ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2020 Rank Band: 201-250

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
Estd-1980 KITSW
website: www.kitsw.ac.in E-mail: principal@kitsw.ac.in ✆ : +91 9392055211, +91 7382564888

DEPARTMENT OF

ELECTRONICS & INSTRUMENTATION ENGINEERING

PG – M.Tech. (VLSI & EMBEDDED SYSTEMS)

PRR -20

SYYLABI, SCHEME OF INSTRUCTION & EVALUATION

(I Semester to IV Semester)

(Applicable from the Academic Year 2020-21)

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE:: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

PRR-20

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (VLSI & EMBEDDED SYSTEMS)
I-SEMESTER OF 2-YEAR M.TECH DEGREE PROGRAMME

[4 Th+2 P+1 MC+1 AC]

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PC	P20VE101	Professional Core-1: Digital IC Design	3	-	-	3	8	8	8	6	10	20	60	40	100
2	PC	P20VE102	Professional Core-2: Microcontroller based Embedded Systems	3	-	-	3	8	8	8	6	10	20	60	40	100
3	PE	P20VE103	Professional Elective-I/ MOOC-I	3	-	-	3	8	8	8	6	10	20	60	40	100
4	PE	P20VE104	Professional Elective-II/ MOOC-II	3	-	-	3	8	8	8	6	10	20	60	40	100
5	PC	P20VE105	Professional Core Lab-I: (*Based on Professional Core- 1*) Digital IC Design Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
6	PC	P20VE106	Professional Core Lab-II: (*Based on Professional Core- 2*) Microcontroller based Embedded Systems Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
7	MC	P20MC107	Research Methodology and IPR	2	-	-	2	8	8	8	6	10	20	60	40	100
8	AC	P20AC108	Audit Course-I	2	-	-	1	8	8	8	6	10	20	60	40	100
			Total	16	-	8	19							480	320	800

* Additional Learning: Students are advised to do MOOCs to bridge the gap in the curriculum, as suggested by the Department Academic Advisory Committee (DAAC). The credits earned by the student through MOOCs will be printed in the semester grade sheet.

L- Lecture, T – Tutorials, P - Practical & C – Credits; Contact hours per week: 24; Total Credits: 19

Professional Elective-I/ MOOC-I	**Professional Elective-II/ MOOC-II**	**Audit Course-I**
P20VE103A: Static Timing Analysis	P20VE104A: Embedded Systems Design with RTOS	P20AC108A: English for Research Paper Writing
P20VE103B: System Verilog for Design & Verification	P20VE104B: Linux and Python programming	P20AC108B: Sanskrit for Technical Knowledge
P20VE103C: Embedded System Concepts	P20VE104C: Advanced VLSI Devices	P20AC108C: Constitution of India
P20VE103D: MOOCs	P20VE104D: MOOCs	P20AC108D: Pedagogy Studies

P20VE101 DIGITAL IC DESIGN

Class: M.Tech. I – Semester **Specialization(s)**: **VLSI & ES**

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on

LO1: characteristics of the basic MOS circuits and effects due to long interconnects
LO2: complex combinational MOS logic circuits with depletion nMOS and pMOS loads
LO3: behaviour of sequential CMOS logic circuits such as latches and flip-flops
LO4: dynamic circuit Techniques for pass transistor circuits and CMOS logic based circuits

UNIT – I (9)

Switching characteristics and interconnect effects: Introduction, Delay-time definitions, Calculation of delay times, Inverter design with delay constraints, Estimation of interconnect parasitics, Calculation of interconnect delay, Switching power dissipation of CMOS inverters

UNIT –II (9)

Combinational MOS logic circuits: Introduction, MOS logic circuits with depletion nMOS Loads, Two-Input NOR Gate, Two-input NAND Gate, CMOS logic circuits, CMOS NOR2 (two-input NOR) gate, CMOS NAND2 (two-input NAND) gate, Complex logic circuits, AOI and OAI gates, Pseudo-nMOS gates, CMOS full-adder circuit, CMOS transmission gates (pass gates)

UNIT– III (9)

Sequential MOS logic circuits: Introduction, Behaviour of bistable elements, SR latch circuit, clocked latch and flip-flop circuits, Clocked SR latch, Clocked JK latch, Master-slave flip-flop, CMOS D-latch and edge-triggered flip-flop

UNIT - IV (9)

Dynamic logic circuits: Introduction, Basic principles of pass transistor circuits, Logic '1' transfer, Logic '0' transfer, Charge storage and charge leakage, Voltage bootstrapping, Synchronous dynamic circuit techniques, Dynamic pass transistor circuits, Dynamic CMOS circuits, CMOS transmission gate logic, Dynamic CMOS logic (precharge-evaluate logic), High performance dynamic CMOS circuits

Text Book(s):

[1] Sung-Mo Kang, Yusuf Leblebici, *CMOS Digital Integrated Circuits: Analysis and Design*, 3rd ed. New Delhi: Mc Graw Hill, 1999. (*Chapter 6 to 9*).

[2] Ken Martin, *Digital Integrated Circuit Design*, Oxford University Press, 2002.

Reference Book(s):

[1] Jan M.Rabaey, AnanthaChadrakasan, BorivojeNikolic, *Digital Integrated Circuits: A Design Perspective*, 2nd ed. New Delhi: Pearson 2016.

[2] David A Hodges, Horace G Jackson and Resve A Saleh, *Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology*, New Delhi: TMH,2005.

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...

CO1: analyze basic CMOS circuits without & with interconnect parasitic constraints and estimate interconnect parasitic resistances & capacitances

CO2: compare the performance of combinational MOS circuits with depletion nMOS and pMOS loads

CO3: design and analyze the sequential MOS circuits such as latches and edge triggered flip-flops

CO4: analyze synchronous dynamic circuit techniques and design high performance dynamic CMOS circuits

Course Articulation Matrix (CAM): P20VE101 DIGITAL IC DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE101.1	1	1	1	2	2
CO2	P20 VE101.2	2	1	2	2	2
CO3	P20 VE101.3	2	1	2	2	2
CO4	P20 VE101.4	2	1	2	2	2
P20VE101		**1.75**	**1**	**1.75**	**2**	**2**

P20VE102 MICROCONTROLLER BASED EMBEDDED SYSTEMS

Class: M.Tech. I – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: architectural features of ARM cortex-M Processor
LO2: programming of ARM using assembly language
LO3: TM4C123 Microcontroller architecture and interfacing
LO4: configuration of TM4C123 microcontroller communication interfaces

UNIT – I (9)

ARM Cortex-M Architecture: ARM instruction, Set architecture, Register set, Operating modes, Processor reset sequence, Pipelined architecture and data path, Memory address map, Bus system and bus matrix, Memory and peripherals, Bit banding, System stack architecture, Debug system, Exceptions and interrupts

UNIT – II (9)

Assembly Language Programming: Software development process, ARM cortex –M assembly language, Addressing modes, Instruction set: Data processing instructions, Memory access instructions, Branch and control instructions

UNIT – III (9)

TM4C123 Microcontroller: TM4C123 Microcontroller Block Diagram, The hardware development board for TM4C123, Microcontroller peripherals, Configuring microcontroller pins as GPIOs, Input – output interfacing for LED and Switch, Methods for input-output synchronization

UNIT – IV (9)

Interfacing with TM4C123: Configuration of interrupts and exceptions, UART configuration, I^2C configuration, SPI configuration, CAN configuration, ADC configuration

Text Book(s):

[1] Muhammad Tahir and Kashif Javed, *ARM Microprocessor Systems – Cortex-M Architecture, programming and Interfacing*, Florida: CRC Press, 2017.

Reference Book(s):

[1] Jonathan W Valvano, *Embedded Systems: Real time interfacing to ARM Cortex-M Microcontrollers*, 5th ed. Self Published, 2017.

[2] Joseph Yiu, *The Definitive Guide to the ARM Cortex-M3*, 2nd ed. USA: Newnes Publishers , 2010.

[3] Andrew N Sloss, Dominic Symes, Chris Wright, *ARM System Developer's Guide - Designing and Optimizing System Software*, San Francisco: Morgan Kaufmann Publishers, 2014.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: utilize ARM Cortex-M processor for design of basic typical embedded systems
CO2: develop embedded 'C' programs for ARM processor
CO3: identify the building blocks of TM4C123 microcontroller
CO4: use interrupts and several communication protocols of TM4C123 microcontroller for effective transfer of data

Course Articulation Matrix (CAM): P20VE102 MICROCONTROLLER BASED EMBEDDED SYSTEMS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE102.1	2	1	-	2	2
CO2	P20VE102.2	2	1	-	2	2
CO3	P20VE102.3	2	1	-	2	2
CO4	P20VE102.4	2	1	-	2	2
P20VE102		**2**	**1**	**-**	**2**	**2**

P20VE103A STATIC TIMING ANALYSIS

Class: M.Tech. I – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on

LO1: basic definitions, advantages and limitations of static timing analysis
LO2: timing & power dissipation modeling of combinational & sequential standard cells
LO3: techniques for reducing parasitic components at critical nodes and delay calculation at different voltage levels
LO4: rise & fall time glitches, overshoot & undershoot glitches and crosstalk delay analysis

UNIT – I (9)

Introduction: need of static timing analysis (STA), Limitations of static timing analysis, Power considerations and reliability considerations
STA Concepts: CMOS logic design, Basic MOS structure, CMOS logic gate standard cells, Modeling of CMOS cells switching waveform, Propagation delay, Slew of a waveform, Skew between signals, Timing arcs and unateness, Min and max timing paths, Clock domains, Operating conditions

UNIT –II (9)

Standard Cell Library: Pin capacitance, Timing modeling, Timing models - combinational cells, Timing models - sequential cells, State-dependent models, Interface timing model for a black box, Advanced timing modeling, Models for crosstalk noise analysis, Power dissipation modeling

UNIT– III (9)

Interconnect Parasitics: RLC for interconnect, Wire load models, Representation of extracted parasitics, Representing coupling capacitances, Hierarchical methodology, and reducing parasitics for critical nets
Delay Calculation: Overview, Cell delay using effective capacitance, Interconnect delay, Slew merging, Different slew thresholds, Different voltage domains, Path delay calculation and slack calculation

UNIT - IV (9)

Crosstalk and Noise: Overview, Crosstalk glitch analysis, Types of glitches-rise and fall glitches, Overshoot & undershoot glitches, Glitch thresholds & propagation, Noise accumulation with multiple aggressors, Aggressor timing correlation, Aggressor functional correlation, Crosstalk delay analysis, Timing verification using crosstalk delay, Computational complexity, Noise avoidance techniques

Text Book(s):

[1] J. Bhasker, R. Chadha, *Static Timing Analysis for Nanometer Designs: A Practical Approach*, New Delhi: Springer, 2009. (*Chapter 1 to 6*)

Reference Book(s):

[1] R. Jayagowri, Pushpendra S. Yadav, *Static Timing Analysis for VLSI circuits*, New Delhi: MEDTECH, A Division of Scientific International, 2018.

[2] Naresh Maheshwari and Sachin S. Sapatnekar, *Timing Analysis and Optimization of Sequential Circuits*, Berlin: Springer Science, 1999.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: classify the needs, advantages and limitations of static timing analysis at different operating conditions

CO2: design the combinational & sequential standard cells using advanced timing modeling

CO3: analyze the combinational & sequential standard cells using interconnect parasitic extraction and delay model

CO4: analyze the combinational & sequential standard cells using crosstalk noise modeling, timing correlation & functional correlation

Course Articulation Matrix (CAM): P20VE103A STATIC TIMING ANALYSIS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE103A.1	1	1	1	2	2
CO2	P20 VE103A.2	2	1	2	2	2
CO3	P20 VE103A.3	2	1	2	2	2
CO4	P20 VE103A.4	2	1	2	2	2
P20VE103A		**1.75**	**1**	**1.75**	**2**	**2**

P20VE103B SYSTEM VERILOG FOR DESIGN & VERIFICATION

Class: M.Tech. I – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on …

LO1: key system verilog enhancements for hardware design and system verilog data types
LO2: features and uses of arrays, structures and unions in system verilog
LO3: procedural blocks, tasks, functions and procedural statements used in system verilog
LO4: modeling of finite state machines and behavioral & transaction level modeling with system verilog

UNIT – I (9)

Introduction to System Verilog: Key system verilog enhancements for hardware design, Enhanced literal value assignments. define enhancements, External compilation unit declarations, Simulation time units and precision, System Verilog data types, Type casting, User-defined types, Enumerated data types

UNIT –II (9)

System Verilog Arrays, Structures and Unions: Structures- Assigning values to structures, Packed and unpacked structures, Passing structures through ports, Passing structures as arguments to tasks and functions, Unions- Typed and anonymous unions
Unpacked unions, Packed unions, Arrays- Using packed and unpacked arrays, Arrays of arrays, Arrays in structures and unions

UNIT– III (9)

System Verilog Procedural Blocks, Tasks and Functions: System Verilog specialized procedural blocks, Enhancements to tasks and functions
System Verilog Procedural Statements: New operators, Operand enhancements, Enhanced for loops, Bottom testing do while loop, New jump statements - break, continue, return, Enhanced case statements, Enhanced if-else decisions

UNIT - IV (9)

Modeling Finite State Machines with System Verilog: Modeling state machines with enumerated types, Using 2-state data types in FSM models
Behavioral and Transaction Level Modeling: Behavioral modeling, Transaction level modeling in System Verilog, Transaction level models via interfaces, Bus arbitration, Transactors, adapters, and bus functional models

Text Book(s):

[1] Stuart Sutherland, Simon Davidmann and Peter Flake, *System Verilog for Design - A Guide to Using System Verilog for Hardware Design and Modeling*, 2nd ed. Berlin: Springer Science, 2006. (*Chapter 1 to 7 and 11*)

Reference Book(s):

[1] C Spear, *System Verilog for Verification-A Guide to Learning the Testbench Language Features*, Berlin: Springer Science, 2006.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: develop hardware modelling programs using key enhancements of system Verilog

CO2: develop system Verilog program for hardware modeling using arrays, structures and unions

CO3: design hardware using procedural blocks, tasks, functions and procedural statements of system Verilog

CO4: design finite state machines using enumerated & 2-state data types and compare behavioral and transaction level modeling

Course Articulation Matrix (CAM): P20VE103B SYSTEM VERILOG FOR DESIGN & VERIFICATION

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE103B.1	1	1	1	2	2
CO2	P20 VE103B.2	2	1	2	2	2
CO3	P20 VE103B.3	2	1	2	2	2
CO4	P20 VE103B.4	2	1	2	2	2
P20VE103B		**1.75**	**1**	**1.75**	**2**	**2**

P20VE103C EMBEDDED SYSTEM CONCEPTS

Class: M.Tech. I – Semester
Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: embedded systems development life cycle and their characteristics
LO2: firmware design approaches and development languages
LO3: different device driver mechanisms
LO4: principles of hardware and software co-design methodologies

UNIT-I (9)

Introduction to Embedded Systems: Definition, Embedded Systems vs. General Computing Systems, Classification of Embedded Systems, Purpose of Embedded systems, Characteristics & Quality attributes of Embedded Systems – Objectives, Phases & Approaches of Embedded Product Development Life Cycle (EDLC) - Embedded System Model

UNIT-II (9)

Typical Embedded System: Processor, Memory & Communication Interfaces, Washing Machine Example
Embedded Firmware: Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Basic Programming in Embedded C

Unit-III (9)

Device drivers: Device drivers for interrupt handling- Memory device drivers – On-board bus device drivers – I/O device drivers
Integration of Hardware and Firmware: Out of circuit programming, In-system programming, In-application programming

Unit-IV (9)

Hardware Software Co-Design and Program Modelling: Fundamental issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to Unified Modeling Language(UML), Hardware Software Trade-offs
Development Environment: Integrated Development Environment (IDE) - Cross-Compilers, Simulators, Emulators & Debugging

Text Books:

[1] K.V. Shibu, *Introduction to Embedded Systems*, 2nd ed. New Delhi: McGraw Hill Education India Private Limited, 2017. *(Chapters 1,2,9,12,15)*
[2] Tammy Noergaard, *Embedded Systems Architecture,* Newnes: Elsevier Inc., 2005.

Reference Books:

[1] Frank Vahid, Tony D. Givargis, *Embedded system Design: A Unified Hardware/Software Introduction*, New Delhi: Wily India Pvt. Ltd., 2006.
[2] Raj Kamal, *Embedded Systems: Architecture, Programming and Design*, 2nd ed. New Delhi: Tata McGraw Hill Education India Private Limited, 2008.
[3] Michael J. Pont, *Embedded C*, 2nd ed. New Delhi: Pearson Education, 2008.
[4] David E. Simon, *An Embedded Software Primer*, New Delhi: Pearson Education Publication, 2002.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: identify the basic steps in the development life cycle of embedded systems
CO2: design and develop embedded firmware using embedded 'C' programming
CO3: design device drivers using embedded system development tools
CO4: analyze hardware software co-design principles and program models

Course Articulation Matrix (CAM): P20VE101 DIGITAL IC DESIGN						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	P20VE103C.1	1	1	1	1	1
CO2	P20VE103C.2	1	1	1	1	1
CO3	P20VE103C.3	1	1	1	1	1
CO4	P20VE103C.4	1	1	1	1	1
P20VE103C		**1**	**1**	**1**	**1**	**1**

P20VE104A EMBEDDED SYSTEM DESIGN WITH RTOS

Class: M.Tech. I Semester Specialization(s)**:** VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Exam	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1:basics need of RTOS in embedded systems
LO2:principles and design using RTOS
LO3:basics of µC/OS-II Features
LO4:functions for inter task communication &synchronization of µC/OS-II

UNIT-I (9)

Introduction to Real Time Operating Systems: Tasks and task states, Tasks and data, Semaphores and shared data, Message queues, Mailboxes, Pipes, Timer functions, Events, Memory management, Interrupt routines in RTOS environment

UNIT-II (9)

Principles of basic design using a RTOS: An example, Encapsulating semaphores and Queues, Hard and soft real time scheduling considerations, Saving memory space, Saving power

UNIT-III (9)

µC/OS-II: Features, Kernel structure, Task management functions and Time management functions

UNIT-IV (9)

µC/OS-II: Functions for inter task communication & Synchronization, Memory management functions, Porting µC/OS-II

Text Book(s):

[1] David E. Simon, *An Embedded Software Primer,* Chennai: Pearson Education Publication, 2005.

