7 User Part.Services and Performance.

Wireless Systems and Standards: AMPS and ETACS,GSM. Advanced intelligent network(AIN)

Suggested Readings:

1. Rappaport, *Wireless Communication*, Pearson Education, 2nd edition, 2002.
2. William C. Y. Lee, *Mobile Cellular Telecommunications: Analog and Digital Systems*, 2nd edition, McGraw-Hill Electronic Engineering Series, 1995.
3. William C. Y. Lee, *Mobile Communication Engineering*, McGraw-Hill, 1997.
4. Mike Gallegher, Randy Snyder, *Mobile Telecommunications Networking with IS-41*, McGraw-Hill, 1997.
5. Kernil, Feher, *Wireless Digital Communications*, PHI, 2002.

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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3122DS	**Wireless Channel Coding Techniques**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Describe performance of digital communication systems and coding gain.
- Design encoder and decoder for various coding schemes.
- Learn cyclic codes.
- Analyze performance improvement of convolution codes.
- Design of turbo encoder and decoder.

Course Outcomes

After completing this course, the student will be able to:

1. Construct Galois fields and understand Galois field arithmetic.
2. Learn the encoding and decoding schemes of various linear block codes.
3. Generate systematic and non-systematic cyclic codes and learn BCH codes.
4. Understand the structural properties of convolution codes and the Viterbi algorithm.
5. Realize a turbo encoder and understand LDPC codes.

UNIT I

Introduction: Modulation and coding, Performance measures of coded modulation fields, Binary field arithmetic, Construction of Galois Field

UNIT II

Introduction to Linear block codes: The minimum distance of block codes, Syndrome decoding, Hamming codes, Reed-Muller codes, Interleaved codes

UNIT III

Cyclic Codes: Generator and parity-check matrices of cyclic codes, Syndrome computation and error , detection, Binary BCH codes, Decoding of BCH codes, Reed-Solomon codes

UNIT IV

Convolutional Codes: Encoding of convolutional codes, Structural properties of convolutional codes, The Viterbi algorithm, The BCJR algorithm

UNIT V

TurboCoding: Introduction to turbo coding, Performance analysis of Turbo codes, Design of Turbo codes, decoding of Turbo codes, Introduction to LDPC Codes, Tanner graph for Linear Block codes.

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Road No: 3, Banjara Hills Hyderabad-34.

Suggested Readings:

1. Shu Lin, Daniel J., Costello, Jr., *Error Control Coding*, 2nd edition, Pearson, 2011.
2. Simon Haykin, *Communication Systems*, 4th Edition, John Wiley & Sons, 2007.
3. Proakis, J. G., &Salehi, M., *Digital Communications*, McGraw-Hill, 2008.
4. Biglieri, E., *Coding for Wireless Channels*, Springer, 2007. *A Handbook for the Digital Engineer*, 5th Edition, Elsevier

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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3133EV	**IOT and its Application**						**Elective**
Pre requisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

1. To understand the concepts of Internet of Things and be able to build IoT applications.
2. To learn the programming and use of Arduino and Raspberry Pi boards.
3. To know about data handling and analytics in SDN.
4.

Course Objectives

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

1. Know basic protocols in sensor networks.
2. Program and configure Arduino boards for various designs.
3. Python programming and interfacing for Raspberry Pi.
4. Design IoT applications in different domains.

UNIT- I

Introduction: Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

UNIT- II

Machine-to-Machine Communications: Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

UNIT- III

Introduction to Python programming: Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.

UNIT- IV

Implementation of IoT with Raspberry Pi: Introduction to Software-defined Network (SDN), SDN for IoT, Data Handling and Analytics.

UNIT- V

Cloud Computing: Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring.

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Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Suggested Readings:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases" by Pethuru Raj and Anupama C. Raman (CRC Press).
2. "Make: Sensors" by Tero Karvinen, Kemo Karvinen, and Villey Valtokari, 1st edition, Maker Media, 2014.
3. "Internet of Things: A Hands-on Approach" by Arshdeep Bahga and Vijay Madisetti.
4. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice."

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Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
PE3134EV	**Hardware Software Co-Design**						**Program Elective**
Pre requisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	p			
-	3	-	-	-	30	70	3

Course Objectives:

- Describe the various Co-Design issues and Co-Synthesis algorithms.
- Discuss the emulation techniques and its target architecture.
- Illustrate the knowledge of firmware development process and tools.
- Apply the validation methods and adaptability.
- Apply the operation system level specification and design.

Course Outcomes:

After completing this course, the student will be able to:

1. Acquire the knowledge on various co-design models.
2. Explore the interrelationship between hardware and software in an embedded system.
3. Acquire the knowledge of firmware development process and tools.
4. Understand validation methods and adaptability.
5. Comprehend the system level specification and design.

1.

UNIT I

Co- Design Issues and Co- Synthesis Algorithms: Co- Design Models, Architectures, and Languages, A Generic Co-design Methodology.: Hardware software synthesis algorithms: hardware/ software partitioning, Distributed system co-synthesis.

UNIT II

Prototyping and Emulation: Prototyping and Emulation techniques, Prototyping and emulation environments, Future developments in emulation and prototyping architecture specialization techniques, System communication infrastructure. Target Architectures: Architecture Specialization techniques, System Communication infrastructure, Target Architecture and Application System classes, Architecture for control dominated systems (8051- Architectures for High performance control), Architecture for Data dominated systems (ADSP21060, TMS320C60), Mixed Systems.

UNIT III

Compilation Techniques and Tools for Embedded Processor Architectures:
Modern embedded architectures, embedded software development needs, compilation technologies, practical consideration in a compiler development environment.

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Road No: 3, Banjara Hills Hyderabad-34

UNIT IV

Design Specification and Verification: Design, co-design, the co-design computational model, concurrency coordinating concurrent computations, interfacing components, Design verification, implementation verification, verification tools, interface verification

UNIT V

Languages for System - Level Specification and Design-I: System- level specification, design representation for system level synthesis, system level specification languages.

Languages for System -Level Specification and Design-II: Heterogeneous specifications and multilanguage co-simulation, the cosyma system and lycos system.

