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)
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DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

PG – M.Tech. (EMBEDDED SYSTEM AND VLSI)

PRR -20

SYLLABI, SCHEME OF INSTRUCTION & EVALUATION

(I Semester to IV Semester)

(Applicable from the Academic Year 2021-22)

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

PRR-20

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (EMBEDDED SYSTEM AND VLSI)
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	P20EV101	Professional Core-1: Digital IC Design	3	-	-	3	8	8	8	6	10	20	60	40	100
2	PC	P20EV102	Professional Core-2: Microcontroller based Embedded Systems	3	-	-	3	8	8	8	6	10	20	60	40	100
3	PE	P20EV103	Professional Elective-I/ MOOC-I	3	-	-	3	8	8	8	6	10	20	60	40	100
4	PE	P20EV104	Professional Elective-II/ MOOC-II	3	-	-	3	8	8	8	6	10	20	60	40	100
5	PC	P20EV105	Professional Core Lab-I: (*Based on Professional Core- 1*) Digital IC Design Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
6	PC	P20EV106	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

[1] 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, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]

Professional Elective-I/ MOOC-I	**Professional Elective-II/ MOOC-II**	**Audit Course-I**
P20EV103A: Semiconductor Device Modeling	P20EV104A: Embedded System Design	P20AC108A: English for Research Paper Writing
P20EV103B: System Verilog for Design and Verification	P20EV104B: Wireless Technologies in Embedded Systems	P20AC108B: Sanskrit for Technical Knowledge
P20EV103C: Linux and Python Programming	P20EV104C: Static Timing Analysis	P20AC108C: Constitution of India
P20EV103D: MOOCs	P20EV104D: MOOCs	P20AC108D: Pedagogy Studies

Contact hours per week: 24; Total Credits: 19

P20EV101 DIGITAL IC DESIGN

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

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: behavior 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: Various delay times in MOS circuits and their calculation, inverter design with delay constraints, estimation of interconnect parasitic, calculation of interconnect delay in inverters, switching power dissipation of inverters

UNIT –II (9)

MOS Logic Circuits: Introduction, MOS Inverter, 2-Input NAND and 2-Input NOR gate with depletion type NMOS as load, CMOS Inverter, 2-Input CMOS logic gates, AOI & IOA gates, CMOS full adder, multiplier and barrel shifter.
Design of Sequential elements: CMOS D-latch and edge triggered flip-flop, estimation of Clock Skew, setup time, hold time and performance computing in sequential circuits, finite state machine modeling.

UNIT– III (9)

CMOS Logic Styles: Pseudo NMOS Logic, Pass transistor logic, Charge storage and Charge leakage, Voltage Bootstrapping, Synchronous Dynamic Circuit techniques, CMOS Transmission Gate logic, CMOS Domino logic (Precharge-Evaluate logic), High performance dynamic CMOS Circuits

UNIT - IV (9)

Memory: ROM MOS NOR and NAND ROM, Precharged MOS NOR ROM memories. RAM: 6T-SRAM Cell design, 3T-DRAM Cell, 1T-DRAM Cell Design.
Memory Peripheral Circuitry: Decoders, Sense Amplifiers, Buffers, Timing and Control Circuitry.
Computer Aided Design (CAD) tools: Role of CAD tools in implementation of digital ICs; RTL, gate and system level synthesis of combinational and sequential circuits with CAD tools; FPGA Design Flow - Xilinx Spartan & Virtex Family Devices.

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, Anantha Chadrakasan, 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 Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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 CMOS logic Styles

CO4: design and analyze SRAM and DRAM Cells circuits

Course Articulation Matrix (CAM): P20EV101 DIGITAL IC DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV101.1	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
P20EV101		**1.75**	**1**	**1.75**	**2**	**2**

P20EV102 MICROCONTROLLER BASED EMBEDDED SYSTEMS

Class: M.Tech. I– Semester
Teaching Scheme:

L	T	P	C
3	–	–	3

Specialization(s): ES & VLSI
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: architectural features of ARM cortex-M4 processor
LO2: programming of ARM cortex processor using M4 assembly language
LO3: architecture and configuring of TM4C123 microcontroller
LO4: interfacing of TM4C123 microcontroller with external peripherals for serial communication

UNIT–I (9)

ARM Cortex-M4 Architecture: ARM instruction set architecture, register set, processor operating modes, interrupts and 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-AHB access port, flash patch and breakpoint unit(FPB), data watch point and trace (DWT), instrumentation trace macro cell (ITM), embedded trace macro cell (ETM),trace port interface unit(TPIU) and memory protection unit

Exceptions and Interrupts Architecture: Cortex-M exceptions and interrupts, exception and interrupt priority, interrupt configuration, handling of exceptions of interrupts, interrupts tail chaining, interrupt nesting with multi-level priority

UNIT – II (9)