[2] Jean J. Labrosse, *µC/OS-II, The real time Kernel*, 3rd ed. Burlington, MA: Focal Press, 2015.

Reference Book(s):

[1] Raj Kamal, *Embedded Systems: Architecture, Programming and Design*, 2nd ed. Noida: TMH Publications, 2008.

[2] Jonathan Valvano, *Embedded Systems: Real-Time Operating Systems for Arm Cortex Microcontrollers*, Charleston: Create Space Independent Publishing Platform, 2012.

[3] Richard Barry, *Using FreeRTOS Real Time Kernel: A practical Guide*, Real Time Engineers Ltd., 2010. (http://www.freertos.org)

[4] S. Siewert and J. Pratt, *Real-Time Embedded Components and Systems with LINUX and RTOS*, Herndon: Mercury Learning and Information LLC, 2016.

Course Learning Outcomes (COs):

Upon completion of this course, students will be able to…

CO1: identify the need of RTOS in embedded systems
CO2: analyze the principles & basic design using a RTOS
CO3: identify functions of kernel & task management in µC/OS-II RTOS
CO4: analyze principles & inter task communication concepts of µC/OS-II RTOS

Course Articulation Matrix (CAM): P20VE104A EMBEDDED SYSTEM DESIGN WITH RTOS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE104A.1	1	1	1	2	2
CO2	P20VE104A.2	1	1	1	2	2
CO3	P20VE104A.3	1	1	1	2	2
CO4	P20VE104A.4	1	1	1	2	2
P20VE104A		**1**	**1**	**1**	**2**	**2**

P20VE104B LINUX AND PYTHON PROGRAMMING

Class: M.Tech. I Semester Specialization(s)**:** VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: Linux commands and operations on file system
LO2: Linux shell and networking concepts including troubleshooting, firewalling
LO3: typical data types, functions, branching, looping conditions in Python programming
LO4: standard modules and perform reading and writing files in Python

UNIT – I (9)

Linux distributions and Licenses, Introducing the command line, File globbing, Quoting commands, Getting help Working with the Linux shell, Understanding standard streams, Understanding regular expressions, Working with sed, Working with awk, Navigating the Linux file system, Understanding the file system, Working with file links, Searching for files, Working with users and groups, Working with file permissions, Working with text files, Working with VIM text editor

UNIT –II (9)

Working with the Command Line, Essential Linux commands, Understanding processes, Signals, Working with Bash shell variables, Introduction to Bash shell scripting, Basic networking concepts, Installing new software and updating the system, Introduction to services, Basic system troubleshooting and firewalling, Introducing Access Control Lists

UNIT– III (9)

Introduction to Python Language, Creating and Running Python Programs, Identifiers and Keywords, Variables and Data Types, Collection Data Types - lists, tuples, dictionaries and sets; Operators and their precedence, Conditional branching, Looping, Functions, Global variables.

UNIT - IV (9)

Exception handling and errors, Modules and Packages, Overview of Python standard modules - math, io, sys, os, datetime, random, os.path; File Handling – reading and writing to text files, reading and writing to binary files, reading and writing to structured text files-CSV, HTML, XML and JSON

Text Book(s):

[1] Oliver Pelz, *Fundamentals of Linux*, Birmingham, UK: Packt Publishing, 2018.
[2] Mark Summerfield, *Programming in Python 3 : A complete introduction to the Python language,* 2nd ed. Boston, MA: Pearson Education, 2010.

Reference Book(s):

[1] Bill Lubanovic, *Introducing Python*, 2nd ed. Sebastopol, CA: O'reilly Media, 2015.
[2] Christine Bresnahan, Richard Blum, *Linux Essentials*, 2nd ed. Indianapolis: John Wiley & Sons, 2015.
[3] Kent D. Lee, *Python Programming Fundamentals*, 2nd ed. London: Springer-Verlag, 2014.

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...

CO1: identify the uses of typical Linux commands & file systems
CO2: identify functions of Linux shell & characteristics of networking
CO3: develop python programs using fundamental programming concepts
CO4: use Python standard modules and perform reading and writing files in Python

Course Articulation Matrix (CAM): P20VE104B LINUX AND PYTHON PROGRAMMING						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20VE104B.1	2	1	1	2	2
CO2	P20VE104B.2	2	1	1	2	2
CO3	P20VE104B.3	2	1	1	2	2
CO4	P20VE104B.4	2	1	1	2	2
P20VE104B		**2**	**1**	**1**	**2**	**2**

P20VE104C ADVANCED VLSI DEVICES

Class: M.Tech. II – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on …

LO1: basic concepts of MOS Device Physics

LO2: overall limitations of nanoscale MOSFETs considering the Channel, Gate, Drain/Source and Substrate related issues individually.

LO3: Silicon-on- Insulator (SOI) devices and its structures, manufacturing materials, operations, characterizations, modelling and applications to control of short channel effects.

LO4: study the a-Si:H material, a-Si:H TFT architecture, fabrication process, layout, performance and characterizations

UNIT – I (9)

Review of long channel MOSFETs: MOS Capacitor Device Physics, Fundamental of MOSFETs, MOSFET Scaling: Short Channel Effects (SCEs), Mobility reduction, Subthreshold Current, Channel Length Modulation, Drain Induced Barrier Lowering (DIBL) and Finite Output Resistance

MOSFET Device Metrics, Transistors to Circuits, Energy Band View of Transistors, Traditional IV Theory, The "Virtual Source Model".

UNIT –II (9)

Nanoscale MOSFETs: Challenges of Nanoscale MOSFETs, Limitations of Nanoscale MOSFETs: Subthreshold Leakage, Threshold Voltage Variation, Mobility Degradation, Hot Carrier Effects, Source Drain Tunnelling, Parasitic Resistance and Capacitance, Reverse Biased Junction Leakage Current etc.

UNIT– III (9)

Advanced MOSFETs: Silicon-on-Insulator (SOI) MOSFETs: Fully Depleted (FD) SOI, Partially Depleted (PD) SOI, Junction Less SOI, Other Multigate SOI-MOSFETs: Double Gate, FinFET, π Gate, Ω Gate, Gate-All- Around (GAA) or surrounding gate, Silicon on Nothing (SON), Nanowire FET

UNIT - IV (9)

Promising Nano devices Beyond CMOS: Thin Film Transistors (TFT): Hydrogenated amorphous silicon (a-Si:H) TFT, Impact-Ionization MOSFETs (IMOSFETs); Tunnel FETs (TFETs); Schottky-Barrier FETs (SBTFETs); Cabron Nanotube-FETs (CNTFETs); Organic FETs(OFETs)

Text Book(s):

[1] S. M. Sze and K. K. Ng, *Physics of Semiconductor Devices*, 3rd ed. NewYork: Wiley, 2006.

[2] Jean-Pierre Colinge (Ed), *FinFETs and Other Multi-Gate Transistors*, Berlin: Springer, 2008.

[3] S. D. Brotherton, *Introduction to Thin Film Transistors: Physics and Technology of TFTs*, Heidelberg: Springer, 2013.

Reference Book(s):

[1] Kevin F Brennan, *Introduction to Semiconductor Devices: For Computing and Telecommunications Applications*, 1st ed. Cambridge: Cambridge University Press, 2005.

[2] Y.P. Tsividis, Colin McAndrew, *Operation and Modeling of the MOS Transitor*, 3rd ed. Oxford: Oxford University Press, 2014.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: analyse CMOS device scaling & it effects on circuit/system performance

CO2: identify the relevant device physics that underlies CMOS device design

CO3: identify necessary techniques in manufacturing advanced VLSI circuits

CO4: make use of typical nano devices & beyond CMOS devices for designing different VLSI circuits

Course Articulation Matrix (CAM): P20VE104C ADVANCED VLSI DEVICES

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE104C.1	1	1	1	2	2
CO2	P20VE104C.2	2	1	2	2	2
CO3	P20VE104C.3	2	1	2	2	2
CO4	P20VE104C.4	2	1	2	2	2
P20VE104C		**1.75**	**1**	**1.75**	**2**	**2**

P20VE105 DIGITAL IC DESIGN LABORATORY

Class: M.Tech. I – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: transfer and switching characteristics of CMOS Inverter at transistor level
LO2: complex combinational and sequential CMOS logic circuits at transistor level
LO3: implementation of adders and multipliers with variable number of inputs using HDLs
LO4: implementation of arithmetic logic unit and finite state machine using HDLs

List of Experiments:

1. Analyze Switching characteristics of CMOS Inverter.
2. Design and analyze CMOS arithmetic circuits (Transistor level).
3. Design and analyze Clocked JK flip-flop (Transistor level).
4. Design and analyze CMOS Schmitt Trigger Circuit (Transistor level).
5. Design and implementation of Adders using HDL.
6. Design and implementation of Digital Multipliers using HDL.
7. Design and implementation of Arithmetic Logic Unit using HDL.
8. Design and implementation of Finite State Machine using HDL.
9. Mini-projects-2

Laboratory Manual:

[1] *Digital IC Design Laboratory Manual,* Dept. of EIE, KITSW.

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...

CO1: analyze the characteristics of CMOS inverter without & with interconnect parasitic constraints and estimate interconnect parasitic resistances & capacitances
CO2: compare the performance of combinational CMOS arithmetic circuits at variable supply voltage & input frequency
CO3: design the sequential CMOS circuits such as edge triggered flip-flops and schmitt trigger circuits
CO4: develop the HDL codes for combinational arithmetic circuits and synchronous sequential circuits

Course Articulation Matrix (CAM): P20VE105 DIGITAL IC DESIGN LABORATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE105.1	2	2	2	2	2
CO2	P20 VE105.2	2	2	2	2	2
CO3	P20 VE105.3	2	2	2	2	2
CO4	P20 VE105.4	2	2	2	2	2
P20VE105		**2**	**2**	**2**	**2**	**2**

P20VE106 MICROCONTROLLER BASED EMBEDDED SYSTEMS LABORATORY

Class: M.Tech. I – Semester
Specialization(s)**: VLSI & ES**

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: writing embedded C programs for ARM microcontrollers
LO2: using SysTick counter of ARM microcontrollers
LO3: programming the interrupts of ARM microcontrollers
LO4: interfacing sensors with ARM microcontrollers

The following experiments are to be performed on ARM Cortex-M TM4C123 microcontroller using Embedded C

1. Reading switches and displaying on LEDs
2. Initializing and displaying message on LCD display
3. Transmitting data using UART
4. Receiving data using UART
5. Toggling LED using SysTick counter
6. Implementing delay function using Timers
7. Using GPIOF interrupt
8. Using SysTick interrupt
9. Interrupt priority demonstration
10. Interfacing LM34 temperature sensor
11. Communicating with Real time clock using I^2C
12. Using PWM module to control LED intensity

Laboratory Manual:

[1] *Microcontroller Based Embedded Systems Laboratory Manual,* Dept. of EIE, KITSW.

Reference Book(s):

[1]. Muhammad Ali Mazidi, Shujen Chen, Sarmad Naimi, Sepehr Naimi, *TI ARM Peripherals Programming and Interfacing Using C Language for ARM Cortex*, Mazidi and Naimi, 2014

Course Learning Outcomes (COs):
Upon completion of this course, students will be able to…

CO1: develop embedded C programs for ARM microcontrollers
CO2: develop embedded C programs for transmit & receive data using UART
CO3: develop embedded C programs for delay functions using timers
CO4: develop embedded C programs for interfacing sensors with ARM microcontrollers

Course Articulation Matrix (CAM): P20VE106 **Microcontroller Based Embedded Systems Laboratory**						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20VE106.1	2	2	1	2	2
CO2	P20VE106.2	2	2	1	2	2
CO3	P20VE106.3	2	2	1	2	2
CO4	P20VE106.4	2	2	1	2	2
P20VE106		**2**	**2**	**1**	**2**	**2**

P20MC107 RESEARCH METHODOLOGY AND IPR

Class: M. Tech., I-Semester

Specialization(s): SCE, DE, VE, PE, SE DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on
LO1: research methodology, approaches, principles of experimental design and research plan
LO2: sampling design, data collection, data representation and statistical analysis
LO3: layout of a research report, technical paper writing, oral presentation and intellectual property
LO4: patent rights and developments in IPR.

UNIT-I (6)

Research Methodology: Meaning of research, Objectives, Motivation, Types, Approaches, Research methods Vs methodology, scientific method, Research process, Criteria for good research, Literature review, Research ethics, Plagiarism, Problems encountered by researchers in India

Defining the Research Problem and Research Design: Selecting a research problem, Necessity and techniques in defining research problem, Need for research design, Features of good design, Different research designs, Basic principles of experimental design, Developing a research plan

UNIT – II (6)

Sampling Design: Census and sample survey, Implications, Steps, Criteria of selecting a sampling procedure, Characteristics of a good sample design, Types of sample designs, Complex random sampling designs

Data Collection & Data Analysis: Collection of primary and secondary data, Observation method, Interview method, Collection of data through questionnaires, Schedules, Data organization, Methods of data grouping, Diagrammatic and graphic representation of data, Regression modeling, Direct and interaction effects, ANOVA, F-test, Time series analysis, Autocorrelation and Autoregressive modeling.

UNIT – III (6)

Interpretation and Report Writing: Interpretation Technique, Precaution in interpretation, Significance, steps and layout of report writing, Types of reports, Oral presentation, Mechanics of writing a research report, Precautions, Format of the research report, synopsis, dissertation, thesis, references/bibliography/webliography, Technical paper writing/ journal/ report writing, Making presentation, Use of visual aids.

Nature of Intellectual Property: Patents, Designs, Trade and Copyright.

Process of Patenting and Development: Technological research, innovation, patenting, development.

UNIT – IV (6)

Patent Rights: Scope of patent rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.

New Developments in IPR: Administration of Patent System, New developments in IPR, IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Book(s):

[1] C.R Kothari and Gaurav Garg, "*Research Methodology, Methods & Techniques*", 4th ed., New Age International Publishers, 2019 (*Chapters 1, 2, 3, 6, 7, 11, 14*)

[2] Deborah Ebouchoux, "*Intellectual Property, The Law of Trademarks, Copyrights, Patents and Secrets*", 4th ed., Delmar, Cengage Learning, 2012 *(Chapter 1, 2, 3, 17, 18)*

[3] ***Anti-plagiarism policy of KITSW*** - A handout prepared by Dean, Research and Development, KITSW, Jan 2020.

[4] Frequently Asked Questions, Office of CGPDTM, INDIA 2020

[5] Patent Office Procedures: http://www.ipindia.nic.in/writereaddata/images/pdf/ patent-office-procedures.pdf

References Book(s):

[1] Stuart Melville and Wayne Goddard, "*Research methodology: An Introduction for Science & Engineering Students*" 2nd ed., JUTA, 2007.

[2] Robert P. Merges, Peter S. Menell, Mark A. Lemley, "*Intellectual Property in New Technological Age - I*", Clause 8, 2016.

[3] Dobera J Halbert, "*Resisting Intellectual Property*", Taylor & Francis Ltd., 1st ed., 2005.

[4] Ranjit Kumar, "*Research Methodology: A Step by Step Guide for beginners*", 3rd ed., Sage Publications India Pvt. Ltd, New Delhi, 2011.