Suggestive Reading:

1. Jorgen Staunstrup, Wayne Wolf, Hardware/Software Co-Design Principles and Practice, 2009, Springer.
2. Giovanni De Micheli, Mariagiovanna Sarni, 2002, Hardware/Software Co-Design, Kluwer Academic Publishers.
3. Patrick R. Schaumont, Practical Introduction to Hardware/Software Co-design, 2010, Springer.

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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3135EV	**CPLD and FPGA Architectures**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

- To Understand the basic operation of Programmable gate arrays
- Learn the architecture of various types of FPGAs / CPLD and design a digital circuit and implement it on an FPGA
- Implement the programming techniques used in FPGA design and Verification

Course Outcomes

By the end of this course, students will be able to:

1. Evaluation of PLDs
2. Familiarity architecture of various types of FPGAs/ CPLD.
3. Design a digital circuit and implement it using reconfigurable logic.
4. Design and develop IP cores and Prototypes in FPGA design.
5. Apply simulators and verify develop FPGA designs.

UNIT– I

Programmable Logic Devices: Revision of basic Digital systems, PROM, PLA, PAL, Architecture of PAL's applications, programming technologies, programmable logic design methods and tools.

UNIT–II

CPLD's: complex programmable logic devices: logic block, I/O block, interconnect matrix, logic blocks and features of Altera flex logic 10000 series CPLDs, max 7000 series CPLD s, AT & T–ORCA"s (Optimized Reconfigurable Cell Array), cypres flash 370 device technology, lattice PLSI's architectures.

UNIT– III

FPGAs: Field Programmable Gate Arrays: Logic blocks, routing architecture, Logic cells and features of commercially available FPGA"s- XILINX XC4000, SPARTAN II, virtex II FPGA"s, XILINX, Altera"s FPGA, ACETEL Act1, Act2, Act3 FPGAS , AMD FPGA.

UNIT–IV

Synthesis process: Placement: objectives, placement algorithms: Mincut-Based placement, iterative improvement Placement, simulated annealing. Routing: objectives, segmented channel routing, Maze routing, Routability estimation, Net delays, Computing signal delay in RC tree networks.

UNIT– V

FPGA implementation steps: simulation process, verification: introduction, logic simulation, design validation, timing verification. Testing concepts: failures, mechanisms and faults, fault coverage, ATPG methods, programmability failures, Case studies: programmable counter, ALU, Barrel shifter.

Suggested Reading:

1. P.K. Chan & S.Mourad, "Digital Design Using Field Programmable Gate Array", Pearson Education 2009
2. S.Trimberger, Edr.,"Field Programmable Gate Array Technology", Kluwer Academic Publications, 1994.
3. J.Old Field, R.Dorf, "Field Programmable Gate Arrays", John Wiley & Sons, Newyork, 1995.
4. S. Brown, R. Francis, J. Rose, Z.Vransic, "Field Programmable Gate array", Kluwer Publn, 1992 5 Manuals from Xilinx, Altera, AMD, Actel.

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Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
PE3136EV	**VLSI For Signal Processing**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

- To enable the students to learn about the concept of pipelining and parallel processing
- To make the students to understand the analysis of VLSI system with high speed and
- To make the students to understand the concept of Power Reduction and Estimation Techniques in VLSI signal processing

Course Outcomes

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

1. Explain parallel and pipelining processing techniques
2. Identify applications for unfolding algorithm
3. Analyze Systolic Design for Space Representations containing Delays
4. Explain Cook-Toom Algorithm, Fast Convolution algorithm by Inspection method
5. Analyze Power Reduction techniques and Power Estimation techniques.

UNIT- I

Introduction to DSP: Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms.
Pipelining and Parallel Processing: Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power.
Retiming: Introduction– Definitions and Properties – Solving System of Inequalities – Retiming Techniques.

UNIT- II

Folding and Unfolding, Folding: Introduction -Folding Transform - Register minimization Techniques–Register minimization in folded architectures–folding of multirate systems.
Unfolding: Introduction– An Algorithm for Unfolding – Properties of Unfolding – critical Path, Unfolding and Retiming – Applications of Unfolding.

UNIT- III

Systolic Architecture Design: Introduction – Systolic Array Design Methodology – FIR Systolic Arrays – Selection of Scheduling Vector – Matrix Multiplication and 2D Systolic Array Design – Systolic Design for Space Representations contain Delays.

UNIT- IV

Fast Convolution: Introduction–Cook-Toom Algorithm–Winograd algorithm–Iterated Convolution–Cyclic Convolution–Design of Fast Convolution algorithm by Inspection.

UNIT- V

Low Power Design: Scaling Vs Power Consumption–Power Analysis, Power Reduction techniques – Power Estimation Approaches.

Programmable DSP: Evaluation of Programmable Digital Signal Processors, DSP Processors for Mobile and Wireless Communications, Processors for Multimedia Signal Processing.

Suggested Readings:

1. Keshab K. Parthi, "VLSI Digital Signal Processing- System Design and implementation",1998, Wiley Inter Science.
2. Kung S.Y, H. J. While House, T. Kailath, *"VLSI and Modern Signal processing"*,1985, Prentice Hall.
3. Jose E. France, Yannis Tsividis, "Design of Analog–Digital VLSI Circuits for Tele communications and Signal Processing",1994, Prentice Hall.
4. Medisetti V.K,"VLSI Digital Signal Processing",IEEE Press (NY),USA,1995.

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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3137EV	**System On-Chip Design**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	2	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- To understand the concepts of System on Chip Design methodology for Logic and Analog Cores
- To understand the concepts of System on Chip Design Validation
- To understand the concepts of SOC Testing.

Course Outcomes

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

1. Understand about SoC Design Methodology
2. Ability to understand the design of different embedded memories
3. Validation and Testing Concepts can be understood
4. Investigate new techniques for future systems

UNIT-I

Introduction - System tradeoffs and evolution of ASIC Technology – System on chip concepts and methodology – SoC design issues - SoC challenges and components.

UNIT-II

Design Methodological for Logic Cores-SoC Design Flow–On-chip buses – Design process for hard cores – Soft and firm cores – Core and SoC design examples.