[5] T. Ramappa, "*Intellectual Property Rights Under WTO*", 4th ed., .S. Chand, 2008

[6] R. Ganesan, "*Research Methodology for Engineers*", MJP Publishers, Chennai, 2011

[7] Patent application procedures: https://patentinindia.com/cost-patent-registration-india/

[8] http://www.ipindia.nic.in/history-of-indian-patent-system.htm

[9] Patent Law India: https://www.mondaq.com/india/patent/656402/patents-law-in-india--everything-you-must-know

[10] How to file patents: https://iptse.com/how-to-file-patents-understanding-the-patent-process-in-india/

[11] How Can I get a patent for my project: https://patentinindia.com/cost-patent-registration-india/

Course Learning Outcomes (COs):

On completion of this course, students will be able to

CO1: develop and formulate research problem using research methodology techniques.
CO2: utilize techniques of data modeling and analysis to solve research problem
CO3: choose an appropriate methodology to write a technical report and present a research paper
CO4: judge patent rights and adapt new developments in IPR for their patent publications

Course Articulation Matrix (CAM): **P20MC107 RESEARCH METHODOLOGY & IPR**

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20MC107.1	2	2	1	-	-
CO2	P20MC107.2	2	2	1	-	-
CO3	P20MC107.3	2	2	1	-	-
CO4	P20MC107.4	2	2	-	-	-
P20MC107		**2**	**2**	**1**	**-**	**-**

P20AC108A ENGLISH FOR RESEARCH PAPER WRITING

Class: M.Tech. I-Semester **Specialization(s): SCE, DE, VE, PE, SE, DS, DC &CSP**

Teaching Scheme: **Examination Scheme:**

L	T	P	C
2	-	-	1

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in /on

***LO1**: planning for quality research writing with improved level of readability*
***LO2**: constituents and attributes of a research paper*
***LO3**: specifications for research transcription and pedagogic skills for reporting research*
***LO4**: guidelines for publishing research papers in quality journals*

UNIT-I (6)

Skills for Research Writing: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy

Improving Level of Readability: Avoiding Ambiguity and Vagueness, Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism

UNIT-II (6)

Constituents of a Research Paper: Abstract, Styles of abstract, Keywords, Characteristics of poor abstract, Assessing quality of abstract, Introduction- outline in introduction, Assessing quality of introduction, Review of Literature, Ways of referring to authors in literature

Attributes of a Research Paper: Methodology, Use of tenses and articles in methodology, Results, Styles of reporting results, Discussion, Styles of writing discussions, Conclusions, Impact of writing conclusions, Assessing quality of conclusions, Final Check-Do's and Don'ts

UNIT-III (6)

Specifications for Research Transcription: Structuring phrasing and summarizing of title and abstract, Structuring phrasing and summarizing of introduction, Critical review of literature, Limitations of previous work and demonstration of innovation in proposed research

Pedagogic skills for reporting research: Structuring and justifying the methodology, Structuring, Reporting, Interpreting and summarizing results, Structuring, Comparing, Interpreting and summarizing discussions, Styles of writing discussions, Structuring, differentiating and summarizing of conclusions

UNIT-IV (6)

Quality Assurance and Corroboration of Research: Indexing and harnessing useful phrases, Adapting final check for readability, Clarity in logical order of argumentation, Checking for journal guidelines, Consistency, Accuracy, Acknowledgements and spell-check

Text Book(s):

[1] Adrian Wallwork, *English for Writing Research Papers,* 2nd ed. New York, Dordrecht Heidelberg London, Springer books, 2016.

Reference Book(s):

[1] Goldbort R, *Writing for Science, London,* 2 ed. Yale University Press, 2006
[2] Day R, *How to Write and Publish a Scientific Paper,* 8th ed. Cambridge University Press, 2016
[3] Adrian Wallwork, *English for Academic Research ,Grammar, Usage and Style,* 2nd ed. New York: Springer Books, 2012.

Course Learning Outcomes (Cos):

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

CO1: *develop essential skills for research writing with improved level of readability.*
CO2: *organize the constituents of research paper and derive conclusions with a final check of Do's and Don'ts*
CO3: *justify, interpret, compare and summarize results for proposed methodologies in research paper*
CO4: *adopt quality assurance methods like final check for readability, consistency and accuracy of a research paper.*

Course Articulation Matrix (CAM): P20AC108A ENGLISH FOR RESEARCH PAPER WRITING						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	P20AC108A.1	1	2	2	-	-
CO2	P20AC108A.2	1	2	2	-	-
CO3	P20AC108A.3	1	2	2	-	-
CO4	P20AC108A.4	1	2	2	-	-
P20AC108A		**1**	**2**	**2**	**-**	**-**

P20AC108B SANSKRIT FOR TECHNICAL KNOWLEDGE

Class: M.Tech. I – Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on …

LO1: proficiency in illustrious Sanskrit, the scientific language in the world
LO2: the depth of grammar in sanskrit
LO3: deeper insight into tenses used in sanskrit
LO4: concepts related to various technical fields

UNIT – I (6)

Introduction: Alphabets, vowels, consonants, Māheśvara sutras, combined alphabets, verbs, basic words

UNIT –II (6)

Study of grammar I: Singular/dual/plural, nominative case, accusative case, instrumental case, dative case, ablative case, genitive case, locative case

UNIT– III (6)

Study of grammar II: Nouns and adjectives, indeclinable, present tense, past tense, future tense, order and request, prefixes, number word, combinations ablative case, genitive case, locative case and cases**.**

UNIT - IV (6)

Technical concepts related to various fields: Technical concepts of Mathematics, Chemistry, Electrical science, Mechanics & Mechanical Science, Metallurgy, Aeronautics, Marine science, measurement of time, astronomy, architecture, botany, agriculture, hygiene & health

Text Book(s):

[1] Dr.Vishwas, *Abhyaspustakam,* 1st ed. New Delhi: Samskrita-Bharti Publication, 2014
[2] Suresh Soni, *India's Glorious Scientific Tradition,* 1st ed. NewDelhi: Ocean books (P) Ltd, 2008 (Unit IV)

Reference Book(s):

[1] Vempati Kutumbshastri, *Teach Yourself Sanskrit*, 1st ed. New Delhi: Prathama Deeksha Rashtriya Sanskrit Sansthanam, 2012

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...

CO1: understand to read and write basic Sanskrit language
CO2: identify the usage of grammar in the ancient Indian language
CO3: make use of tenses in Sanskrit language
CO4: analyze the ancient Sanskrit literature on Science and Technology

Course Articulation Matrix (CAM): P20AC108B SANSKRIT FOR TECHNICAL KNOWLEDGE						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20AC108B.1	2	1	1	-	-
CO2	P20AC108B.2	2	1	1	-	-
CO3	P20AC108B.3	2	1	1	-	-
CO4	P20AC108B.4	2	1	1	-	-
P20AC108B		**2**	**1**	**1**	**-**	**-**

P20AC108C CONSTITUTION OF INDIA

Class: M. Tech. I – Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on

LO1: state policy and parliamentary form of government, council of ministers
LO2: necessity of act of information technology and its powers, cyber security and its laws
LO3: consumer protection act, rights of consumer-deficiency in service
LO4: crimes against women, different legislations, process of investigation and right to information act

UNIT – I (6)

Constitutional Law: Constitution meaning and significance-constitutional history-status of fundamental rights-role of fundamental duties-implementation of the directive principles of the state policy-parliamentary form of government-president-prime minister-council of ministers-federal structure in constitution-relations between central and state-amendment of constitution –procedure and kinds of amendments.

UNIT –II (6)

Law of information technology: Evolution-genesis and necessity of information technology act-features and various authorities under it act-their powers-impact of other related enactments-e-commerce laws in india-digital and electronic signatures in indian laws-e-contracts and its validity in india-cyber tribunals-definition and necessity of cyber security-computer and cyber security-e-mail security-database security-operating system security-advance computers-network and mobile security techniques- sensitive personal data and information in cyber laws-cyber crimes-hacking-phishing –stalking-cyber terrorism.

UNIT– III (6)

Corporate Law: Definition and essentials of valid contract - corporate incorporation and management-directors of company-company secretary-corporate governors-different system of corporate governors-corporate governance and social responsibility-emerging trends-corporate and social environment responsibility-competition law-objectives competition commission of india-consumer protection act-consumerism-rights of consumer-deficiency in service-unfair trade practices-e-contracts etc.

UNIT - IV (6)

Criminal Law: Definition of crime--crimes against women including cyber crimes-criminal justice systems-protection for women for atrocities-different legislations like constitution, indian penalcode, human rights, domestic violence, equality in rights, dowry prohibition, prevention of child marriage, prevention of sexual harassment against woman at work place, protection of children some sexual harassment – investigation – compliant - process of investigation – fir, panchanama, closure report, charge sheet etc - procedure of search

Right to Information Act: Freedom of information - indian constitution and right to information - legislating the right to information - salient features of the right to information act 2005 - public authority under rti act - nature of rti, exemptions and limitations -

composition, powers and functions of the information commissions - right to information and implementation issues

Text Book(s):

[3] M.P.Jain, Indian *Constitutional Law*, Vol.1, Wadhwa & Co, Nagpur, 2003
[4] Vakul Sharma, *Information Technology – Law and Practice,* Universal Law Publishing, 3rd Ed. 2011
[5] Gower and Davies, *Principles of Modern Company Law,* Sweet and Maxwell Publishing, 10th Ed.
[6] Ratan Lal and Dhiraj Lal: *Indian Penal Code*, Wadhwa & Co., 36th Ed. 2000
[7] O.P.Srivastava: *Principles of Criminal Law,* Eastern Book Company, 6th Ed. 2016
[8] KM Shrivastava, *The Right to Information: A Global Perspective*, Lancer Publisher, New Delhi (2013)

Reference Book(s):

[1] H.M.Seervai, *Constitutional Law of India, Vol.3,* N.M.Tripathi , 4th Ed., 1997
[2] G.C.V.Subba Rao, *Indian Constitutional Law*, S.Gogia& Co., Hyderabad
[3] Dr.S.R.Myneni, *Information Technology Law (Cyber Laws),* Asia Law House, Hyderabad, 1st Ed. 2018.
[4] J.M. Thomson: *Palmer's Company Law, Vol.4, 21st Ed. Wildy & Sons Ltd.*
[5] P.S.Achutan Pillai: *PSA Pillai's Criminal Law*, Butterworth Co., 2000.
[6] K.D.Gour: *Criminal Law*, *Cases and Materials*, 9th Ed. LexisNexis, 2019.
[7] Sairam Bhat, *Right to Information and Good Governance*, National Law School of India University, 2016.
[8] Dheera Khandelwal and KK Khandelwal , A Commentary and Digest on the *Right to Information Act, 2005,* 2nd Ed., 2014.

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...

CO1: develop the knowledge in state policy and parliamentary form of government
CO2: make use of information technology act and cyber security
CO3: utilize the consumer protection act and rights consumer
CO4: perceive the legislations and understand the process of investigation and right to information act

Course Articulation Matrix (CAM): P20AC108C : CONSTITUTION OF INDIA						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20AC108C.1	1	1	1	-	-
CO2	P20AC108C.2	1	1	1	-	-
CO3	P20AC108C.3	1	1	1	-	-
CO4	P20AC108C.4	1	1	1	-	-
P20AC108C		**1**	**1**	**1**	**-**	**-**

P20AC108D PEDAGOGY STUDIES

Class: M. Tech. I –Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop student's knowledge in/on…

LO1: terminology of pedagogy studies, role of curriculum, relation between teaching and learning
LO2: effectiveness of pedagogical practices and teaching strategies
LO3: student centered approaches of learning
LO4: factors supporting effective pedagogy, research gaps and future directions of potential areas

UNIT-I (6)

Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning- Behaviourism, Constructivism, Social constructivism, Critical theory, Difference between curriculum and syllabus, Curriculum, Importance of curriculum for students and teachers, Role played by the curriculum

Teaching- Learning Process: Introduction, Concept of pedagogy, Principles of teaching, Maxims of teaching, Phases of learning, Relationship between teaching and learning, Factors of teaching and learning in classroom situation, Difference between teaching and learning.

UNIT-II (6)

Overview of pedagogical practices in developing countries: *Overview and aims, Pedagogy approaches, Pedagogy as practice, Pedagogy as ideas, Pedagogy and equity, Curriculum, Teacher education - initial teacher education, Continuing professional development, Training unqualified teachers, Effectiveness of pedagogical practices, Pedagogic theory and pedagogical strategies, Teachers' attitudes and beliefs*

Strategies of Teaching: Features, Characteristics, Advantages and limitations of lecture method, Demonstration method, Experimental method and Discussion method

UNIT-III (6)

Student Centred Approaches: Features, characteristics, Advantages and limitations of constructivist approach of learning, Discovery method of learning, Enquiry method, Project Based Learning (PBL), Activity Based Learning (ABL)

Practical Approaches: Features of experiential learning and Teacher's role, Peer tutoring, Field visits and process of organizing, E-learning tools, Strengths and weaknesses.

UNIT-IV (6)

Role of teacher education, school curriculum, guidance materials in supporting effective pedagogy: Professional development, Alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

Research gaps and future directions: Research design, contexts, Pedagogy, Teacher education, curriculum and assessment, Dissemination and research impact

Textbooks:

[1] Dr. S. K. Bhatia, Dr. Sonia Jindal, *A Textbook of curriculum, pedagogy and evaluation*, 1st ed., New Delhi: Paragon International Publishers, 2016.

[2] Jo Westbrook, Naureen Durrani, Rhona Brown, David Orr, John Pryor, Janet Boddy, Francesca Salvi, *Pedagogy, Curriculum. Teaching Practices and Teacher Education in Developing Countries*, Education Rigorous Literature Review, Center for International Education, University of Sussex, December 2013.

Reference books:

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

[2] Agrawal 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? Multi-site 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 RJ, *Culture and pedagogy: International comparisons in primary education.* Oxford and Boston: Blackwell, 2001.

[6] Chavan M, *Read India: A mass scale, rapid, 'learning to read' campaign,* 2003.

[7] www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Learning Outcomes (COs):
On completion of this course, the students will be able to…

CO1: describe the significance of curriculum, relationship between teaching and learning
CO2: justify the effectiveness of pedagogical practices of teaching and compare the lecture, demonstration, experimental and discussion methods of teaching strategies
CO3: analyse the role of student centered approaches in learning of a student and identify suitable approaches for the improvement
CO4: exemplify the role of professional development, curriculum, assessment for effective pedagogy and identify the research gaps in allied areas

Course Articulation Matrix: P20AC108D PEDAGOGY STUDIES

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20AC108D.1	-	1	-	-	-
CO2	P20AC108D.2	1	1	1	-	-
CO3	P20AC108D.3	1	1	1	-	-
CO4	P20AC108D.4	1	1	1	-	-
P20AC108D		**1**	**1**	**1**	**-**	**-**

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE:: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

PRR-20

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (VLSI & EMBEDDED SYSTEMS)
II-SEMESTER OF 2-YEAR M.TECH DEGREE PROGRAMME

[4 Th+2 P+1 Mini Project +1 AC]

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PC	P20VE201	Professional Core-3: Analog IC Design	3	-	-	3	8	8	8	6	10	20	60	40	100
2	PC	P20VE202	Professional Core-4: Internet of Things	3	-	-	3	8	8	8	6	10	20	60	40	100
3	PE	P20VE203	Professional Elective-III/ MOOC-III	3	-	-	3	8	8	8	6	10	20	60	40	100
4	PE	P20VE204	Professional Elective-IV/ MOOC-IV	3	-	-	3	8	8	8	6	10	20	60	40	100
5	PC	P20VE205	Professional Core Lab-III: (*Based on Professional Core- 3*) Analog IC Design Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
6	PC	P20VE206	Professional Core Lab-IV: (*Based on Professional Core- 4*) Internet of Things Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
7	PROJ	P20VE207	Mini Project with Seminar	-	-	4	2	-	-	-	-	-	-	100	-	100
8	AC	P20AC208	Audit Course-II	2	-	-	1	8	8	8	6	10	20	60	40	100
			Total	14	-	12	19							520	280	800

* Additional Learning: Students are advised to do MOOCs to bridge the gap in the curriculum, as suggested by the Department Academic Advisory Committee (DAAC). The credits earned by the student through MOOCs will be printed in the semester grade sheet.

Note: The students shall undergo mandatory Industrial training/ Internship for at least 6 to 8 weeks during summer vacation at Industry/R&D organization. Internship evaluation will be done during the III semester.

L- Lecture, T – Tutorials, P – Practicals & C – Credits ; Contact hours per week: 26; Total Credits: 19

Professional Elective-III/ MOOC-III	**Professional Elective-IV/ MOOC-IV**	**Audit Course-II**
P20VE203A: Low Power VLSI Design	P20VE204A: Artificial Intelligence & Machine Learning	P20AC208A: Stress Management by Yoga
P20VE203B: System on Chip Design	P20VE204B: Industrial IOT	P20AC208B: Value Education
P20VE203C: Wireless Technologies in Embedded systems	P20VE204C: VLSI DSP Architectures	P20AC208C: Personality Development through Life Enlightenment Skills
P20VE203D: MOOCs	P20VE204D: MOOCs	P20AC208D: Disaster Management

P20VE201 ANALOG IC DESIGN

Class: M. Tech. II – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on …

LO1: MOS characteristics, models, types of amplifiers and design of current mirrors
LO2: design techniques for differential amplifiers and operational amplifiers
LO3: stability and frequency compensation of feedback systems and reference generators
LO4: Nyquist rate and oversampling data converters

UNIT – I (9)

MOS Transistors: Introduction to analog design, MOS I/V characteristics, Second – order effects, Brief review of small signal and Large signal model of MOSFETs
Single Stage Amplifiers: Common Source Amplifier, Source follower, Common gate amplifier, Cascode amplifiers
Current mirrors: Simple CMOS current sinks and source, MOS current mirror, degenerated current mirrors, High output impedance - current mirrors, Cascode stage Wilson current mirror, Bipolar current mirrors - bipolar gain stages, Widlar current mirror

UNIT –II (9)

Single ended and fully differential amplifiers and its performance analysis: General considerations, comparison of performance single stage amplifiers and its performance: Low frequency gain, Input common mode range, Slew rate, Common mode rejection ratio, Offset, Noise, Power supply rejection

Two stage amplifiers: Stability analysis of multipole system, Compensation of two-stage amplifier, Phase margin, Gain margin, Gain-bandwidth, Frequency compensation of two-stage op-amps: Miller and R-C compensation, Voltage buffer, Current buffer compensation

UNIT– III (9)

Bandgap references: General considerations, Supply-Independent biasing, Temperature independent references, PTAT and CTAT voltage generation, Constant – Gm biasing, Current reference

Low dropout regulators: Regulators with NMOS and PMOS pass gate, Comparison of Cap and Capless LDO's

UNIT - IV (9)

Data converter fundamentals: Ideal D/A converter, Ideal A/D converters, Quantization noise, signed codes, performance limitations
D/A Converters: R-2R DAC, oversampling current steering DAC, Delta-sigma DAC, Capacitor DAC
A/D Converters: Single-slope ADC, SAR ADC, Pipeline ADC, Flash ADC, Delta-sigma ADC

Text Book(s):

[1] Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, New Delhi: Tata McGraw Hill Edition, 2002.
[2] D.Johns, K.Martin, *Analog Integrated Circuit Design*, New Delhi: John Wiley & Sons, Inc., 2008.

Reference Book(s):

[1] Willy M Samsen, *Analog Design Essentials*, Heidelberg: Springer, 2007.

[2] Allen & Holberg, *CMOS Analog Circuit Design*, 3rd ed. Oxford: Oxford University Press, 2013.

[3] Meyer, Gray, Hurst & Lewis, *Analysis & Design of Analog Integrated Circuits*, 5th ed. New York: Wiley, 2009.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: identify basic building blocks of analog circuits

CO2: design operational amplifiers and its applications

CO3: analyze voltage and current references, understanding of regulators

CO4: model Nyquist rate & oversampling data converters

Course Articulation Matrix (CAM): P20VE201 ANALOG IC DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE201.1	1	1	1	2	2
CO2	P20VE201.2	2	1	2	2	2
CO3	P20VE201.3	2	1	2	2	2
CO4	P20VE201.4	2	1	2	2	2
P20VE201		**1.75**	**1**	**1.75**	**2**	**2**

P20VE202 INTERNET OF THINGS

Class: M.Tech. II – Semester
Specialization(s)**: VLSI & ES**

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam:	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: various protocols for implementing IoT applications
LO2: raspberry pi board components and interfacing sensors
LO3: cloud services for IoT and creating home security dashboard
LO4: publishing messages to a MQTT broker and phone

UNIT-I (9)

Internet of things(IoT): Definition, Applications and challenges
IoT Protocols: IoT protocol stack, 6LoWPAN adaptation layer, Application layer protocols - HTTP, CoAP, MQTT, AMQP, XMPP; REST architectures

UNIT-II (9)

Raspberry Pi 3 board: Understanding the raspberry pi 3 board and its components, Installing the operating system, Setting up python tools, Retrieving the board's assigned IP address, Installing and upgrading the necessary libraries, Using GPIO to connect to the outside world, interfacing different sensors with raspberry pi, Interfacing an LCD, Using sense HAT emulator

UNIT-III (9)

Cloud services for IoT, Accessing the web services, Controlling a servo through command line, Controlling servo using weather data, Setting up a raspberry pi web server using python web frame work, Creating a home security dashboard, Displaying sensory data on the dashboard

UNIT-IV (9)

MQTT brokers, Publishing messages to a *MQTT* broker with a Python client, Sending text message from raspberry pi to phone using twilio, Creating a door bell button using bluetooth, Home appliance control with blynk app

Text Book(s):

[1] Simone Cirani et al, Internet of things: architectures, protocols and standards, USA: John Wiley & Sons, 2019.
[2] Colin Dow, Internet of Things Programming Projects, Birmingham: Packt Publishing, 2018.

Reference Book(s):

[1] Dimitrios Serpanos, Marilyn Wolf, *Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies*, USA: Springer International Publishing, 2018.

[2] David Hanes et al, *IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things*, USA: Cisco Press, 2017.

[3] Ammar Rayes, Samer Salam, *Internet of Things – From Hype to Reality*, USA: Springer International Publishing, 2017.

[4] Arshadeep Bahga, Vijay Madisetti, *Internet of Things: A hands on approach*, Hyderabad: Universities Press India, 2015.

Course Learning Outcomes (COs):
Upon completion of this course, students will be able to…

CO1: identify various protocols for implementing IoT applications
CO2: develop python programs to interface sensors to raspberry pi
CO3: create web-based dashboard for IoT applications
CO4: use MQTT protocol to publish message to a broker

Course Articulation Matrix (CAM): P20VE202 INTERNET OF THINGS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE202.1	1	1	1	2	2
CO2	P20VE202.2	1	1	2	2	2
CO3	P20VE202.3	1	1	2	2	2
CO4	P20VE202.4	1	1	2	2	2
P20VE202		**1**	**1**	**1.75**	**2**	**2**

P20VE203A LOW POWER VLSI DESIGN

Class: M.Tech. II – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):

This course will develop students' knowledge in/on …

LO1: sources of power dissipation, circuit level power estimation and statistical techniques
LO2: low voltage CMOS circuit design styles and short channel effects in deep sub-micrometer MOS devices
LO3: static RAM architecture & organization and energy computing & recovery techniques
LO4: sources of power dissipation in software, estimation and optimization of power for software design

UNIT – I (9)

Introduction and need of low power design, sources of power dissipation and design strategies for low power; Physics of power dissipation in CMOS - low power VLSI design limits; Power estimation at circuit level – modeling of signals, signal probability calculations, statistical techniques, input vector compaction, circuit reliability

UNIT –II (9)

Design styles and testing – low voltage CMOS circuit design styles, leakage current in deep submission transitions and design issues, minimization of short channel effects (SCE) and hot carrier effects; Testing of deep sub micron ICs with elevated intrinsic leakage

UNIT– III (9)

Low power architectures – MOS static RAM cells, banked organization SRAMS, reducing voltage swing on bit lines, write lines, driver circuits and sense amplifier circuits. Energy computing and recovery techniques – energy dissipation using an RC model, energy recovery circuit design, design with partially reversible logic and supply clock generation

UNIT - IV (9)

Software design for low power - dedicated hardware Vs software implementation, power dissipation, estimation and optimization; Automated power code generation and co design for low power

Text Book(s):

[1] Kaushik Roy, Sharad Prasad, *Low Power CMOS VLSI Circuit Design,* New Delhi: Wiley India (P.) Ltd., 2000.

Reference Book(s):

[1] A.P. Chandrakasan, R.W. Broderson, *Low Power design*, New York: Springer Science,1999.
[2] J.B. Kuo, J.H. Juo, *Low Voltage VLSI Circuits*, NJ: John Wiley & Sons.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: differentiate static & dynamic power dissipations in CMOS circuits and estimate power dissipation using statistical techniques

CO2: compare & contrast the low voltage CMOS circuit design styles and estimate the leakage currents due to short channel effects

CO3: construct low power SRAM architectures and integrate energy recovery techniques used for reversible logic circuits

CO4: classify the sources of software power dissipation and analyze the co-design for low power using optimization techniques

Course Articulation Matrix (CAM): P20VE203A LOW POWER VLSI DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE203A.1	1	1	1	2	2
CO2	P20 VE203A.2	2	1	2	2	2
CO3	P20 VE203A.3	2	1	2	2	2
CO4	P20 VE203A.4	2	1	2	2	2
P20VE203A		**1.75**	**1**	**1.75**	**2**	**2**

P20VE203B SYSTEM–ON-CHIP

Class: M.Tech. II – Semester

Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in/on …

LO1: *system architecture for SOC design with hardware and software*
LO2: *various types of processors and processor selection for SOC*
LO3: *concepts of cache memory architectures on SOC and Model of Simple Processor – memory interaction*
LO4: *bus interconnection architectures and customization with reconfiguration technologies*

UNIT – I (9)

Introduction to the System Approach: System Architecture, Components of the system, Hardware & Software, Processor, Architectures, Memory and Addressing; System level interconnection, An approach for SOC Design, System Architecture and Complexity

UNIT – II (9)

Processors: Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling; Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors

UNIT – III (9)

Memory Design for SOC: Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time, Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction

UNIT – IV (9)

Interconnect Customization and Configuration: Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses, Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time; SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance-Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism

Text Book(s):

[1] Michael J. Flynn and Wayne Luk, Computer System Design System-on-Chip, New Jersey: John Wiley & Sons Inc, 2011. (Chapters 1,3 to 6)
[2] Steve Furber, ARM System on Chip Architecture, 2nd ed., New Delhi: Dorling Kindersley (India) Pvt. Ltd., 2000.

Reference Book(s):

[1] Ricardo Reis, *Design of System on a Chip: Devices and Components*, New York: Kluwer Academic Publishers, 2004.
[2] Prakash Rashinkar, Peter Paterson and Leena Singh L, *System on Chip Verification – Methodologies and Techniques*, New York: Kluwer Academic Publishers, 2001.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: analyze SOC Architecture and design
CO2: distinguish the different Processor design Architectures and processor selection for SOC
CO3: classify the cache memory architectures on SOC
CO4: differentiate the interconnection strategies and their customization on SOC

Course Articulation Matrix (CAM): P20VE203B SYSTEM–ON-CHIP						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20VE203B.1	1	1	1	2	2
CO2	P20VE203B.2	2	1	2	2	2
CO3	P20VE203B.3	2	1	2	2	2
CO4	P20VE203B.4	2	1	2	2	2
P20VE203B		**1.75**	**1**	**1.75**	**2**	**2**

P20VE203C WIRELESS TECHNOLOGIES IN EMBEDDED SYSTEMS

Class: M.Tech. II – Semester
Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: basic principles and parameters of wireless sensor networks
LO2: embedded hardware & software design for WSNs
LO3: basic characteristics of MAC protocols & outing technologies in WSNs
LO4: security issues in wireless sensor networks and their communication

UNIT-I (9)

WI-FI: Features of different WLAN generations, IEEE 802.11 Architecture, Different physical layers, Data link layer, Medium access control layer, Functions, Mobility, Security, IEEE 802.11 Family and its derivatives

UNIT-II (9)

Bluetooth: Introduction, Architecture and throughputs, Physical and baseband layers, Link manager control, Logical link control and adaptation protocol(L2CAP), Service discovery protocol

UNIT-III (9)

ZigBee: IEEE 802.15.4 Architecture, MAC Layer, Security, Frame structures, ZigBee general stack
Wimax: Introduction to IEEE 802.16, MAC and physical layers

UNIT-IV (9)

LTE & 5G: Introduction to 1G, 2G and 3G networks, Long-Term Evolution (LTE): Features, Network Architecture and Protocols, Control and user planes, Broadcast and multicast service, MAC and Physical layer in LTE, 5G: Introduction to LTE advanced, D2D communications, LTE-WiFi integration, Characteristics of 5G, 5G frequencies, Cloud RAN

Text Book(s):

[1] Houda Labiod, Hossam Afifi, Cosantino De Santis, *Wi-Fi, Bluetooth, ZigBee and Wimax*, Dordrecht: Springer Publications, 2007.
[2] Khaldoun Al Agha, Guy Pujolle, Tara Ali-Yahiya, *Mobile and Wireless Networks*, Volume 2, London: ISTE & John Wiley & Sons, 2016.

Reference Book(s):

[1] Mischa Schwartz, *Mobile Wireless Communications*, Cambridge: Cambridge University Press, 2005.
[2] K. Daniel Wong, *Fundamentals of Wireless Communication Engineering Technologies*, Hoboken, NJ: John Wiley & Sons, 2012.
[3] Aftab Ahmad, *Wireless and mobile data networks*, Hoboken, NJ: John Wiley & Sons, 2005.

Course Learning Outcomes (COs):
Upon completion of this course, students will be able to…

CO1: identify principles & working of Wireless Sensor Networks (WSNs)
CO2: analyze embedded hardware & software design for WSNs
CO3: compare the characteristics of MAC protocols & routing technologies in WSNs
CO4: estimate the risk and security issues in wireless sensor networks and their communication

Course Articulation Matrix (CAM): P20VE203C WIRELESS TECHNOLOGIES IN EMBEDDED SYSTEMS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE203C.1	2	1	1	2	2
CO2	P20VE203C.2	2	1	1	2	2
CO3	P20VE203C.3	2	1	1	2	2
CO4	P20VE203C.4	2	1	1	2	2
P20VE203C		**2**	**1**	**1**	**2**	**2**

P20VE204A ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Class: M.Tech. II – Semester
Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: fundamental concepts of Artificial Intelligence(AI)
LO2: process interpretation using ontologies & Bayesian , temporal reasoning methodologies in AI
LO3:fundamental concepts in Machine Learning & Supervised learning methods
LO4: unsupervised learning methods , clustering and dimensionality reduction methods

UNIT-I (9)

Artificial Intelligence (AI): Introduction to artificial intelligence, Proposing and evaluating AI applications, Case study: Google Duplex
Search and Planning: Problem spaces and search, Knowledge and rationality, Heuristic search strategies, Search and optimization (gradient descent), Adversarial search, Planning and scheduling, Case studies: Playing chess, Manufacturing scheduling

UNIT-II (9)

Knowledge Representation and Reasoning: Logic and inference, Ontologies, Bayesian reasoning, Temporal reasoning, Case study: Medical diagnosis, Propositional logic, First-order logic, Knowledge representation, Quantifying uncertainty, Probabilistic reasoning.

UNIT-III (9)

Machine learning: What is machine learning?, Supervised vs. unsupervised learning
Supervised methods: Regression -- linear, logistic, ridge; Classification – decision trees, SVM, random forests; Model performance evaluation – MSE, lift, AUC, Type 1 vs 2 errors, Case study: Bank failure prediction

UNIT-IV (9)

Unsupervised Methods: Dimensionality reduction: PCA, Clustering – k-means, hierarchical clustering, Semi-supervised methods, Reinforcement learning, Choosing among machine learning techniques, Case study: Public health outcome clustering

Text Book(s):

[1] Russell, S. & Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed. New York: Pearson Education Publications, 2010.
[2] Goodfellow, I., Bengio, Y. and Courville, A., *Deep Learning*, Cambridge: MIT Press, 2016.
[3] Andreas C. Mueller and Sarah Guido, *Introduction to Machine Learning with Python*, Sebastopol, CA: O'Reilly Media, 2016.

Reference Book(s):

[1] Vinod Chandra S. S, Anand Hareendran S, *Artificial Intelligence and Machine Learning*, Prentice Hall, India, 2014.

[2] Ethem Alpaydin, *Introduction to machine learning*, 2nd ed. Cambridge: MIT Press, USA, 2010.

[3] Ameet V Joshi, *Machine Learning and Artificial Intelligence*, Gewerbestrasse, Cham: Springer-Nature, 2020.

[4] Denis Rothman, *Artificial Intelligence by Example*, 2nd ed. Birmingham: Packt Publishing, 2020.

Course Learning Outcomes (COs):

Upon completion of this course, students will be able to…

CO1: identify fundamental principles of Artificial Intelligence (AI)
CO2: examine representation of information about real time scenario as interpreted by computer
CO3: identify the key aspects of Machine learning & Regression analysis
CO4: analyze the unsupervised learning methods

Course Articulation Matrix (CAM): P20VE204A ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE204A.1	2	1	1	2	2
CO2	P20VE204A.2	2	1	1	2	2
CO3	P20VE204A.3	2	1	1	2	2
CO4	P20VE204A.4	2	1	1	2	2
P20VE204A		**2**	**1**	**1**	**2**	**2**

P20VE204B INDUSTRIAL INTERNET OF THINGS

Class: M.Tech. II – Semester **Specialization(s):** VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: challenges, future trends, automation protocols and wireless technologies in industrial internet of things
LO2: automation trends and security issues in industrial internet of things
LO3: hardware specifications, operational principle and basic programming of programmable logic controllers
LO4: components of process control systems, industrial bus standards & SCADA

UNIT-I (9)

Industrial Internet of Things(IIoT): Introduction to IIoT, Challenges in industrial networks, Future trends in industrial networks, Recent developments in industrial networks for industry 4.0, Industrial automation protocols, Interaction with IoT ecosystem, Summary of current wireless IIoT technologies, Ultra-Reliable Low-Latency Communication (URLLC) for IIoT applications

UNIT-II (9)

Automation Trends in IIoT: Industrial revolutions, Enabling technologies for new productive model, Automation networks in smart industries – Automation pyramid, Information and operational technologies convergence and distribution, Reference Architecture for IIoT and factories digitalization
Security in IIoT: Cloud models, Cloud computing security, IoT security, IIoT security issues and challenges

UNIT-III (9)

Programmable Logic Controllers (PLC): Introduction, Parts of PLC, Principle of operation, PLCs Vs PC, PLC sizes, PLC hardware components – I/O section, Discrete and analog modules, I/O specifications, CPU, Memory design, Terminal devices, Human machine interfaces (HMIs)
Basics of PLC programming: Data files, Program files, PLC scan process, PLC programming languages, Bit level instructions, Instruction addressing, Branch instructions, Internal relay instructions, If open and if close examination, Entering ladder diagrams, Modes of operation

UNIT-IV (9)

Process Control, Network Systems and SCADA(Qualitative): Types of processes, Structure of control systems, On/Off control, PID control, Motion control, Data communications – Serial communication, Bus standards: DeviceNet, ControlNet, EtherNet/IP, Field bus, Profibus, HART, Major elements of a SCADA system, Alarm handling in SCADA systems

Text Book(s):

[1] Ismail Butun, *Industrial IoT : Challenges, Design Principles, Applications, and Security*, Switzerland: Springer Nature, 2020
[2] Frank D. Petruzella, *Programmable logic controllers*, 5th ed. New York: McGraw Hill education, 2017.

Reference Book(s):

[1] Alasdair Gilchrist, *Industry 4.0: The Industrial Internet of Things,* California: Apress Media, 2016.
[2] James A. Rehg Glenn J. Sartori, *Programmable Logic Controllers*, 2nd ed. London: Pearson education, 2014.
[3] John R. Hackworth and Frederick D. Hackworth, Jr., *Programmable Logic Controllers: Programming Methods and Applications,* New Delhi: Dorling Kindersley (India) Pvt. Ltd., 2008.
[4] Boyer SA, *Supervisory Control and Data Acquisition (SCADA),* Pittsburgh: International Society of Automation Press, 2004.