UNIT-III

Design Methodology for Memory and Analog Cores-Embedded memories –Simulation modesSpecification of analog circuits – A to D converter – Phase locked loops –High I/O.

UNIT-IV

Design Validation-Core level validation–Test benches–SoC design validation – Co-simulation – hardware/ Software co-verification. Case Study: Validation and test of systems on chip.

UNIT-V

SoC Testing – SoC Test Issues – Cores with boundary scan – Test methodology for design reuse –Testing of microprocessor cores – Built in self-method – testing of embedded memories.

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Road No: 3, Banjara Hills Hyderabad-34

Suggested Reading:

1. RochitRajsunah, System-on-a-chip: Design and Test, Artech House,2007.
2. Prakash Raslinkar, Peter Paterson &Leena Singh, System-on-a-chip verification: Methodology and Techniques, Kluwer Academic Publishers, 2000.
3. M. Keating, D. Flynn,R.Aitken, A. Gibbons Shi, Low Power Methodology Manual for System-on- Chip Design Series: Integrated Circuits and Systems, Springer, 2007.

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Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
PE3138EV	**Medical Image Techniques**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To familiarize the students with various medical imaging modalities.
- To make learners understand the principles, detectors and operating procedures of X-ray, CT, MRI, ultrasound, PET and SPECT.
- To make the students learn the advantages, disadvantages and hazards of various medical imaging equipment.

Course Outcomes

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

1. Interpret the working principle and operating procedure and applications of X- ray equipment.
2. Understand the image reconstruction techniques and applications of CT.
3. Summarize the image acquisition and reconstruction techniques in MRI.
4. Comprehend the working principle, modes and medical applications of ultrasound imaging.
5. Examine the operation and applications of PET, SPECT and radio nuclide instrumentation.

UNIT- I

X ray Imaging: Electromagnetic spectrum, Production of X-rays, X-ray tubes- Stationary and Rotating Anode types, Block diagram of an X-Ray Machine, Collimators and Grids, Timing and Exposure controls. X-Ray Image visualization-Films, Fluorescent screens, Image Intensifiers. Dental X-Ray machines, Portable and mobile X-Ray units, Mammographic X-Ray equipment, Digital Radiography and flat panel detectors. Radiation safety, ALARA principle, Dose units and dose limits, Radiation dosimeters and detectors.

UNIT- II

Computed Tomography: Basic principles, CT number scale, CT Generations. Major sub systems- Scanning system, processing unit, viewing unit, storage unit. Need and Principle of sectional imaging, 2D image reconstruction techniques-Iteration and Fourier methods.
Applications of CT -Angio, Osteo, Dental, Perfusion (Body & Neuro),Virtual Endoscopy, Coronary Angiography.

UNIT- III

Magnetic Resonance Imaging: Principles of NMR imaging systems, Image reconstruction techniques-Relaxation processes, imaging/ pulse sequences. Sub systems of an NMR imaging system, NMR detection system, types of coils, biological effects and advantages of NMR imaging.
Functional MRI - The BOLD effect, intra and extra vascular field offsets, source of T2* effects, Creating BOLD contrast sequence optimization sources and dependences of physiological noise in fMRI.

UNIT- IV

Ultrasound Imaging: Principles of image formation -Imaging principles and instrumentation of A-mode, B-Mode, Gating Mode, Transmission mode and M-mode. Basics of multi-element linear array scanners, Digital scan conversion.
Doppler Ultrasound and Colour Doppler imaging, Image artifacts, Biological effects, Ultrasound applications in diagnosis, therapy and surgery.

UNIT- V

Nuclear Medicine–Radio isotopes in medical diagnosis, Basic instrumentation-Radiation detectors, Pulse height analyzer, Rectilinear scanner, Gamma camera.
Emission Computed Tomography (ECT), Principle and instrumentation of Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET). Comparison of SPECT, PET and combined PET/ X-ray CT.

Suggested Readings:

1. Khandpur R.S., Handbook of Biomedical Instrumentation, Tata Mc Graw Hill,2016.
2. S Webb, "The Physics of Medical Imaging", Adam Highler, Bristol Published by CRC Press, 1988.
3. ACKak, "Principle of Computed Tomography", IEEE Press NewYork, 1988.
4. Hykes, Heorick, Starchman, Ultrasound physics and Instrumentation MOSBY year book, 2nd Ed.1992.
5. Stewart C. Bushong, Magnetic Resonance Imaging-physical and biological principles, MOSBY, 2nd Ed., 1995.

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3139EV	**Low Power VLSI Design**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To study the sources of power dissipation and low power design techniques with voltage
- To study various low power arithmetic units and the design of low power multipliers
- To study about low power memory technologies

Course Outcomes

After completing this course, the student will be equipped with:

1. Understand various power components
2. Understand and design low power memories
3. Understand and use mathematical models for power analysis in CMOS circuits
4. Design low power architectures
5. Understand and design multipliers

UNIT- I

Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects–Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT- II

Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance, Minimization Approaches: System Level Measures and Circuit Level Measures.

UNIT- III

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder Architectures–RippleCarryAdders,CarryLook-AheadAdders,CarrySelectAdders,Carry Save Adders, Low-Voltage Low-Power Design Techniques–Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

UNIT- IV

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of

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Muffakham Jah College of Engg. & Tech
Road No: 3

Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier and Introduction to Wallace Tree Multiplier.

UNIT- V

Low-Voltage Low-Power Memories: Basics of ROM ,Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Pre-charge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

Suggested Readings:

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011.
2. Ming-BOLIN, "Introduction to VLSI Systems :A Logic, Circuit and System Perspective" ,CRC Press, 2011
3. Anantha Chandrakasan, "Low Power CMOS Design", IEEE Press/Wiley International, 1998
4. Kaushik Roy,Sharat C.Prasad,"Low Power CMOS VLSI Circuit Design",John Wiley & Sons,2000.
5. GaryK.Yeap,"PracticalLowPowerDigitalVLSIDesign",KluwerAcademicPress,2002.