Course Learning Outcomes (COs):
Upon completion of this course, students will be able to…

CO1: analyze the challenges & recent developments in industrial internet of things technologies
CO2: analyze the automation networks trends and security issues related to industrial internet of things
CO3: identify the hardware components & functions of PLC systems and develop ladder diagram programs for PLC using logical functions
CO4: identify required communication bus standards for industrial applications

Course Articulation Matrix (CAM): P20VE204B Industrial Internet of Things						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20VE204B.1	1	1	1	2	1
CO2	P20VE204B.2	1	1	1	2	2
CO3	P20VE204B.3	1	1	1	2	2
CO4	P20VE204B.4	1	1	1	2	1
P20VE204B		**1**	**1**	**1**	**2**	**1.5**

P20VE204C VLSI DSP ARCHITECTURES

Class: M.Tech. II – Semester

Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on

LO1: efficient design of DSP architectures suitable for VLSI

LO2: techniques for altering the existing DSP structures to suit VLSI implementations.

LO3: fast Convolution, Pipelining and Parallel Processing of IIR Filters

LO4: different bit-level multiplier architectures of FIR Filters

UNIT - I (9)

Introduction to DSP Systems: Pipelining and parallel processing of FIR filters–typical DSP algorithms, Data flow and dependence graphs–critical path, Loop bound, Iteration bound longest path matrix algorithm, Pipelining and parallel processing of FIR filters, Pipelining and parallel processing for low power

UNIT – II (9)

Retiming, Algorithmic Strength Reduction: Retiming – definitions and properties, Unfolding – an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application, Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, Rank-order filters, Odd-Even merge-sort architecture, Parallel rank-order filters

UNIT – III (9)

Fast Convolution, Pipelining and Parallel Processing of IIR Filters: Fast convolution – Cook-Toom algorithm, Modified Cook-Toom algorithm, Pipelined and parallel recursive filters – Look-ahead pipelining in first-order IIR filters, Look-ahead pipelining with power-of-2 decomposition, Clustered look-ahead pipelining, Parallel processing of IIR filters, Combined pipelining and parallel processing of IIR filters

UNIT – IV (9)

Bit-Level Arithmetic Architectures: Bit-level arithmetic architectures – parallel multipliers with sign extension, Parallel carry-ripple and carry-save multipliers, Design of Lyon's bit-serial multipliers using Horner's rule, Bit-serial FIR filter, CSD representation, CSD multiplication using Horner's rule for precision improvement, Distributed arithmetic fundamentals and FIR filters

Text Book(s):

[1] Keshab K. Parhi, *VLSI Digital Signal Processing Systems, Design and implementation,* New Delhi: Wiley India (P.) Ltd., 2007. *(Chapters 1 to 10,13)*

[2] U.Meyer – Baese, *Digital Signal Processing with Field Programmable Gate Arrays*, 3rd ed. Berlin: Springer-Verlag, 2007.

Reference Book(s):

[1] Rulph chassaing, *Digital Signal Processing and applications with C6713 and C6416 DSK*, Wiley 2005.

[2] Nasser Kehtarnavaz, *Digital Signal Processing System Design: Lab view based hybrid programming*, Academic press 2008.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: design pipelining and parallel processing of Low Power FIR filters
CO2: develop the DSP architectures suitable for VLSI
CO3: analyze the pipelined and parallel processing of IIR filters
CO4: build the parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers.

ɒurse Articulation Matrix (CAM): P20VE204C VLSI DSP ARCHITECTURES

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	**P20VE204C**.1	1	1	1	2	2
CO2	**P20VE204C**.2	2	1	2	2	2
CO3	**P20VE204C**.3	2	1	2	2	2
CO4	**P20VE204C**.4	2	1	2	2	2
P20VE204C		**1.75**	**1**	**1.75**	**2**	**2**

P20VE205 ANALOG IC DESIGN LABORATORY

Class: M.Tech. II – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on …

LO1: characteristics of MOSFET and single stage amplifiers
LO2: differential amplifiers and operational amplifiers
LO3: bandgap reference circuits
LO4: simulation of ADC and DAC circuits

List of Experiments

1. MOSFET characterization
2. Design of Single-stage amplifiers for the given the specifications
3. Design of various current mirrors (basic, cascode and low-voltage cascode)
4. Design of various single stage differential amplifiers (5-Transistor amplifier, Telescopic and folded cascode)
5. Design of Miller compensated two-stage operational amplifier for the given specifications
6. Design of Voltage Reference and Current Reference Circuits
7. Modeling and design of Successive Approximation Register ADC
8. Modeling and design of Current-steering DAC
9. Mini-projects-2

Laboratory Manual:

[1] *Analog IC Design Laboratory Manual,* Dept. of EIE, KITSW.

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...

CO1: analyze the characteristics of MOSFET with respect to process & temperature variations
CO2: design single-stage amplifiers
CO3: design multi-stage amplifier with miller compensation
CO4: design bandgap reference circuits & data converters

Course Articulation Matrix (CAM): P20VE205 ANALOG IC DESIGN LABORATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE205.1	2	2	1	2	2
CO2	P20VE205.2	2	2	1	2	2
CO3	P20VE205.3	2	2	1	2	2
CO4	P20VE205.4	2	2	1	2	2
P20VE205		**2**	**2**	**1**	**2**	**2**

P20VE206 INTERNET OF THINGS LABORATORY

Class: M.Tech. II – Semester
Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
-	-	3	2

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: developing Python programs for interfacing sensors
LO2: develop Python programs using Sense HAT emulator
LO3: publishing data to MQTT broker
LO4: building web-based dashboard for IoT applications

List of Experiments

The following experiments are to be performed on Raspberry Pi 3 board by developing Python programs.

1. Flashing/Running LEDs
2. Measuring temperature and humidity
3. Interfacing Liquid Crystal Display
4. Using sense HAT emulator to display weather data
5. Measuring three axis acceleration with a accelerometer
6. Measuring pith, roll and yaw using a gyroscope
7. Controlling a servo motor with command line
8. Accessing weather data from cloud
9. Controlling servo position based on the weather data returned from the Yahoo! weather web service
10. Building a web-based dashboard with things board
11. Sending and receiving data in real-time through Internet with PubNub
12. Publishing messages to a MQTT broker with a Python client
13. Home application control using blynk app

Laboratory Manual:

[1] *Internet of Things Laboratory Manual,* Dept. of EIE, KITSW.

Reference Book(s):

[1] Colin Dow, *Internet of Things Programming Projects,* Birmingham: Packt Publishing, 2018.

Course Learning Outcomes (COs):
Upon completion of this course, students will be able to…

CO1: develop Python programs for interfacing typical IO devices
CO2: develop Python programs for accessing data from cloud to control servo motor
CO3: develop Python programs for publishing data to MQTT broker
CO4: build web-based dashboard for IoT applications

Course Articulation Matrix (CAM): **P20VE206 Internet of Things Laboratory**						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20VE206.1	2	2	1	2	2
CO2	P20VE206.2	2	2	1	2	2
CO3	P20VE206.3	2	2	1	2	2
CO4	P20VE206.4	2	2	1	2	2
P20VE206		**2**	**2**	**1**	**2**	**2**

P20VE207 MINI PROJECT WITH SEMINAR

Class: M.Tech. II - Semester
Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
-	-	4	2

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	---

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO1: implementing a project independently by applying knowledge to practice
LO2: literature review and well-documented report writing
LO3: creating PPTs and effective technical presentation skills
LO4: writing technical paper in scientific journal style & format and creating video pitch

Continuous Internal Evaluation (CIE) for Mini Project with Seminar:

1) The *Post Graduate Mini Project Evaluation Committee (PGMPEC)* shall be constituted with HoD as a Chairman, M.Tech. Coordinator as a Convener and three to five other faculty members representing various specializations in that particular programme as members.
2) Student has to take up independent mini project on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student.
3) *PGMPEC* shall allot a faculty supervisor to each student for guiding on
   (a) Selection of topic
   (b) Literature survey and work to be carried out
   (c) Preparing a report in proper format
   (d) Right conduct of research and academic activity to promote academic integrity
   (e) Use of anti-plagiarism software to detect plagiarism in the report and submission of Mini project report within acceptable plagiarism levels
   (f) Effective mini project oral presentation before the PGMPEC

   There shall be only Continuous Internal Evaluation (CIE) for seminar
4) The CIE for mini project is as follows:

Assessment	Weightage
Mini project Supervisor Assessment	**20%**
PGMPEC Assessment: *(i) Registration presentation* ***(10%)*** *(ii) Working model / process / software package / system developed* ***(20%)*** *(iii) Mini project report* ***(20%)*** *(iv) Mini project paper* ***(10%)*** *(v) Mini project video pitch* ***(10%)*** (vi) *Final presentation (with PPT) and viva-voce* ***(10%)***	**80 %**
Total Weightage:	**100%**

Note: It is mandatory for the student to

(i) appear for final presentation (with PPT) and viva-voce to qualify for course evaluation

(ii) write mini project paper in given journal format

(ii) create a good video pitch to present mini project

(a) **Mini Project Topic**: The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals/Technical Magazines on the topics of potential interest

(b) **Working Model**: Each student is requested to develop a working model/ process/ software package /system on the chosen work and demonstrate before the *PGMPEC* as per the dates specified by *PGMPEC*

(c) **Mini Project Report:** Each student is required to submit a well-documented mini project report as per the format specified by *PGMPEC*

(d) **Anti-Plagiarism Check:** The mini project report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the *PGMPEC* as per the schedule notified by the department

(f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her mini project. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (*if any*) and social impact

5) The student has to register for the Mini project as supplementary examination in the following cases:

i) he/she is absent for oral presentation and viva-voce

ii) he/she fails to submit the report in prescribed format

iii) he/she fails to fulfill the requirements of Mini project evaluation as per specified guidelines

6) (a) The CoE shall send a list of students registered for supplementary to the HoD concerned

(b) The PGMPEC, duly constituted by the HoD, shall conduct Mini project evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply knowledge to practice to design and conduct experiments and utilize modern tools for developing working models / process / system leading to innovation and entrepreneurship

CO2: demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report

CO3: make an effective oral presentation through informative PPTs, showing knowledge on the subject and sensitivity towards social impact of the Mini project

CO4: write a "Mini project paper" in scientific journal style and format from the prepared Mini project report and create a video pitch on Mini project

Course Articulation Matrix (CAM): **P20VE207 MINI PROJECT WITH SEMINAR**						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	**P20VE207.1**	2	-	2	2	2
CO2	**P20VE207.2**	2	-	2	2	2
CO3	**P20VE207.3**	-	2	-	1	1
CO4	**P20VE207.4**	-	2	-	1	1
P20VE207		**2**	**2**	**2**	**1.5**	**1.5**

P20AC208A STRESS MANAGEMENT BY YOGA

Class: M.Tech. II–Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC &CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: awareness about different types of stress
LO2: yoga in the management of stress
LO3: positive health and overall wellbeing
LO4: prevention of stress related health problems by yoga practice

UNIT – I (6)

Stress: Definition of Stress, Types of stress - Acute and chronic; Stressors; Definition of Yoga from various sources, Types of yoga – Karma yoga, Gnana yoga, Bhakti yoga and Raja yoga; Concept of Bhagavad Gita; Yoga versus exercise; Basics of Physiology and Psychology; Brain and its parts – central nervous system (CNS), peripheral nervous system (PNS), hypothalamic pituitary adrenal (HPA) axis; Sympathetic and Parasympathetic nervous systems; Fight and Flight mechanism; Relationship between stress and yoga

UNIT –II (6)

Ashtanga Yoga: Do's and Don'ts in life; Yamas – ahimsa, satya, asteya, bramhacharya and aparigraha; Niyama – shaucha, santosha, tapa, svadhyaya, ishvarapranidhana; Asana; Pranayama; Pratyahara; Dharana; Dhyana; Samadhi

UNIT– III (6)

Asana and Stress: Definition of Asana from Patanjali; Origin of various names of asanas; Various yoga poses and their benefits for mind and body; Sequence of performing asanas - standing, sitting, lying down on stomach, lying down on back and inverted postures; Activation of Annamaya kosha; Effect on various chakras, systems and glands thereby controlling the stress levels through the practice of asanas

UNIT - IV (6)

Pranayama: Anulom and Vilom Pranayama, Nadi shudhi Pranayama, Kapalabhati Pranayama, Bhramari Pranayama, Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation; Cyclic meditation; Instant Relaxation technique (IRT); Quick Relaxation Technique (QRT); Deep Relaxation Technique (DRT)

Text Book(s):

[1] *Yogic Asanas for Group Training - Part-I*, Nagpur: Janardhan Swami Yogabhyasi Mandal.

[2] Swami Vivekananda, *Rajayoga or Conquering the Internal Nature*, Kolkata: Advaita Ashrama (PublicationDepartment).

Reference Book(s):

[1] Nagendra H.R and Nagaratna R, *Yoga Perspective in Stress Management*, Bangalore : Swami Vivekananda Yoga Prakashan.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: differentiate yoga and exercise

CO2: explain eight steps of Ashtanga yoga

CO3: describe different yogasanas, and their benefits for mind and body

CO4: discuss the benefits of pranayama and meditation as an effective tool for stress management

Course Articulation Matrix (CAM): P20AC208A STRESS MANAGEMENT BY YOGA						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20AC208A.1	1	1	-	-	-
CO2	P20AC208A.2	1	1	-	-	-
CO3	P20AC208A.3	1	1	-	-	-
CO4	P20AC208A.4	1	1	-	-	-
P20AC208A		**1**	**1**	**-**	-	-

P20AC208B VALUE EDUCATION

Class: M.**Tech. II – Semester** Specializations: **SCE, DE, VE, PE, SE, DS & CSP**

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge on /in…

LO1: value of education and self-development
LO2: importance of cultivation of values
LO3: personality and behaviour development
LO4: character and competence

UNIT – I (6)

Values and self-development: Social values and individual attitudes; Work ethics; Indian vision of humanism; Moral and non-moral valuation; Standards and principles; Value judgments

UNIT – II (6)

Importance of cultivation of values: Sense of duty, devotion, self-reliance, confidence, concentration, truthfulness, cleanliness, honesty, humanity, discipline, power of faith; National Unity, patriotism; Love for nature

UNIT – III (6)

Personality and Behavior Development: Soul and scientific attitude; Positive thinking; Integrity, discipline and punctuality; Love and Kindness; Avoid fault thinking, free from anger; Dignity of labor

Universal brotherhood and religious tolerance: True friendship, love for truth, happiness vs suffering; Aware of self-destructive habits; Association and cooperation; Doing best for saving nature

UNIT – IV (6)

Character and Competence: Holy books vs blind faith; Self-management and good health; Science of reincarnation; Equality, non-violence, humility, role of women; All religions and same message; Mind your mind, self-control, honesty, studying effectively

Text Book:

[1] S. K. Chakroborty, *Values and Ethics for organizations: Theory and practice*, New Delhi: Oxford University Press, 2000.

Reference Books:

[1] D. N. Grose, *A text book of Value Education,* New Delhi: Dominant Publishers and Distributors, 2005.
[2] Yogesh Kumar Singh and Ruchika Nath, *Value Education*, New Delhi: A. P. H. Publishing Corporation, 2005.
[3] S. P. Ruhela, *Human Values and Education*, New Delhi: Sterling Publishers Pvt. Ltd., 1986.
[4] V. Narayan Karan Reddy, *Man, Education and Values,* New Delhi: B. R. Publishing Corporation, 1979.
[5] Bharatwaj Tilak Raj, *Education of Human Values,* New Delhi,: 2nd Ed., Mittal Publications, 2001.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: illustrate social & moral values and inculcate Indian vision of humanism
CO2: develop sense of duty, national unity and love for nature
CO3: utilize positive thinking and develop universal brotherhood
CO4: build character & competence through holy books

Course Articulation Matrix (CAM): P20AC208B VALUE EDUCATION						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20AC208B.1	-	1	-	-	-
CO2	P20AC208B.2	-	2	-	-	-
CO3	P20AC208B.3	-	1	-	-	-
CO4	P20AC208B.4	-	2	-	-	-
P20AC208B		**-**	**1.5**	**-**	**-**	**-**

P20AC208C PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Class: M.Tech. II-Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge on/in…

LO1: holistic development of personality
LO2: accomplishment of day to day responsibilities and to achieve the highest goal
LO3: basic knowledge to maintain a stable mind, pleasing personality and determination
LO4: personality building towards becoming a role model

UNIT – I (6)

Holistic development of personality: Neetisatakam - Verses-19, 20, 21, 22(wisdom), Verses-29, 31, 32 (pride& heroism), Verses-26, 28, 63, 65(virtue), Verses-52, 53, 59(don'ts), Verses-71, 73, 75, 78(do's)

UNIT – II (6)

Approach to day to day work and duties: Shrimad Bhagwad Geeta - Chapter2-Verses 41, 47, 48 chapter3-Verses 13, 21, 27, 35; Shrimad Bhagwad Geeta - Chapter6-Verses 5, 13, 17, 23, 35, chapter18-Verses 45, 46, 48

UNIT – III (6)

Statements of basic Knowledge: Shrimad Bhagwad Geeta - Chapter2-Verses 56, 62, 68 chapter12-Verses 13, 14, 15, 16, 17, 18

UNIT – IV (6)

Personality of Role model: Shrimad Bhagwad Geeta - Chapter2-Verses 17, chapter3-Verses 36,37,42 chapter4-Verses 18,38,39, chapter18-Verses 37,38,63

Text Book:

[1] Swami Swarupananda, *Shrimad Bhagavad Geeta*, Advaita Ashram (Publication Department), Kolkata: Printed in Sharada Press, Car Street, Mangalore.