Head of Department
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Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3140EV	**Machine Learning with Artificial Neural Networks**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

- Discuss the basic theory underlying machine learning.
- Illustrate the importance of dimensionality reduction and clustering methods.
- Analyze the SVM for classification and concept to neural network.
- Describe the architecture, issues of various feed forward and feedback neural networks.
- Compare different neural network architectures and select the appropriate architecture for a given problem.

Course Outcomes

After completing this course, the student will be equipped with:

1. Understand the basic theory underlying machine learning
2. Explore the methods of dimensionality reduction and clustering
3. Familiarize SVM for classification problem and understand basic Neural Network
4. Evaluate weight gradients in a feed forward neural network by using the back propagation algorithm.
5. Apply learning rules to perform the training with appropriate neural networks.

UNIT- I

Introduction: Definitions, Datasets for Machine Leaming, Different Paradigms of Machine Learning, Data Normalization, Hypothesis Evaluation, Linear Regression. Parameter Estimation: Maximum Likelihood and Bayesian Parameter Estimation

UNIT- II

Feature Selection and Dimensionality Reduction: Principal Component Analysis (Eigen values, Eigen vectors, Orthogonality), Linear Discriminate Analysis. Clustering: Distance measures, Different clustering methods (Distance, Density, Hierarchical), Types of clustering algorithms: k-means clustering, Hierarchical Clustering Algorithm.

UNIT- III

Classification: Support Vector Machines, Linear learning machines and Kernel space, Making Kernels and working in feature space, Implementation of SVM for classification and regression problems.

Artificial Neural Networks: Introduction and ANN Structure: Biological neurons and artificial neurons. Model of an ANN, Activation functions used in ANNs. Typical classes of network

architectures: Multilayer Perception. Software implementation of various activation functions.

UNIT- IV

Back propagation: Training and Convergence, Radial Basis Functions-Net, Feed Forward ANN: Structures of Multi-layer Feed Forward Networks.
Training Neural Networks: Loss, Training and validating/Testing, Optimization: Gradient Descent, Stochastic Gradient Descent, ADAM, Over fitting: Drop out, Normalization. Training Neural Networks with various activation function and optimization using MatLab/ Keras/ any suitable software.

UNIT- V

Convolutional Neural Networks: Motivation (Neuroscience),Convolutional layers, Additional layers, Training CNN, Classification examples (AlexNet) with MatLab/Keras/any suitable software.
Recurrent Neural Networks : Training RNNs with MatLab/Keras/any suitable software.
Adversarial Approaches to ANN/Generative Adversarial Neural Networks : Training GANs with MatLab /Keras / any suitable software.

Suggested Readings:

1. Tom Michel, Machine Learning, McGr awHill,1997
2. B.Yeganaranarana ,Artificial NeuralNetworks,PrenticeHall,NewDelhi,2007.
3. M.Gopal, Applied Machine Learning, McGraw Hill Education(India).
4. SimonHaykin,NeuralNetworks(AComprehensiveFoundation),McMillanCollege Publishing Company, New York, 1994.
5. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, AGuide to Convolutional Neural Networks for Computer Vision, Morgan &Claypool Publishers, 2018.

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PE3321DS	**Optical Fiber Communication Systems**						**Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

- Analyse optical fiber as wave guide
- Learnvariousopticalsourcesanddetectorsusedinopticalsignaltransmission
- Familiarize with various components used in optical communicate on like, preamplifiers, links
- Estimate Performance evaluation of optical communication
- Explore applications of optical communication in Local Area Networks

Course Outcomes

After completing this course, the student will be able to:

1. Understand different types of optical fiber, mode theory and Signal degradation in Optical fiber.
2. IdentifythemeritsanddemeritsofvariousOpticalSourcesanddetectorsinOptical Communication.
3. Understand point to point link and receiver performance.
4. Know the different Components used in Optical Communication Link.
5. Design WDM system with various system consideration.

UNIT I

Optical Fibers: Fiber Structures, Wave-guiding and fabrications, Overview of Optical fiber communications, Elements of an Optical fiber transmission Link, Nature of light, Basic optical laws and definitions, Modes and configurations, Mode theory of circular wave guides, Single, Multi mode step index and Graded index Fibers , Fiber materials. Signal degradation in Optical Fibers. Dispersion, Pulse broadening in graded index fibers, Mode coupling, Design optimization of single mode Fibers.

UNIT II

Optical Sources & Detectors: Semiconductors as optical Sources and their fabrication. LED and Laser diodes, Linearity of sources, Modal, Partition and reflection noise, Physical principles of PIN and APD, Photo detector noise, detector response time, Avalanche multiplication noise, Temperature effect on avalanche gain, Comparison of Photo detectors.

UNIT III

Optical Fiber communication: Basic communication system, Fundamental receiver operation, Digital receiver performance calculations. Pre-amplifiers types, Analog receivers. Fiber Links: Point to point links, Line coding, Error correction, Noise effects on digital transmission system performance. Overview of analog links, Carrier noise ratio in analog systems.

UNIT IV

Multi-channel transmission techniques: WDM concepts and components. Operational principles of WDM, Passive components, Tunable sources, Tunable filters, Introduction of optical amplifiers.

UNIT V

Optical Networks: Basic Networks, SONET/SDH, Broadcast and select WDM networks, Wavelength Routed Networks, Nonlinear effects on Network Performance, Performance of EDFA+WDM systems, Optical CDMA, Ultrahigh capacity Networks.

Suggested Readings:

1. DjafarK.mynbaevLowelll.Scheiner"FibreOpticCommunicationsTechnology", Pearson Education Asia.
2. Senior John M."Optical Fiber Communications Principles and Practice", Prentice Hall India, second edition, 1996
3. KeiserGerd,"OpticalFibreCommunications",McGrawHill,secondedition,1991

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Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
MC5161ME	**Research Methodology and IPR**						**Mandatory Course**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

To make students to

- Motivate to choose research has career
- Formulate the research problem, prepare the research design
- Identify various sources for literature review and data collection report writing
- Equip with good methods to analyse the collected data
- Know about IPR copyrights

Course Outcomes

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

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, Interview, questionnaires
4. Analyse problem by statistical techniques: ANOVA,F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT- I

Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods Verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT- II

Literature Survey and Report writing: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Need of Review, Guidelines for Review, Record of Research Review.

Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanism of writing a report. **Research Proposal Preparation**: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

UNIT- III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT- IV

Data Collection and Analysis: Methods of data collection, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Importance of Parametric, non- parametric test, testing of variance of two normal populations, use of Chi-square, ANOVA, F-test, z-test

UNIT - V

Intellectual Property Rights: Meaning, Nature, Classification and protection of Intellectual Property, The main forms of Intellectual Property, Concept of Patent, Patent document, Invention protection, Granting of patent, Rights of a patent, Licensing, Transfer of technology.

Suggested Readings:

1. C.R Kothari, Research Methodology, Methods& Techniques; New Ag International Publishers, 2004
2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2011
3. Y.P. Agarwal, Statistical Methods: Concepts, Application and Computation, Sterling Publications Pvt. Ltd., New Delhi, 2004
4. G.B.Reddy, Intellectual Property Rights and the Law 5th Ed. 2005 Gogia Law Agency
5. Ajit Parulekar and Sarita D' Souza, Indian Patents Law–Legal & Business Implications, Macmillan India Ltd, 2006

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Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
OE9101CE	**Cost Management of Engineering Projects**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- To apply modern software packages to conduct analysis of real world data.
- To understand the technical underpinning of engineering economic analysis.
- The ability to apply the appropriate analytical techniques to a wide variety of real world problems and data sets.
- To summarize and present the analysis results in a clear and coherent manner.

Course Outcomes

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

1. Students should be able to learn the cost concepts in decision making.
2. Students should be able to do cost planning and Marginal Costing.
3. Students should be able to create a database for operational control and decision making.

UNIT-I

Introduction and Overview of the Strategic Cost Management Process: Cost concepts in decision-making, relevant cost, Differential cost, Incremental cost, 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 centers, 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.

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.

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

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.

Suggested Readings:

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

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Electronics & Communication Engineering
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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
OE 9102CS	**Business Analytics**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

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.
- Gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision-making.
- Become familiar with processes needed to develop, report, and analyze business data.
- Use decision-making tools/operations research techniques.
- Manage business processes 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.
- Students will be able to understand the basic rules of research formulation and procedures for obtaining patent rights.

Course Outcomes

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

1. Students will demonstrate knowledge of data analytics.
2. Students will demonstrate the ability to think critically in making decisions based on data and deep analytics.
3. Students will demonstrate the ability to use technical skills in predictive and prescriptive modeling to support business decision-making.
4. 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 Carle 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 8 Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent Trends in Embedded and collaborative business intelligence, Visual data 4 recovery, Data Storytelling and Data journalism.

Suggested Readings:

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

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
OE9103EC	**Embedded System Design**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

- Detailed overview of important concepts of Embedded systems.
- Analyze PIC microcontroller, its features and programming.
- Describe ARM Microcontroller architectural details and instruction set.
- Understand ARM Memory management.
- Learn the techniques to develop an embedded system and case studies.

Course Outcomes

After completing this course, the student will be able to:

1. Understand the fundamentals of embedded system design.
2. Enumerate the instruction set of ARM Processor by studying the architecture of ARM core.
3. Acquire knowledge on the serial, parallel, and network communication protocols.
4. Learn the embedded system design lifecycle and co-design issues.
5. List the various embedded software development tools used in the design of embedded systems for various applications.

UNITI

Introduction to Embedded Systems: Overview of Embedded System Architecture, Challenges &Trends of Embedded Systems, Hardware Architecture, Software Architecture. Application areas of Embedded Systems and Categories of Embedded Systems. Embedded System Design and Co-Design issues and Design Cycle Process

UNIT II

PIC 18: Family Overview, Architecture, Instruction Set, Addressing modes. Timers, interrupts of PIC 18, Capture/Compare and PWM modules of PIC 18

UNIT III

ARM Architecture: ARM Design Philosophy, Registers, Program Status Register, Instruction Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families. Instruction Set: Data Processing Instructions, Addressing Modes, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

UNIT IV

ARM Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instruction Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Instructions. Exception and interrupt handling.

ARM Memory Management: Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation Access Permissions, Context Switch.

UNIT V

Embedded Software Development Tools, Host and Target Machines, Linkers/Locators for Embedded Software, Getting Embedded Software into the Target System, Debugging Techniques,

Case Studies: Design of Embedded Systems using Microcontrollers - for applications in the areas of communications and automotives. (e.g., GSM/GPRS, CAN, Zigbee)

Suggested Readings:

1. Raj Kamal, *Embedded Systems – Architecture, Programming and Design*, 2nd Edition, TMH, 2008.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, *ARM Systems Developer's Guides – Designing & Optimizing System Software*, Elsevier, 2008.
3. Mazidi, MCKinlay, and Danny Causey, *PIC Microcontrollers and Embedded Systems*, Pearson Education, 2007.
4. David E. Simon, *An Embedded Software Primer*, 1st Edition, Pearson Education, 1999.
5. Jonathan W. Valvano, *Embedded Microcomputer Systems: Real Time Interfacing*, Thomas Learning, 1999.

Head of Department
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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
OE 9104EE	**Waste to Energy**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-	-	-	**30**	**70**	**3**

Course Objectives

- To enable students to be aware of the generation of energy from waste.

Course Outcomes

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

1. Students should be able to learn the classification of waste as a fuel.
2. Students should be able to learn the manufacture of charcoal.
3. Students should be able to carry out the designing of gasifiers and biomass stoves.
4. Students should be able to learn the biogas plant technology.

UNIT-I

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

UNIT-II

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-III

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

UNIT-IV

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and 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

UNIT-V

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.