Reference Books:

[1] Prof. Satyavrata Siddhantalankar, *Bhagavad Geeta* , New Delhi: Oriented Publishing

[2] P.Gopinath, *Bhartrihari's Three Satakam (Niti-sringar-vairagya),* New Delhi: Rashtriya Sanskrit Sansthanam

[3] Maharaja Bhadrihari , *Nithishatakam Translated by P.Jwala Dutta Sharma*, Dharm Diwakar Press, Moradabad, 1909, First Edition

[4] *world.com/section_personality_development.html*

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: build an holistic personality
CO2: develop himself to accomplish his responsibilities and achieve his highest goal in life
CO3: perceive basic knowledge to maintain stable mind, pleasing personality and determination
CO4: originate himself to become a role model thus leading mankind to peace and prosperity

Course Articulation Matrix (CAM): P20AC208C PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEMENT SKILLS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20AC208C.1	2	1	1	-	-
CO2	P20AC208C.2	2	1	1	-	-
CO3	P20AC208C.3	2	1	1	-	-
CO4	P20AC208C.4	2	1	1	-	-
P20AC208C		**2**	**1**	**1**	-	-

P20AC208D DISASTER MANAGEMENT

Class: M.Tech. II – Semester **Specialization(s)**: SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on …

LO1: disaster management cycle and relation between disaster & development
LO2: risk / vulnerability assessment and reduction strategies
LO3: management strategies, approaches, frameworks and governance
LO4: disaster mitigation aspects and recovery strategies

UNIT – I (6)

Introduction to Disaster: Concepts of hazard, vulnerability & risks; natural and manmade disasters- earthquake, cyclone, floods , volcanoes; famine, displaced populations, industrial & transport accidents; slow and rapid onset disasters - famine, draught , epidemics , air crash, tidal waves & tsunami

Mitigation and Management techniques of Disaster: Basic principles of disasters management, disaster management cycle, political, social, economic impacts of disasters, gender and social issues during disasters, principles of psychosocial issues and recovery during emergency situations, Impact of disaster on development, different stake holders in disaster relief, refugee operations during disasters, human resettlement and rehabilitation issues during and after disasters, intersectorial coordination during disasters, models in disasters

UNIT –II (6)

Disaster Risk and Vulnerability: Introduction to disaster risk and vulnerability, risk analysis techniques, process of risk assessment, analytical systems for risk assessment, natural hazard/ risk assessment, understanding climate risk, mapping of risk assessment, decision making for risk reduction, problems in risk assessment, strategies for risk reduction, community-based risk reduction; observation and perception of vulnerability, vulnerability identification, vulnerability types and dimensions, vulnerability and social and economic factors

Preparedness and Response:Disaster preparedness significance & measures, institutional mechanism for disaster preparedness, disaster preparedness policy & programmes, concept and significance of disaster preparedness plan, community based disaster preparedness plan, prediction, early warnings and safety measures of disaster, resource mobilization, post disaster reliefs & logistics management, emergency support functions and coordination mechanism

UNIT– III (6)

Disaster Management and Governance: Institutional arrangements, disaster management strategies & approaches, Community Based Disaster Preparedness (CBDP) - components, teams, preparedness, linkages with development programmes

Disaster Response in India: Legal framework, National disaster management Act, 2005, institutions for disaster management – NDMA, NIDM, role of government agencies, NCMC committee, crisis management group, need, media, community resilience, social & economic problems, funding mechanism

UNIT - IV (6)

Disaster Risk Mitigation: Background, strengthening, Sendai framework and strengthening disaster risk governance, responsibility matrix

Disaster Recovery: Scope, approach, recovery process, steps involved in recovery process, early, mid& long-term recovery, reconstruction; coordination–central, state, & private sectors and voluntary organizations;rehabilitation–economical and psychological

Text Books:

[1] Manual on *Natural Disaster Management in India*, M C Gupta, NIDM, New Delhi, 2016*(Chapters 1- 5,7,9 &10)*

[2] N. G. Dhawan, A. S. Khan, *Disaster Management and Preparedness*, 1st ed., New Delhi: CBS Publication, 2014.*(Chapters 1,2,3,4,6,7,8 &10)*

Reference Books:

[1]Ashok Kumar and Vipul Anekant, *Challenges to internal security of India*, Tata McGraw hill,2020

[2] Larry R. Collins, *Disaster management and Preparedness*, CRC Press, 2004

[3]Tony Moore and Raj Lanka, *Hand book of Disaster and Emergency Management*, 3rd ed., Elsevier, 2006.

[4]R. K. Dave, *Disaster Management in India: Challenges and Strategies*, Prowess Publishing, 2018

[5] M. M. Sulphey, *Disaster Management*, 1st ed.,Prentice Hall of India, 2016.

[6] M. Pandey, *Disaster Management*, 1st ed., Wiley India, 2014.

[7] R. B. Singh, *Natural Hazards and Disaster Management: Vulnerability and Mitigation*, Noida: Rawat Publications, 2006

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1:categorize disasters, analyse the phases of disaster management cycle and relation between disaster & development

CO2: perform risk / vulnerability assessment and devise response & preparedness strategies for risk / vulnerability reduction

CO3: identify the role of government and private agencies involved in disaster assistance

CO4: analyse the mitigation measures and recovery strategies to inculcate a culture of resilience

Course Articulation Matrix (CAM): P20AC208D DISASTER MANAGEMENT						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20AC208D.1	2	1	1	-	-
CO2	P20AC208D.2	2	1	1	-	-
CO3	P20AC208D.3	1	1	-	-	-
CO4	P20AC208D.4	2	1	-	-	-
P20AC208D		**1.75**	**1**	**1**	**-**	**-**

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE:: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

PRR-20

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (VLSI & EMBEDDED SYSTEMS)
III-SEMESTER OF 2-YEAR M.TECH DEGREE PROGRAMME

[2 Th+1 Dissertation+1 Internship]

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PE	P20VE301	Professional Elective-V/ MOOC-V	3	-	-	3	8	8	8	6	10	20	60	40	100
2	OE	P20OE302	Open Elective-I/ MOOC-VI	3	-	-	3	8	8	8	6	10	20	60	40	100
3	PROJ	P20VE303	Dissertation *Phase-I* / Industrial Project (*to be continued in IV – semester also*)	-	-	18	9	-	-	-	-	-	-	100	-	100
4	PROJ	P20VE304	Internship Evaluation	-	-	2	-	-	-	-	-	-	-	100	-	100
			Total	6	-	20	15							320	80	400

* Additional Learning: Students are advised to do MOOCs to bridge the gap in the curriculum, as suggested by the Department Academic Advisory Committee (DAAC). The credits earned by the student through MOOCs will be printed in the semester grade sheet.

L- Lecture, T – Tutorials, P - Practicals & C - Credits
Contact hours per week: 26; Total Credits: 15

Professional Elective-V/ MOOC-V	**Open Elective-I/ MOOC-VI**
P20VE301A: Design for Testability	P20OE302A: Business Analytics
P20VE301B: Radio Frequency IC design	P20OE302B: Industrial Safety
P20VE301C: Embedded Wireless Sensor Networks	P20OE302C: Operations Research
P20VE301D: MOOCs	P20OE302D: Cost Management of Engineering Projects
	P20OE302E: Composite Materials
	P20OE302F: Waste to Energy
	P20OE302G: Renewable Energy Sources
	P20OE302H: MOOCs

P20VE301A DESIGN FOR TESTABILITY

Class: M.Tech. III – Semester

Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives(LOs):
This course will develop students' knowledge in/on…

LO1: basic concepts of Design for Testability and different modeling techniques
LO2: testing for single stuck at faults and ATPG pattern generation for SSFs
LO3: board level and system level DFT approaches for digital design
LO4: concepts of Built in Self test (BIST) and BIST architectures

UNIT - I (9)

Introduction to Test and Design for Testability (DFT) Fundamentals. Modeling digital circuits at logic level, register level and structural models, Levels of modeling, Logic; Simulation: Types of simulation, Delay models, Element evaluation, Hazard detection, Gate level event driven simulation, Fault Modeling – Logic fault models, Fault detection and redundancy, Fault equivalence and fault location, Single stuck and multiple stuck – Fault models; Fault simulation applications, General techniques for Combinational circuits

UNIT – II (9)

Testing for single stuck at faults (SSF) – Automated test pattern generation (ATPG/ATG) for SSFs in combinational and sequential circuits, Functional testing with specific fault models; Vector simulation – ATPG vectors, formats, Compaction and compression, Selecting ATPG Tool

UNIT – III (9)

Design for testability – testability trade-offs, techniques, Scan architectures and testing – controllability and absorbability, generic boundary scan, full serial integrated scan, storage cells for scan design, Board level and system level DFT approaches, Boundary scan standards; Compression techniques – different techniques, syndrome test and signature analysis

UNIT – IV (9)

Built-in self-test (BIST) – BIST Concepts and test pattern generation, Specific BIST Architectures – CSBL, BEST, RTS, LOCST, STUMPS, CBIST, CEBS, RTD, SST, CATS, CSTP, BILBO, Brief ideas on some advanced BIST concepts and design for self-test at board level

Text Books(s):

[1] Miron Abramovici, Melvin A. Breur, Arthur D. Friedman, *Digital Systems Testing and Testable Design,* Mumbai: Jaico Publishing House, 2001. *(Chapters 1 to 6,9 to 11)*

[2] Alfred Crouch, *Design for Test for Digital ICs & Embedded Core Systems,* NJ*:* Prentice Hall Inc., 1999.

Reference Book(s):

[1] M.L. Bushnell, V. D. Agrawal, *Essentials of Electronic Testing for Digital, Memory and Mixed Signal VLSI Circuits*, New York: Kluwer Academic Publishers, 2000.

[2] P.K. Lala, *Digital Circuits Testing and Testability*, New York: Academic Press, 1997.

Course Learning Outcomes (COs):

On completion of this course, students will be able to ...

CO1: build fault models for testing combinational and Design fault models for testing digital systems

CO2: develop the Automated test pattern generation (ATPG/ATG) for SSFs in combinational and sequential circuits

CO3: design the various DFT approaches for digital design and compression

CO4: analyze the different approaches for Built in Self test(BIST)

Course Articulation Matrix (CAM): P20VE301A DESIGN FOR TESTABILITY						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20VE301A.1	1	1	1	2	2
CO2	P20VE301A.2	2	1	2	2	2
CO3	P20VE301A.3	2	1	2	2	2
CO4	P20VE301A.4	2	1	2	2	2
P20VE301A		**1.75**	**1**	**1.75**	**2**	**2**

P20VE301B RADIO FREQUENCY IC DESIGN

Class: M.Tech. III – Semester **Specialization(s)**: VLSI & ES

Teaching Scheme:

L	T	P	C
2	-	-	1

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on …

LO1: RF IC design and noise sources in MOSFETs
LO2: low noise amplifiers and comparison between wideband & narrowband
LO3: analysis of active & passive mixers
LO4: frequency synthesizer & clock recovery circuits

UNIT – I (9)

Basic concepts of RF IC design : Design Bottle necks of RF IC design Non linearity and Time invariance Sensitivity and dynamic range, Passive impedance transformation, RF radio receiver front end non idealities and design parameters: Effects of nonlinearity, 1 dB compression point, Derivation of required noise figure at receiver front end, Required IIP3 at receiver front end, Partitioning of required NF at receiver front end and IIP3 into individual NF and IIP3

Noise: Noise sources in MOSFETs, Modeling of thermal noise and flicker noise, noise analog integrated circuits

UNIT –II (9)

Low Noise Amplifier: Introduction: General philosophy, Matching networks, Comparisons of narrowband and wideband LNA, Wideband LNA Design: DC bias, Gain and frequency response, Noise Figure, Narrowband LNA: Impedance matching, Matching the imaginary part matching the real part, interpretation of power matching similarity between Q factor and turns ratio, Narrowband LNA: Principles, Core amplifier design, Noise figure, Power dissipation, Trade-offs between noise figure and power dissipation, Noise contribution from other sources

UNIT– III (9)

Mixers: Active mixer, Modeling mixers, Unbalanced mixer circuits, Single balanced mixer circuit, Double balanced mixer circuits, Quantitative description of Gilbert mixer, Conversion gain, Distortion, Analysis of Gilbert mixer, Passive mixers: Switching mixer, Distortion in unbalanced switching mixer, Conversion gain and noise

UNIT - IV (9)

Frequency synthesizer and Clock recovery circuits: PLL based frequency synthesizer: Concepts of PLL, Phase detector, Charge pump, RF Synthesizer architectures, Frequency dividers, VCO, LC oscillators, Ring oscillator, Phase noise, Loop filter and system design

Text Book(s):

[1] B.Razavi, *RF Microelectronic,* New Delhi: Prentice-Hall Ind., 1998.
[2] Leung Bosco, *VLSI for Wireless Communication*, 2nd ed. New York: Springer Science Media LLC, 2011

Reference Book(s):

[1] Thomas H.Lee, *Design of COMS RF Integrated Circuits*, Cambridge: Cambridge University Press, 1998.
[2] Y.P. TSIVIDIS, *Mixed Analog and Digital Devices and Technology*, New Delhi: TMH, 1996.

[3] R. Jacob Baker, H.W Li D.E. Boyce, *CMOS Circuits Design, Layout and Simulation*, New Delhi: Prentice-Hall Ind., 1998.

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...

CO1: identify the design bottlenecks specific to RF IC design

CO2: develop low noise amplifiers using noise sources and noise models for the devices & systems

CO3: design mixers to improve the bandwidth of RF amplifiers

CO4: design various RF amplifiers

Course Articulation Matrix (CAM): P20VE301B RADIO FREQUENCY IC DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20VE301B.1	1	1	1	2	2
CO2	P20VE301B.2	2	1	2	2	2
CO3	P20VE301B.3	2	1	2	2	2
CO4	P20VE301B.4	2	1	2	2	2
P20VE301B		**1.75**	**1**	**1.75**	**2**	**2**

P20VE301C EMBEDDED WIRELESS SENSOR NETWORKS

Class: M.Tech. III – Semester
Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation:	60 marks
End Semester Exam :	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on…

LO1: basic principles and parameters of Wireless Sensor Networks
LO2: hardware & embedded software design for Wireless Sensor Networks (WSNs)
LO3: basic characteristics of MAC Protocols & Routing Technologies in WSNs
LO4: security issues in WSN and their communication

UNIT-I (9)

Introduction: Wireless Communication Technologies, Wireless Sensor Networks, Application Areas of WSNs, Challenges in the Design and Implementation of WSNs
Principle of Wireless Sensor Networks: IEEE 802.15.4 Standard and Wireless Sensor Network, Constructing WSNs with IEEE 802.15.4, ZigBee and 6LoWPAN

UNIT-II (9)

Hardware Design for WSNs: General Wireless Sensor Node Architecture, System-on-Chip and Component-based Design, Design Guidelines, Power Management, Energy Scavenging
Embedded Software Design for WSNs: Jennic ZigBee Application Development, Contiki 6LowPAN Application Development, General Procedure of Sensor Drivers, Sensor Driver for an Analog Flow Sensor, Sensor Driver for a Digital Temperature Sensor, Implementing a WSN with IEEE 802.15.4

UNIT-III (9)

MAC protocols: Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols
Routing Technologies in WSNs: Classification of Routing Protocols in WSNs, AODV Routing Protocols Cluster-Tree Routing Protocol, Energy-Aware Routing Protocols

UNIT-IV(9)

Basic Concepts of OSI Security: Unique Challenges in WSN Security, Classifications of Security Attacks on WSNs, ZigBee Security Services, Time Synchronization in wireless sensor networks, Sensor data fusion techniques, Connecting WSNs with Internet

Text Book(s):

[1] Shuang-Hua Yang, *Wireless Sensor Networks: Principles, Design and Applications*, London: Springer-Verlag, 2014.
[2] Waltenegus Dargie, Christian Poellabauer, *Fundamentals of wireless sensor networks : theory and practice*, Hoboken, NJ: John Wiley & Sons Ltd., 2010.

Reference Book(s):

[1] Kazem Sohraby, Daniel Minoli, Taieb Znati, *Wireless sensor networks: technology, protocols, and applications*, Hoboken, NJ: John Wiley & Sons Ltd., 2007.

[2] Holger Karl, Andreas Willig, *Protocols and architectures for wireless sensor networks*, Hoboken, NJ: John Wiley & Sons, 2005.

[3] Hossam Mahmoud Ahmad Fahmy , *Wireless Sensor Networks_ Concepts, Applications, Experimentation and Analysis,* London: Springer Science, 2016.