Suggested Readings:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Handbook, Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. Wereko-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

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Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills, Hyderabad-34

Course Code	Course Title						Core/Elective
OE 9105ME	**Industrial Safety**						**Open Elective**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives

- Causes for industrial accidents and preventive steps to be taken.
- Fundamental concepts of Maintenance Engineering.
- About wear and corrosion along with preventive steps to be taken.
- The basic concepts and importance of fault tracing.
- Thestepsinvolvedincarryingoutperiodicandpreventivemaintenanceofvarious equipment used in industry

Course Outcomes

After completing this course, the student will be equipped with:

1. Concepts of engineering systems safety
2. Identify the causes for industrial accidents and suggest preventive measures.
3. Identify the basic tools and requirements of different maintenance procedures.
4. Apply different techniques to reduce and prevent wear and corrosion in Industry.
5. Identify different types of faults present in various equipment like machine tools, IC Engines, boilers etc.
6. Apply periodic and preventive maintenance techniques as required for industrial equipment like
   motors, pumps and air compressors and machine tools etc.

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 colour 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.

Suggested Readings:

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

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
AD9001HS	**English for Research Paper Writing**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	30	70	-

Course Objectives

- Understand that how to improve your writing skills and level of read ability
- Understand the nuances of language and vocabulary in writing a Research Paper.
- Develop the content, structure and format of writing a research paper.
- Produce original research paper without plagiarism

Course Outcomes

After completing this course, the student will be equipped with:

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT- I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits, Limitations – outcomes.

UNIT- II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings, Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT- III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism

UNIT- IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing – The final draft and proof reading.

UNIT- V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech

volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – Advantages/Benefits **Presentation Skills :** Developing Persuasive Presentations, Structure of Presentation, Presentation Slides, Presentation Delivery, role of the audience, what to search and cite, how to establish credibility.

Suggested Readings:

1. C.R Kothari, Gaurav, Garg,—Research Methodology Methods and Techniques‖,4/e, New Age International Publishers.
2. Day R,—How to Write and Publish a Scientific Paper",Cambridge University Press,2006
3. MLA Hand book for writers of Research Papers‖,7/e,East West Press Pvt.Ltd, New Delhi
4. Lauri Rozakis, Schaum's, Quick Guide to Writing Great Research Papers‖,Tata McGraw Hills Pvt. Ltd, New Delhi.

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
AD9002CE	**Disaster Management**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	**-**	**-**	**-**	**30**	**70**	-

Course Objectives

- To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters.
- To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters.
- To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.

Course Outcomes

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

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and Practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. 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.

UNIT-I

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT-II

Repercussions of Disasters and Hazards: Economic Damage, Loss of 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.

UNIT-III

Disasters 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

UNIT-IV

Disaster 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.

UNIT-V

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. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

Suggested Readings:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal Book Company.
2. Sahni, Pardeep (Eds.),"Disaster Mitigation Experiences and Reflections", PHI, NewDelhi.
3. Goel S.L.,"Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi.

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills, Hyderabad-34.

Course Code	Course Title						Core/Elective
AD9003HS	**Sanskrit for Technical Knowledge**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	-	-	-	**30**	**70**	-

Course Objectives

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- To make the novice Learn the Sanskrit to develop the logic in mathematics, science & and other subjects
- To explore the huge knowledge from ancient Indian literature

Course Outcomes

By the end of this course, students will be able to:

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT– I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants- significance of Amarakosa- parts of Speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive Voice-Past/Present/Future Tense-Syntax-Simple Sentences (elementary treatment only)

UNIT–II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP-sulba, sutramor baudhayana theorem (origination of Pythagoras theorem)- value of pie- Madhava's sine and cosine theory (origination of Taylors series).
The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of Michaelson and Morley theory).

UNIT– III

Role of Sanskritin Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):
Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower-Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth- Pingala chandasutram (origination of digital logic system)

UNIT–IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology):

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills, Hyderabad-34

Computer languages and the Sanskrit languages-computer command words and the vedic command words-Analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT– V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants- plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout- equipment-distillation vessel-kosthi yanthram

Suggested Reading:

1. Kapail Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Pride of India, Samskrita Bharati Publisher, ISBN: 81-8727627-4,2007.
3. Shri Rama Verma,Vedas the source of ultimate science, N
4. M Krishnamachariar, History of Classical Sanskrit Literature, TTD Press, 1937.
5. M.R. Kale, A Higher Sanskrit Grammar: For the Use of School and College Students, Motilal Banarsidass Publishers, 2015.

Head of Department
Electronics & Communication Engineering
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Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
AD9004HS	**Value Education**						**Audit I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	**30**	**70**	-

Course Objectives

- Understand the need and importance of Values for self-development and for National development.
- Imbibe good human values and Morals
- Cultivate individual and National character.

Course Outcomes

After completing this course, the student will be equipped with:

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values;Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books: Self-management and Good health; internal & external cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma, and Guna: Concept of soul; Science of Reincarnation, Character, and Conduct; Concept of Dharma; Cause and Effect-based Karma Theory; The qualities of Divine and Devilish; Sattvic, Rajasic, and Tamasic gunas.

Suggested Readings:

1. Chakroborty,S.K.,Values&EthicsfororganizationsTheoryandpracticeǁ,OxfordUniversityPres s, New Delhi, 1998.
2. Jaya Dayal Goyandaka, Srimad Bhagavad Gita with Sanskrit Text, Word Meaning, and Prose Meaning, Gita Press, Gorakhpur, 2017.

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Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
AD9011HS	**Constitution of India and Fundamental Rights**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	30	70	--

Course Objectives

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

Course Outcomes

After completing this course, the student will be equipped with:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. 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.
4. Discuss the passage of the Hindu Code Bill of1956.

UNIT-I

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II

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.

UNIT-III

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.

UNIT-IV

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayat

raj: Introduction, PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V

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.

Suggested Readings:

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

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
AD9012HS	**Pedagogy Studies**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	-	-	-	**30**	**70**	-

Course Objectives

- To present the basic concepts of design and policies of pedagogy studies.
- To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design, and assessment practices.
- To familiarize with various theories of learning and their connection to teaching practice.
- To create awareness about the practices followed by DFID, other agencies, and other researchers.
- To provide understanding of critical evidence gaps that guide the professional development.

Course Outcomes

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

1. Illustrate the pedagogical practices followed by teachers in developing countries, both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics, and types of educational research and perspectives on research.
4. Describe the role of classroom practices, curriculum, and barriers to learning.
5. Understand research gaps and learn the future directions.

1.

UNIT-I

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.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education

UNIT-III

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 material 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.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Suggested Readings:

1. Ackers J, Hardman F, Classroom Interaction in Kenyan Primary Schools, Compare‖, 31 (2): 245 – 261, 2001.
2. Agarwal M, Curricular Reform in Schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.
3. Akyeampong K, Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER), Country Report 1. London: DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count? International Journal Educational Development, 33 (3): 272- 282, 2013.
5. Alexander R J, Culture and Pedagogy: International Comparisons in Primary Education, Oxford and Boston: Blackwell, 2001.
6. ChavanM, ReadIndia:Amassscale,rapid, learning to read campaign, 2003.

Head of Department
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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
AD9013HS	**Stress Management by Yoga**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**2**	-	-	-	**30**	**70**	-

Course Objectives

- Creating awareness about different types of stress and the role of yoga in the management of stress.
- Promotion of positive health and overall wellbeing (physical, mental, emotional, social, and spiritual).
- Prevention of stress-related health problems through yoga practice.

Course Outcomes

After successful completion of the course, the students will be able to:

1. Understand yoga and its benefits.
2. Enhance physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas.
5. Improve work performance and efficiency.

UNIT-I

Meaning and Definition of Yoga - Historical Perspective of Yoga - Principles of Ashtanga Yoga by Patanjali

UNIT- II

Meaning and Definition of Stress - Types of Stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and Depression. Meaning of Management - Stress Management.

UNIT- III

Concept of Stress According to Yoga - Stress Assessment Methods - Role of Asana, Pranayama, and Meditation in the Management of Stress

UNIT- IV

Asanas - (5 Asanas in Each Posture) - Warm-up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine Asanas - Surya Namaskar

UNIT- V

Pranayama:

Anulom and Vilom Pranayama - Nadishodhana Pranayama - Kapalabhati Pranayama - Bhramari

Pranayama - Nadanusandhana Pranayama.

Meditation Techniques:

Om Meditation - Cyclic Meditation - Instant Relaxation Technique (QRT) - Quick Relaxation Technique (QRT) - Deep Relaxation Technique (DRT)

Suggested *Readings*:

1. "Yogic Asanas for Group Training - Part I", Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Raja Yoga or Conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.
3. Nagendra H. R. and Nagaratna R., "Yoga Perspective in Stress Management", Swami Vivekananda Yoga Prakashan, Bangalore.

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Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
AD9014HS	**Personality Development Through Life Enlightenment Skills**						**Audit II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	2	-	-	-	**30**	**70**	-

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

Course Outcomes

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

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Practice emotional self-regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT- I

Neeti satakam–Holistic Development of Personality -Verses19,20,21,22(Wisdom)-Verses29,31,32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT- II

Neeti satakam–Holistic Development of Personality (cont'd)-Verses52,53,59(don'ts)-Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT- III

Introduction to Bhagavadgeetha for Personality Development -Shrimad Bhagavad geetha:Chapter 2 – Verses41, 47, 48-Chapter3–Verses13,21,27,35-Chapter 6–Verses5,13,17,23,35-Chapter18–Verses

45,46,48Chapter–6:Verses5,13,17,23,35;Chapter–18:Verses45, 46,48

UNIT- IV

Statements of Basic Knowledge -Shrimad Bhagavadgeetha:Chapter 2-Verses56, 62,68 -Chapter 12–Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT- V

Role of Bhagavadgeetha in the Present Scenario -Chapter 2 –Verses17 -Chapter 3 –Verses36, 37, 42- Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Suggested Readings:

1. SrimadBhagavadGita,SwamiSwarupanandaAdvaitaAshram(PublicationDepartment),Kolkata
2. Bhartrihari'sThreeSatakam(Niti-sringar-vairagya),P.Gopinath,RashtriyaSanskritSansthanam, New Delhi

Online Resources: NTPEL: http://nptel.ac.in/downloads/109104115/

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Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
PC3151EV	**VLSI System Design Lab**						**Lab-I**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	1

Course objectives

- Understand and Analyze MOSFET Characteristics
- Design and Evaluate CMOS Inverters and Oscillators
- Develop and Test Digital Circuits

Course Outcomes

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

1. Describe and analyze the fundamental characteristics of MOSFETs.
2. Design and construct three-stage and five-stage ring oscillators using different technology nodes.
3. Demonstrate their ability to create and understand analog circuits.
4. Analyze and evaluate the performance of digital circuits.

PartA:

1. Characteristics of MOSFET.
2. Calculation of rise time and fall time for CMOS inverter.
3. To build a three stage and five stage ring oscillator circuit in 0.18 um and 0.13 um technology and compare its frequencies and time period.
4. NMOS Common Source Amplifier.
5. Design of Differential Amplifier.
6. Design of Operational Amplifier.
7. Draw the layout of Inverter Circuit.

Part B:

1. Experiment on Digital Circuits All basic gates Not, AND , NOR NAND OR Ex-OR Ex-NOR
2. Experiment on Digital Circuits Half Adder and Full Adder.
3. Experiment on Digital Circuits Multiplexer and De-Mux.
4. Experiment on Digital Circuits Encoder and Decoder.
5. Experiment on Digital Circuits ALU Design

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PC3152EV	**Embedded Systems Lab**						**Lab-II**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**50**	-	**1**

Course objectives

- Develop Embedded Systems with LPC2148 Microcontroller
- Implement Advanced Embedded System Features
- Understand and Apply Real-Time Operating System (RTOS) Concepts

Course Outcomes

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

1. To program the LPC2148 microcontroller to control LED blinking with accurate delay timings and create responsive and interactive embedded applications.
2. Illustrate their capability to control analog signal parameters in digital systems.
3. Demonstrate their ability in interfacing and communication protocols.
4. Demonstrate an understanding of real-time concepts using an RTOS to manage complex embedded applications.

Part A: Implement using the LPC2148 microcontroller on an ARM development kit.