Course Learning Outcomes (COs):

Upon completion of this course, students will be able to…

CO1: identify the principles of Wireless Sensor Networks (WSNs) applicable to embedded systems
CO2: analyze hardware & embedded software design for WSNs
CO3: identify the characteristics of MAC protocols & routing technologies in WSNs
CO4: estimate the risk and security issues in WSNs & their communication

Course Articulation Matrix (CAM): P20VE301C EMBEDDED WIRELESS SENSOR NETWORKS						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20VE301C.1	2	1	-	2	2
CO2	P20VE301C.2	2	1	-	2	2
CO3	P20VE301C.3	2	1	-	2	2
CO4	P20VE301C.4	2	1	-	2	2
P20VE301C		**2**	**1**	-	**2**	**2**

P20OE302A BUSINESS ANALYTICS

Class: M. Tech., III –Semester

Specialization: SCE, DE, VE, PE, SE DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):

This course will develop student's knowledge in/on…

LO1: fundamental concepts of business analytics and descriptive analytics
LO2: data collection and data visualization methods
LO3: text analysis and simulation methods in business analytics
LO4: social media, web and health care analytics

UNIT-I (9)

Introduction to Business Analytics: Introduction to business analytics, why analytics, business analytics: the science of data-driven decision making, business context, technology data science, descriptive analytics, predictive analytics, prescriptive analytics descriptive, predictive, and prescriptive analytics techniques, big data analytics, web and social media analytics, machine learning algorithms, framework for data-driven decision making, analytics capability building, roadmap for analytics capability building, challenges in data-driven decision making and future

Descriptive Analytics: Introduction to descriptive analytics, data types and scale, structured and unstructured data, cross-sectional, time series, and panel data, types of data measurement scales, population and sample, measures of central tendency, percentile, decile, and quartile, measures of variation

UNIT-II (9)

Data Collection: Introduction, the value of data, data collection preliminaries, data collection methods, data types, problem formulation preliminaries, challenges in data collection, data collation, validation and presentation, data collection in the retailing industry

Data Visualization: Introduction, motivating example, methods of data visualization, software and data visualization

UNIT-III (9)

Text Analytics: Introduction, motivating text analysis, methods of text analysis, natural language processing

Simulation: Introduction, motivating examples, simulation modeling method and case studies

UNIT-IV (9)

Applications of Business Analytics: Introduction, what is social media and web analytics, display advertising in real time, A/B experiments for measuring value of digital media and handling e-retailing challenges, strategies for mobile devices, the future of social media analytics

Health Care Analytics: Introduction, methods of health care analytics

Textbooks:

[1]. U Dinesh Kumar, Business Analytics: The Science of Data-Driven Decision Making, 1st ed., 2017. (Units-I)

[2]. Bhimasankam Pochiraju, Sridhar S, Essentials of Business Analytics: A Textbook,1st ed. Springer Nature Switzerland, 2019. (Units-II, III, IV).

Reference Books:

[1]. R N Prasad, Seema Acharya, Fundamentals of Business analytics: Big Data, 2nd ed. Wiley Publications, 2017.

[2]. Foster Provest, Tom Fawcett Data Science for Business:, 1st ed. USA: O'Reilly, 2013.

Course Learning Outcomes (COs):

On completion of this course, the students will be able to…

CO1: describe the concepts of business analytics and descriptive analytics

CO2: apply the data collection and data visualization methods in business analytics

CO3: categorize text analysis and simulation methods in business analytics

CO4: apply social media & web analytics and health care analytics in real world problems

Course Articulation Matrix: P20OE302A : BUSINESS ANALYTICS						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20OE302A.1	-	-	-	-	-
CO2	P20OE302A.2	1	1	-	-	-
CO3	P20OE302A.3	1	1	-	-	-
CO4	P20OE302A.4	2	2	-	-	-
P20OE302A		**1.33**	**1.33**	**-**	**-**	**-**

P20OE302B INDUSTRIAL SAFETY

Class: M. Tech. III –Semester

Specialization(s):SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: need for safety in industries
LO2: fundamentals of maintenance engineering
LO3: causes for wear& corrosion and method of lubrication
LO4: faults tracing in equipment and importance of preventative maintenance

UNIT –I (9)

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

UNIT –II (9)

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(9)

PREVENTION OF WEAR AND CORROSION : Wear- types, causes, effects, wear reduction methods, lubricants; types and applications, lubrication methods, general sketch, working and applications- screw down grease cup, pressure grease gun, splash lubrication, gravity lubrication, wick feed lubrication, side feed lubrication, ring lubrication, definition, principle and factors affecting the corrosion, types of corrosion, corrosion prevention methods

UNIT –IV(9)

FAULT TRACING AND PREVENTATIVE MAINTAINCE : 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 - machine tool, pump, air compressor, internal combustion engine, boiler, electrical motors, types of faults in machine tools and their general causes, periodic and preventative maintenance; advantages of preventative maintenance, Repair cycle importance

*****

Textbook:

[1] John Ridley and John Channing., *Safety at work*, 6th ed., UK: Elsevier Butterworth-Heinemann,2003.[Unit 1& Unit 2] chapter [2,3,5,6,7,8]

[2] Amit Gupta., "Industrial Safety and environment" Laxmi Publications (P) LTD., New Delhi., 2006., 1973., [Unit3 & Unit 4] chapters [10,11,12,13,14,15,16,17]

Reference Books:

[1] R. Keith Mobley Editor, Lindley R. Higgins Darrin J. Wikoff., *Maintenance Engineering Handbook*, 7th ed., New York: Mc Graw Hill International, 2008

[2] Mohammed Ben–Daya.,UdayKumar., Prabhakar Murthy D.N., *Introduction to Maintenance Engineering*, New Delhi: Wiley India Pvt. Ltd., 2016.

Course Learning Outcomes(COs):

Upon completion of this course, students will be able to….

CO1: summarize the principles of industrial safety and maintenance

CO2: describe the functions of maintenance department and list the types of maintenance & tools used for maintenance

CO3: identify the causes for wear ,tear& corrosion and suitable lubrication method for a given application

CO4: describe the significance of decision-tree and apply it for problems in equipment to detect and classify the faults and need of preventative maintenance.

Course Articulation Matrix (CAM): P20OE302B INDUSTRIAL SAFERTY

COs		PO1	PO2	PO3	PSO1	PSO2
CO1	P20OE302B.1	1	1	1	-	-
CO2	P20OE302B.2	1	1	1	-	-
CO3	P20OE30B.3	1	1	1	-	-
CO4	P20OE302B.4	1	1	1	-	-
P20OE302B		**1**	**1**	**1**	**-**	**-**

P20OE302C OPERATIONS RESEARCH

Class: M.Tech. III – Semester **Specialization(s)**: **Common to All**

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge in/on

LO1: linear programming problems
LO2: non linear optimization problem
LO3: sequencing, scheduling and network model
LO4: decision making theory and queuing models

UNIT – I (9)

Linear Programming Problem (LPP): Mathematical formulation of LPP, Solution of linear programming problems-Simplex method, artificial variable technique, Duality in LPP and Dual Simplex method; Sensitivity analysis.

UNIT –II (9)

Non-Linear Programming Problem (NLPP): Classification of NLPP, Unconstrained optimization techniques- Iterative methods - Random search methods, steepest decent method, Conjugate gradient method, Fibonacci method and Golden section method.

Constrained Optimization Techniques-- Lagrange's method and Kuhn-Tucker method.

UNIT– III (9)

Sequencing and Scheduling: Sequencing and scheduling of n jobs one, two and three machine problems, scheduling of n jobs through k machines problem.

Project Network: Network construction-CPM and PERT; Resource analysis in network problems.

UNIT - IV (9)

Decision Analysis and Game Theory: Introduction, Decisions under uncertainty- Laplace criterion, Max-min criterion, Savage Criterion and Hurwitz criterion; Game Theory-Introduction, two person zero sum games and the maximin-minimax principle; Mixed strategy games- graphical method and linear programming method, dominance property.

Queuing Theory- Elements and operating characteristics of a queuing system, Poisson queuing systems, study of single server queuing model with infinite capacity.

Text Books:

[1] Kanti swarup, P.K.Gupta, Man Mohan, *Operations Research,* S. Chand & Sons, New Delhi. 16th edn., 2013. (Chapters: 2, 4, 5, 6, 12, 16, 17, 21, 25, 27)

[2] S.S. Rao, *Optimization Techniques,* New Age International, New Delhi, 3rd edn., 2013. (Chapters: 6)

Reference Book(s):

[1] H.A. Taha, *Operations Research an Introduction,* Prentice Hall of India, 6th Edn., 2006

[2] N.D Vohra, *Quantitative Techniques in Management*, 3rd edn, TMH, 2010

Course Learning Outcomes (COs):
On completion of this course, students will be able to ...
CO1: model engineering real time problems and solve them using various LPP techniques
CO2: optimize the engineering problems using NLPP methods
CO3: apply the tools and techniques to solve sequencing and scheduling problems and project network models
CO4: analyze conflicting situations using game theory and solve various queuing model parameters

Course Articulation Matrix (CAM): P20OE302C: OPERATIONS RESEARCH						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20OE302C.1	2	1	1	-	-
CO2	P20OE302C.2	2	1	1	-	-
CO3	P20OE302C.3	2	1	1	-	-
CO4	P20OE302C.4	2	1	1	-	-
P20OE302C		**2**	**1**	**1**	**-**	**-**

P20OE302D COST MANAGEMENT OF ENGINEERING PROJECTS

Class: M.Tech. III-Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge on /in…

LO1: cost concepts, objectives of costing system, project management
LO2: standard costing, cost control and reduction
LO3: cost behavior, profit planning and types of budgets
LO4: quantitative techniques for cost management

UNIT-I (9)

Overview of Cost Accounting: Cost concepts in decision making, Objectives of a costing system, Different costs of Projects - Relevant cost, Differential cost, Incremental cost, Opportunity cost, Activity Based Costing.
Project: Meaning, Types of projects, Benefits of project management, Project life cycle

UNIT-II (9)

Standard Costing: Meaning, Advantages and limitations, Standard costing in manufacturing and process industries, Standard costing and standardized costing, Standard cost and estimated cost.
Cost Control and Reduction: Cost control meaning, Distinction between cost control and cost reduction, Advantages and disadvantages of cost control and cost reduction, Cost control techniques, Essential for success of cost controls and cost reduction programme, Areas of cost reduction, Tools and techniques of cost reduction.

UNIT-III (9)

Cost Behavior and Profit Planning: Marginal Cost, Absorption Cost, Break-even analysis, Cost-Volume-Profit (CVP) analysis, Profit-Volume (PV) ratio, Sales ratio, Margin of safety
Budgets: Budgetary control, Flexible budget, Performance based budgets, Zero based budgets

UNIT-IV (9)

Quantitative Techniques for Cost Management: Linear Programming Problems (LPP includes graphic method and simplex method), Transportation problems, Assignment problems

Text Book(s):

[1] S.P. Jain, K.L.Narang, *Advanced Cost Accounting*, New Delhi: Kalyani Publishers, 2014 (Chapter 7, 10 ,11 13, 14, 16 &27)
[2] N.D. Vohra, *Quantitative Techniques in Management*, 3rd ed. New Delhi: Tata McGraw Hill Book Co. Ltd. 2007 (Chapter 2,3, 5 and 6)

Reference Book(s):

[1] Ashish K. Bhattacharya, *Principles & Practices of Cost Accounting*, 3rd ed. New Delhi: Prentice Hall India Learning Private Limited, 2004.
[2] Harold Kerzner, *Project Management: A systems approach to Planning, Scheduling and Controlling,* 10th ed. New Delhi: John Wiley & Sons Inc., 2009.

[3] V K Kapoor, *Operations Research,* New Delhi: Sultan Chand & Sons, 2013.
[4] Charles T. Horngren and George Foster, *Cost Accounting A Managerial Emphasis*, New Delhi: Prentice Hall of India, 1991.

Course Learning Outcomes (Cos):

Upon completion of this course, the student will be able to…

CO1: interpret overview of cost accounting and project management
CO2: distinguish standard costing in manufacturing and process industries, estimate cost control and reduction
CO3: estimate cost behavior, profit planning and budget
CO4: apply quantitative techniques for linear programming, transportation and assignment problems

Course Articulation Matrix (CAM): P20OE302D COST MANAGEMENT OF ENGINEERING PROJECTS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20OE302D.1	1	1	1	-	-
CO2	P20OE302D.2	1	1	1	-	-
CO3	P20OE302D.3	2	1	1	-	-
CO4	P20OE302D.4	2	1	1	-	-
P20OE302D		**1.5**	**1**	**1**	**-**	**-**

P20OE302E COMPOSITE MATERIALS

Class: M. Tech., III -Semester

Specialization: SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives(LOs):

This course will develop students' knowledge in/on…

LO1: composite material properties and applications

LO2: properties and applications of fibers and rule of mixture

LO3: manufacturing and applications of metal matrix, ceramic matrix and carbon-carbon composites

LO4: polymer matrix composites, manufacturing and applications

UNIT- I (9)

Composite Materials: Definition, Classification, Characteristics, Advantages, Applications, Functional requirements of reinforcement and matrix, Effect of reinforcement on composite performance - Size, Shape, Distribution and volume fraction

UNIT-II (9)

Reinforcements: Preparation - layup, Curing, Fibers-glass, Carbon, Kevlar, Boron, Properties and applications- fibers, Whiskers, Particle reinforcements, Mechanical behavior of composites, Rule of mixtures, Inverse rule of mixtures, Isostrain and isostress conditions

UNIT-III (9)

Manufacturing of Metal Matrix Composites: Casting – solid state diffusion technique, Cladding – hot isostatic pressing, Properties and applications

Manufacturing of Ceramic Matrix Composites: Liquid metal infiltration – liquid phase sintering, Properties and applications

Manufacturing of Carbon/carbon Composites: Knitting, Braiding, Weaving; Properties and applications

UNIT-IV (9)

Manufacturing of Polymer Matrix Composites: Preparation of molding compounds and prepregs, Manufacturing of polymer matrix composites - hand layup, Autoclave, Filament winding, Compression molding and reaction injection molding, Properties and applications

Text Books:

[1] Chawla K.K., *Composite Materials*, 4th ed., New York: Springer, Verlag, 2019. (*Chapters 1, 2, 5, 6, 7 & 8*)

Reference Books:

[1] Agarwal, B.D. and Broutman, L. J., *Analysis and Performance of Fiber Composites*, 4th ed., USA: John Wiley & Sons, 2017.

[2] Strong A.B., *Fundamentals of Composite Manufacturing*, 2nded., SME, 2007.

[3] Sharma S.C., *Composite materials*, 1sted., New Delhi: Narosa Publications, 2000.

[4] Mathews F.L. and Rawlings R.D., *Composite materials: Engineering and Science*, 1st ed., England: Chapman and Hall, 1994.

[5] Krishnan K., Chawla *Composite Materials Science and Engineering*, India: Springer Private Limited, 2009.

[6] P.K. Mallick, *Fiber Reinforced Composite materials, Manufacturing and Design*, New York: CRC Press, Taylor and Francis Group, 2010.

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: classify composite materials and explain their applications
CO2: outline properties and applications of reinforcements.
CO3: categorize manufacturing methods for metal matrix composite, ceramic matrix composite, carbon/carbon composite and their properties.
CO4: compare manufacturing methods of polymer matrix composites.

Course Articulation Matrix (CAM) P20OE302E : COMPOSITE MATERIALS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	20OE302E.1	1	1	1	-	-
CO2	20OE302E 2	1	1	1	-	-
CO3	20OE302E.3	1	1	1	-	-
CO4	20OE302E.4	1	1	1	-	-
20OE302E		**1**	**1**	**1**	**-**	**-**

P20OE302F WASTE TO ENERGY

Class: M.Tech. III–Semester

Specialization(s): SCE, DE, VE, PE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge on /in…

LO1: concept of waste to energy
LO2: production of energy form waste.
LO3: technologies for waste to energy.
LO4: standards for waste to energy plants and carbon credits.

UNIT – I (9)

Introduction: Principles of waste management and waste utilization, Waste management hierarchy and 3R principle of reduce, Reuse and recycle, Waste as a resource and alternate energy source.

Waste Sources & Characterization: Waste production in different sectors such as domestic, industry and agriculture, Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous), Characterization of waste for energy utilization.

UNIT – II (9)

Technologies for Waste to Energy: Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation, Thermo-chemical conversion – combustion, Incineration and heat recovery, Pyrolysis, Gasification, Plasma arc technology.

Waste to Energy Options: Landfill gas, Collection and recovery, Refuse Derived Fuel (RDF) – Fluff, Briquettes, Pellet, Alternate Fuel Resource (AFR) – Production and use in cement plants, Thermal power plants and Industrial boilers, Conversion of wastes to fuel resources for other useful energy applications, Energy from plastic wastes – Non-recyclable plastic waste for energy recovery, Energy recovery from wastes and optimization of its use, benchmarking and standardization, Energy analysis.

UNIT – III (9)

Energy production: Waste activities – Collection, Segregation, Transportation and Storage requirements, Location and Siting of 'Waste to Energy' plants, Industry specific applications – In-house use – Sugar, Distillery, Pharmaceuticals, Pulp and Paper, Refinery and Petrochemical industry.

Centralized and Decentralized Waste to Energy Plants: Centralized and decentralized energy production, distribution and use, Comparison of centralized and decentralized systems and its operations.

UNIT-IV (9)

Waste to Energy & Environmental Implications: Environmental standards for waste to energy plant operations and gas clean-up, Savings on non-renewable fuel resources.

Carbon Credits: Carbon foot print calculations and Carbon credits transfer mechanisms.

Text Book:

[1] *Waste to Resources: A Waste Management Handbook*, NewDelhi: TERI Press,2014. (Unit – I, III & IV)

[2] Sunil Pandey, *Industrial and Urban Waste Management in India*, New Delhi : TERI Press, 2015 (Unit –II)

Reference Books:

[1] Banwari Lal and Patwardhan ,*Wealth from Waste: Trends and Technologies*, New Delhi :TERI Press, 2014.

[2] S.N Mukhopadhyay, *Fundamentals of waste and Environmental Engineering*, New Delhi: TERI Press, 2016.

[3] Gazette Notification on Waste Management Rules 2016.

[4] CPCB Guidelines for Co-processing in Cement/Power/Steel Industry.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: outline the operations of waste sources and alternate energy sources
CO2: adopt waste to energy technologies
CO3: list the stages of waste to energy production
CO4: appraise environmental standards and estimate carbon foot print.