1. LED Blinking with Delay
2. Button Press Detection
3. PWM (Pulse Width Modulation) for LED Brightness Control
4. UART Communication
5. Analog to Digital Conversion (ADC)
6. Timer-Based Event Handling
7. DC Motor Speed and Direction Control
8. LCD Display Interface
9. Wireless Communication using Bluetooth or Wi-Fi Module
10. Temperature and Humidity Monitoring System

Part B: Understand Real Time Concepts using any RTOS through Demonstration of:

1. Timing
2. Multi-Tasking
3. Semaphores
4. Message Queues
5. Round-Robin Task Scheduling
6. Preemptive Priority based Task Scheduling
7. Priority Inversion
8. Signals
9. Interrupt Service Routines

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34

Course Code	Course Title						Core/Elective
PC3153EV	**VLSI Design Verification and Testing Lab**						**Lab-III**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**50**	-	**1**

Course objectives

- Understand Object-Oriented Programming Concepts
- Apply Inheritance and Method Overriding
- Implement Concurrency and Synchronization Mechanisms

Course Outcomes

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

1. Demonstrate their understanding of class instantiation and initialization.
2. Demonstrate their ability to use static class properties and methods effectively.
3. Illustrate their understanding of code reuse and polymorphism.
4. Showcase their ability to manage and synchronize multiple threads in concurrent programming.
5. Implement synchronization and communication mechanisms in a multi-threaded environment.

List of Experiments:

1. Access the class properties and methods by creating objects.
2. Use class constructor to initialize the class properties while creating the object for a class.
3. Demonstrate the working of Static class properties and methods.
4. Use the concept of Inheritance to extend the functionality of an existing class.
5. Demonstrate the process of overriding class members.
6. Write a program to demonstrate the use of local and protected keywords.
7. Use rand and randc to generate a random stimulus.
8. Write a program to demonstrate how threads work using fork-join.
9. Write a program to demonstrate the function of semaphore
10. Write a program to demonstrate the function of mailbox

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills, Hyderabad-34

Course Code	Course Title						Core/Elective
PC3154EV	**Seminar**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**2**	**50**	-	**1**

Course Outcomes

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

1. Develop the habit of referring the journals for literature review.
2. Understand the gist of the research paper.
3. Identify the potential for further scope.
4. Present the work in an efficient manner.
5. Write the documentation in standard format.

Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Deliver the seminar for a maximumdurationof30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
2. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the Department.

Guidelines for awarding marks		
S. No.	**Description**	**Max. Marks**
1	Contents and relevance	10
2	Presentation skills	10
3	Preparation of PPT slides	05
4	Questions and answers	05
5	Report in a prescribed format	20

Note:

1. The seminar presentation should be a gist of at least five research papers from **Peer-reviewed** or UGC recognized journals.
2. The seminar report should be in the following order: Background of work, literature

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills, Hyderabad-34

review, techniques used, prospective deliverables, discussion on results, conclusions, critical appraisal and reference.

3. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.
4. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar presentation shall remain void.

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
PC3155EV	**Mini Project with Seminar**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	4	50	-	2

Course Outcomes

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

1. Formulate a specific problem and give solution
2. Develop model/ models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

- As part of the curriculum in the II- semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter-disciplinary/industry relevance.
- The students can select a mathematical modeling based/Experimental investigations or Numerical modeling
- Alltheinvestigationsshouldbeclearlystatedanddocumentedwiththereasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference

Departmental committee: Supervisor and a minimum of two faculty members

Guidelines for awarding marks inCIE(Continuous Internal Evaluation):Max.Marks:50		
Evaluation by	**Max. Marks**	**Evaluation Criteria/ Parameter**
Supervisor	20	Progress and Review
	05	Report
Departmental Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech.
Road No: 3, Banjara Hills Hyderabad-34.

Course Code	Course Title						Core/Elective
PC3156EV	**Major Project Phase–I**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**20**	**100**	-	**10**

Course Outcomes

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

1. Exposed to self-learning various topics.
2. Learn to survey the literature such as books, journals and contact resource persons for the selected topic of research.
3. Learn to write technical reports.
4. Develop oral and written communications kills to present.
5. Defend their work in front of technically qualified audience

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminarshouldbebasedontheareainwhichthecandidatehasundertakenthedissertationwork.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the committee consists of Chairperson-BoS, Osmania University and Head, Supervisor & Project coordinator from the respective Department of the Institute.
- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for awarding marks in CIE(Continuous Internal Evaluation):Max.Marks:100		
Evaluation by	**Max. Marks**	**Evaluation Criteria/ Parameter**
Supervisor	30	Project Status/ Review(s)
	20	Report
Departmental Committee (Chairperson BoS, Osmania University and Head, Supervisor & Project coordinator from the respective Department of the institution)	10	Relevance of the Topic
	10	PPT Preparation
	10	Presentation
	10	Question and Answers
	10	Report Preparation

Note: The Supervisor has to assess the progress of the student regularly

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-3

Course Code	Course Title						Core/Elective
PC3157EV	**Major Project Phase–II (Dissertation)**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	**32**	-	**200**	**16**

Course Outcomes

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

1. Use different experimental techniques and will be able to use different software/computational /analytical tools.
2. Design and develop an experimental setup/equipment/test rig.
3. Conduct tests on existing setups/ equipments and draw logical conclusions from the results after analyzing them.
4. Either work in a research environment or in an industrial environment.
5. Conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

- It is a continuation of Major Project Phase–I started in semester-III.
- The student has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner and Chairperson BoS, & Head, Osmania University and Supervisor from the Institute.
- Thecandidatehastobeinregularcontactwithhis/herSupervisor/Co-Supervisor

Guidelines for awarding marks in SEE(Semester End Examination):Max.Marks:200		
Evaluation by	**Max. Marks**	**Evaluation Criteria/ Parameter**
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	30	Quality of the work which may lead to publications
	10	Analytical/Programming/Experimental Skills Preparation
	10	Report preparation in a standard format
External Examiner and Chairperson, BoS & Head, Osmania University (All together)	20	Power Point Presentation
	60	Quality of thesis and evaluation
	30	Innovations, application to society and Scope for Future study
	20	Viva-Voce

Head of Department
Electronics & Communication Engineering
Muffakham Jah College of Engg. & Tech
Road No: 3, Banjara Hills Hyderabad-34