Course Articulation Matrix: P20OE302F WASTE TO ENERGY						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20OE302F.1	1	1	1	-	-
CO2	P20OE302F.2	1	1	1	-	-
CO3	P20OE302F.3	1	1	1	-	-
CO4	P20OE302F.4	1	1	1	-	-
P20OE302F		1	1	1	**-**	**-**

P20OE302G RENEWABLE ENERGY SOURCES

Class: M.Tech. III – Semester

Specialization(s): SCE, DE, VE, SE, DS, DC & CSP

Teaching Scheme:

L	T	P	C
3	-	-	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop student's knowledge in/on…

LO1: different types of renewable energy sources and principles of solar energy systems
LO2: principles of wind energy and geothermal energy systems
LO3: harnessing energy from oceans and biomass
LO4: working of fuel cells and different types of energy storage systems

UNIT-I (9)

Introduction: Conventional and non-conventional sources of energy – brief description of different renewable energy sources

Solar energy: Introduction to prospects of solar PV systems: Photovoltaic effect and electrical equivalent circuit of a PV cell, Dependence of a PV cell characteristic on temperature, Solar cell output characteristics, Flat plate and concentrating collectors, Solar applications-solar heating/cooling technique, Solar distillation, Drying, Street lighting, Domestic lighting, Solar PV pumping systems

UNIT-II (9)

Wind energy: Principles of wind power, Evaluation of wind intensity, Operation of a wind turbine and wind power curve, Different types of wind turbine generators, Topography and classification of wind turbines and its applications

Geothermal Energy: Origin and types of geothermal energy, Operational difficulties, Liquid dominated systems

UNIT-III (9)

Energy from Oceans: Ocean temperature differences, Ocean waves, Energy from the waves; Introduction of tidal power, Basic principle of tidal power, Components of tidal power plants

Bioenergy: Introduction, Bio-mass conversion technologies, Photo synthesis, Biogas generation, Biogas from power plant wastes, Methods of maintaining biogas production, Utilization of biogas, Biogas gasification

UNIT-IV (9)

Chemical energy sources: Introduction to fuel cells, Principle of operation of fuel cell, Classification of fuel cells, Advantages, Disadvantages and applications of fuel cells

Types of energy storage systems: Introduction, Mechanical energy storage systems, Batteries, Ultra-capacitors, Super conducting magnetic storage, Applications

Case study on present scenario of energy generation in India

Textbook(s):

[1] Rai G.D, *Non-Conventional Energy Sources*, 4th ed., New Delhi: Khanna Publishers, 2010.

Reference book(s):

[1] B.H. Khan, *Non-conventional Energy Resources*, 2nd ed., New Delhi: McGraw Hill Publishers, 2006.

[2] Felix A. Farret, M. Godoy Simoes, *Integration of Alternative Sources of Energy*, New York: John Wiley & Sons, 2006.

[3] Bansal N. K. Kaleeman and M. Miller, *Renewable Energy Sources and Conversion Technology*, New Delhi: Mc Graw-Hill Publishers, 2006.

[4] Duffie and Beckman, *Solar Energy Thermal Process*, New York: John Wiley & Sons, 2006.

Course Learning Outcomes (COs):
Upon completion of this course, the student will be able to…

CO1: compare conventional and non-conventional energy resources; describe solar cell characteristics and discuss applications of solar energy

CO2: compute power output of wind and describe principle of geothermal energy system

CO3: describe harnessing of electric power from oceans and biomass

CO4: describe principle of operation of fuel cells and list different types of energy storage systems

Course Articulation Matrix: P20OE302G RENEWABLE ENERGY SOURCES

CO		PO 1	PO 2	PO 3	PSO1	PSO2
CO1	P20OE302G.1	2	1	1	-	-
CO2	P20OE302G.2	2	1	1	-	-
CO3	P20OE302G.3	2	1	1	-	-
CO4	P20OE302G.4	2	1	1	-	-
P20OE302G		**2**	**1**	**1**	**-**	**-**

P20VE303 DISSERTATION PHASE-I /INDUSTRIAL PROJECT

Class: M.Tech. III - Semester

Specialization(s): VLSI & ES

Teaching Scheme:

L	T	P	C
-	-	18	9

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	--

Course Learning Objectives (LOs):
This course will develop students' knowledge on /in…

LO1: selecting problem based Dissertation title in one of the areas of specialization
LO2: literature review and well-documented report writing
LO3: effective technical presentation skills with creating PPTs and speaking with technical knowledge
LO4: creating video pitch

Registration Presentation: The Registration Dissertation Presentation shall include a brief report and presentation focusing the identified topic, literature review, time schedule indicating the main tasks, and expected outcome.

Progress Presentation-I: At the end of first stage (third semester), student shall be required to submit a preliminary report of work done for evaluation to the project coordinator and present the same before the *Department Post Graduate Review Committee* (DPGRC).

Evaluation for Dissertation / Industrial Project:

Dissertation work shall be normally conducted in two stages: Dissertation *Phase-I* in third semester and Dissertation *Phase-II* in fourth semester.

Dissertation *Phase-I*:

(i) The Department *Post Graduate Review Committee (DPGRC)* shall be constituted with HoD as a Chairman, M.Tech. Coordinator as a Convener and three to five other faculty members representing various specializations in that particular programme as members.

(ii) (a) Student shall take up independent Dissertation Phase-I on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their programme of study, which would supplement and complement the program assigned to each student

(or)

(b) Student shall take up industrial project (in any industry) relevant to the courses offered in their programme of study, which would supplement and complement the program assigned to each student

(iii) DPGRC shall allot a faculty supervisor to each student for guiding on
(a) Selection of topic
(b) Literature survey and 50% work to be carried out during phase-I
(c) Preparing a report in proper format
(d) Effective oral presentation on dissertation phase-I before the DPGRC
(e) Right conduct of research and academic activity to promote academic integrity
(f) Use of anti-plagiarism software to detect plagiarism in the report and submission of dissertation report within acceptable plagiarism levels

(iv) In case of students with industrial projects, internal guide shall be there to track the progress from time to time

(v) There shall be only Continuous Internal Evaluation (CIE) for Dissertation Phase-I

(vi) CIE for the Dissertation Phase-I in third semester is as follows:

Assessment	Weightage
Dissertation Phase-I Supervisor Assessment	**50%**
DPGRC Assessment: *(i) Registration Presentation* ***(10%)*** *(ii) Progress Report on Phase-I* ***(10%)*** *(iii) Video pitch on Phase-I* ***(10%)*** *(iv) Progress Presentation -I and viva voce* ***(20%)***	**50%**
Total Weightage:	**100%**

Note: It is mandatory for the student to
(i) appear for progress presentation -I and viva voce to qualify for course evaluation
(ii) create a good video pitch on dissertation phase-I

(a) **Dissertation Topic:** The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals/Technical Magazines on the topics of potential interest
(b) **Working Model:** Each student is required to develop a working model/ process/software package/system, on the chosen work and demonstrate before the DPGRC as per the dates specified by DPGRC at the end of dissertation phase-II
(c) **Progress Report:** Each student is required to submit a well-documented progress report on dissertation phase-I as per format specified by DPGRC

(vii) The student has to register for the Dissertation Phase-I as supplementary examination in the following cases:
(a) he/she is absent for oral presentation and viva-voce
(b) he/she fails to submit the report in prescribed format
(c) he/she fails to fulfill the requirements of Dissertation Phase-I evaluation as per specified guidelines

(viii) (a) The CoE shall send a list of students registered for supplementary to the HoD concerned
(b) The DPGRC, duly constituted by the HoD, shall conduct Dissertation Phase-I evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):
On completion of this course, students will be able to…

CO1: select current topics in their specialization and allied areas from peer reviewed journals / technical magazines/ conference proceedings
CO2: demonstrate the skills for performing literature survey, identify gaps, analyze the technical content and prepare a well-documented Dissertation report
CO3: create informative PPTs with effective oral presentation, showing knowledge on the subject and sensitivity towards social impact of the Dissertation
CO4: demonstrate Dissertation through effective video pitch

Course Articulation Matrix (CAM): P20VE303 DISSERTATION PHASE-I /INDUSTRIAL PROJECT

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20VE303.1	2	-	2	2	2
CO2	P20VE303.2	2	-	2	2	2
CO3	P20VE303.3	-	2	-	1	1
CO4	P20VE303.4	-	2	-	1	1
P20VE303		**2**	**2**	**2**	**1.5**	**1.5**

P20VE304 INTERNSHIP EVALUATION

Class: **M.Tech. III - Semester** Branch: VLSI & ES

Teaching Scheme:

L	T	P	C
-	-	2	-

Examination Scheme:

Continuous Internal Evaluation	100 marks
End Semester Examination	--

Course Learning Objectives (LOs):

This course will develop students' knowledge on /in…

LO1: selection of internship in one of the areas of course specialization
LO2: practical and real time subject application
LO3: writing well-documented report
LO4: effective technical presentation skills with creating PPTs

Guidelines for Internship:

(1) The students shall undergo 6-8 weeks internship during summer/winter vacation at industry/R&D organization / Academic Institutes like IITs & NITs.

(2) The students preferably shall undergo internship at one organization only. In case of any difficulty, the stipulated period of internship shall be completed at different organizations with minimum of two weeks internship at every stage.

(3) The internship evaluation shall be done in the III semester of study and hence the students shall complete the prescribed period of internship before start of III semester (from end of I semester to commencement of III semester).

(4) The internship evaluation shall be done by *Department Post Graduate Evaluation Committee (DPGRC)*.

Evaluation for Internship:

There shall be only Continuous Internal Evaluation (CIE) for Internship Evaluation

(ix) CIE for the Internship in third semester is as follows:

Assessment	**Weightage**
Internship Supervisor's Evaluation: *a) Completion of Internship Assignment* ***(10%)*** *b) Quality of work in completing the Internship Assignment* ***(10%)*** c) *Attendance, punctuality and work hours* ***(10%)***	***30%***
DPGRC Assessment: *a) Duration (8 /6 weeks)* ***(15% / 10%)*** *b) Internship Report* ***(35%)*** *c) Oral Presentation (with PPT) and viva voce* ***(20%)***	***70%***
Total Weightage:	***100%***

Note: It is mandatory for the student to
(i) appear for oral presentation (with PPT) and viva voce to qualify for course evaluation

(a) Internship Report: Each student is required to submit a well-documented internship report as per format specified by DPGRC

(b) Anti-Plagiarism Check: The internship report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(c) Presentation: Each student should prepare PPT with informative slides and make an effective oral presentation before the DPGRC as per the schedule notified by the department

(x) The student has to register for the Internship as supplementary examination in the following cases:

(a) he/she is absent for oral presentation and viva-voce
(b) he/she fails to submit the report in prescribed format
(c) he/she fails to fulfill the requirements of Internship evaluation as per specified guidelines

(xi) (a) The CoE shall send a list of students registered for supplementary to the HoD concerned
(b) The DPGRC, duly constituted by the HoD, shall conduct Internship evaluation and send the award list to the CoE within the stipulated time

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: learn new concepts and apply them to the solution of engineering problems
CO2: function effectively on multidisciplinary teams and interface with other areas of organization
CO3: clearly communicate their ideas in writing and prepare a well-documented internship report
CO4: create informative PPTs and clearly communicate their ideas orally demonstrating technical knowledge

Course Articulation Matrix (CAM): P20VE304 INTERNSHIP EVALUATION

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	**P20VE304.1**	2	-	2	2	2
CO2	**P20VE304.2**	2	-	2	2	2
CO3	**P20VE304.3**	-	2	-	1	1
CO4	**P20VE304.4**	-	2	-	1	1
P20VE304		**2**	**2**	**2**	**1.5**	**1.5**

DEPARTMENT OF ELECTRONICS & INSTRUMENTATION ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE:: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (VLSI & EMBEDDED SYSTEMS)
IV-SEMESTER OF 2-YEAR M.TECH DEGREE PROGRAMME

PRR-20

[1 Dissertation]

S. No.	Course Category	Course Code	Course Title	Hours per Week			Credits	Evaluation Scheme								
								CIE - TA							ESE	Total Marks
								I²RE				Minor	MSE	Total		
				L	T	P		ATLP	CRP	CP	PPT					
1	PROJ	P20VE401	Dissertation *Phase-II*	-	-	30	15	-	-	-	-	-	-	60	40	100
			Total	-	-	30	15							60	40	100

L- Lecture, T – Tutorials, P - Practicals & C - Credits
Contact hours per week: 30; Total Credits: 15

P20VE401 DISSERTATION PHASE-II

Class: M.Tech. IV - Semester **Specialization(s):** VLSI & ES

Teaching Scheme:

L	T	P	C
-	-	30	15

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives (LOs):
This course will develop students' knowledge on /in…

LO1: recognize and formulate a problem to analyze, synthesize, evaluate, simulate and create a their project
LO2: design an innovative product by applying current knowledge and adopt to emerging applications of engineering and technology
LO3: creating PPTs and effective technical presentation and knowledge skills
LO4: writing technical paper in scientific journal style & format

Progress Presentation -II shall be conducted during the 5th /6th week of IV semester.

Progress Presentation -III shall be conducted during the 12th /13th week of IV semester.

Evaluation for Dissertation Work:

Dissertation *Phase-II*:

(i) Student has to continue the Dissertation work in 4th semester as Dissertation Phase-II

(ii) There shall be Continuous Internal Evaluation (CIE) for 60 marks and End Semester Examination for 40 marks.

(iii) The evaluation for Dissertation Phase-II is as follows:

Assessment	Weightage
Dissertation Supervisor Assessment (10%) *DPGRC* Assessment: *(i) Progress Presentation -II (10%)* *(ii) Progress Presentation -III (10%)* *(iii) Working model/process/software package/system developed (10%)* *(iv) Dissertation Video pitch (10%)* *(v) Dissertation Paper (10%)*	**60%**
End Semester Examination: *(i) Dissertation Report (20%)* *(ii) Oral presentation with PPT and viva-voce (20%)*	**40%**
Total Weightage	**100%**

Note: It is mandatory for the student to
(i) appear for oral presentation (with PPT) and viva-voce to qualify for course evaluation
(ii) write dissertation paper in given journal format
(ii) create a good video pitch on dissertation phase-I & II

(a) **Working Model:** Each student is required to develop a working model/ process/system on the chosen work and demonstrate before the DPGRC as per the dates specified by DPGRC at the end of dissertation phase-II
(b) **Dissertation Report:** Each student is required to submit a well-documented dissertation report as per the format specified by DPGRC
(c) **Anti-Plagiarism Check:** The dissertation report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

(d) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the DPGRC as per the schedule notified by the department

(e) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her dissertation Phase-I & II. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (if any) and social impact

(iv) **Dissertation Synopsis Presentation (DSP):**

(a) Students, with the consent of supervisor, shall apply to the DPGRC for conduct of dissertation synopsis presentation (DSP). This shall normally happen when the supervisor feels that the student has done significant work to qualify for M.Tech. dissertation.

(b) Those students who clear DSP shall only be allowed to submit the dissertation report for end semester examination

(v) **Dissertation Report:**

After clearing DSP, student shall be required to submit two bound copies of dissertation report, one for the department and other for the Dissertation Supervisor. The Dissertation report shall be evaluated by the DPGRC and external examination shall be conducted on a pre-notified date.

Course Learning Outcomes (COs):

On completion of this course, students will be able to…

CO1: apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models / process / system leading to innovation and entrepreneurship

CO2: design the hardware/software to demonstrate the principle of working to correlate the analytical simulation and experimental results

CO3: create informative PPT and demonstrate communication skills through effective oral presentation showing knowledge on the subject and sensitivity towards social impact of the Dissertation

CO4: write a "Dissertation paper" in scientific journal style and format from the prepared Dissertation report and create a video pitch on Dissertation

Course Articulation Matrix (CAM): P20VE401 DISSERTATION PHASE-II

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20VE401.1	2	-	2	2	2
CO2	P20VE401.2	2	-	2	2	2
CO3	P20VE401.3	-	2	-	1	1
CO4	P20VE401.4	-	2	-	1	1
P20VE401		**2**	**2**	**2**	**1.5**	**1.5**

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (VLSI & EMBEDDED SYSTEMS)

COURSE CREDIT STRUCTURE AND COURSE WEIGHTAGE

COURSE CREDIT STRUCTURE

Semester	PRR-20 Curriculum	As per Model Curriculum
I	19	18
II	19	18
III	15	16
IV	15	16
Total:	**68**	**68**

COURSE WEIGHTAGE

Courses	% Weightage of Courses
Professional Theory	42.85 % (9/21)
Professional Lab	38.1 % (8/21)
Other	19.05 % (4/21)
Total:	**100 % (21/21)**

SEMESTER vs COURSE CATEGORY WEIGHTAGE

Number of Courses / Number of Credits (*Course Category wise*)

Semester	MC	PC	PE	OE	PROJ	AC	TOTAL
I	1/2	4/10	2/6	-	-	1/1	**8/19**
II	-	4/10	2/6	-	1/2	1/1	**8/19**
III	-	-	1/3	1/3	2/9	-	**4/15**
IV	-	-	-	-	1/15	-	**1/15**
Total	**1/2**	**8/20**	**5/15**	**1/3**	**4/26**	**2/2**	**21/68**
% Weightage of Course Category	**2.94 % (2/68)**	**29.41 % (20/68)**	**22.05 % (15/68)**	**4.41 % (3/68)**	**38.23 % (26/68)**	**2.94 % (2/68)**	**100 % (68/68)**