Assembly Language Programming: Software development process, basics of ARM Cortex-M4 assembly language, addressing modes, instruction set; Data processing instructions- shift, rotate and logical instructions, arithmetic instructions, data movement instructions, bit field instructions, test and compare instructions, saturating instructions; Memory access instructions- load and store instructions, LDR with PC relative addressing mode, ADR instruction, double and multiple word memory access, stack memory access with PUSH and POP; Branch and control instructions- branch instructions, conditional branch execution, implementing branching structures, implementing loops and switch-case, combined compare and conditional branch, if-then conditional instruction block, table branch instructions, special instructions

UNIT – III (9)

TM4C123 Microcontroller: TM4C123 Microcontroller block diagram, microcontroller GPIOs, minimum connectivity for TM4C123, hardware development board for TM4C123; Microcontroller peripherals-peripherals on the memory map; Configuring microcontroller pins as GPIOs- clock and bus configuration, mode control configuration, pad control configuration, data control configuration, GPIO configuration for alternate functionality, configuring KEIL tools for hardware debugging

UNIT – IV (9)

Interfacing with TM4C123: Input-output interfacing for LED, LCD and Switch; Methods for input-output synchronization- blind cycle, polling based methods, interrupt driven methods; types of exceptions or interrupts, configuring interrupts for Cortex-M devices, timer configuration, ADC configuration

Serial Communication Interfaces with TM4C123: UART configuration, I^2C configuration, Serial Peripheral Interface (SPI) configuration, Controller Area Network (CAN) configuration

Text Books:

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

[2] *Joseph Yiu, The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, 3rd ed., Oxford: Newnes Publications, 2013.*

Reference Books:

[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, *and ARM System Developer's Guide- Designing and Optimizing System Software*, SanFrancisco: MorganKaufmann Publishers, 2014.

[4] https://silo.tips/download/arm-cortex-m3-assembly-language

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

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

CO1: utilize ARM Cortex-M4 processor for design of small scale embedded systems
CO2: develop assembly language programs for ARM cortex processor
CO3: identify and configuring the building blocks of TM4C123 microcontroller
CO4: design small scale embedded applications for effective transfer of data by using interrupts of TM4C123 microcontroller with external peripherals.

Course Articulation Matrix (CAM): P20EV102: MICROCONTROLLER BASED EMBEDDED SYSTEMS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV102.1	2	2	1	2	2
CO2	P20EV102.2	2	2	1	2	2
CO3	P20EV102.3	2	2	1	2	2
CO4	P20EV102.4	2	2	1	2	2
P20EV102		**2**	**2**	**1**	**2**	**2**

P20EV103A SEMICONDUCTOR DEVICE MODELLING

Class: M.Tech. I – Semester

Specialization(s): ES & VLSI

Teaching Scheme:

L	T	P	C
3	–	–	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

Course Learning Objectives:

This course will develop students' knowledge in/on

LO1: carrier statistics and energy band theory of PN junction
LO2: physics of ideal and non-ideal MOS transistor
LO3: MOS transistor DC and dynamic modelling
LO4: characteristics and applications of advance devices appropriate for industry

UNIT – I(9)

Carrier Statistics: Shockley-Read-Hall (SRH) recombination theory, Boltzmann transport equation, high field mobility and low field mobility

Energy Band Theory of PN Junction: Band diagrams, C-V characteristics, high level injection, low level injection, ohmic contacts, non ohmic contacts and thermionic emission model for current transport

UNIT – II (9)

Physics of MOS Transistor: Ideal MOS structure, MOS device in thermal equilibrium, work function differences, charges in oxide, band diagram of non-ideal MOS, flat-band voltage, threshold voltage, MOS capacitors, drain-conductance and trans-conductance, effect of source bias and body bias on threshold voltage and device operation

UNIT – III (9)

MOS Transistor DC Modelling: Pao-Shah model, charge sheet model, piece-wise linear model, models for depletion devices, carrier mobility models in deep sub-micron and nano scale dimensions, short geometry models

MOS Transistor Dynamic Modelling: Intrinsic charges and capacitance, Meyer's model, quasi static and non-quasi static model, low frequency and high frequency modelling of MOS transistors

UNIT – IV (9)

SOI MOSFET: PD SOI, FD SOI and their characteristics, threshold voltage of a SOI MOSFET, Multi-gate SOI MOSFETs and alternate MOS structures

FinFETs: I-V characteristics, device capacitances, parasitic effects of extension regions, performance of simple combinational gates and amplifiers, novel circuits using FinFETs and GAA devices

Textbook:

[1]. Donald A Neamen, "Semiconductor Physics and Devices: Basic Principles", McGraw-Hill Education, 1997.
[2]. Yuan Taur & Tak H Ning, "Fundamentals of Modern VLSI Devices", Cambridge University Press, 1998.

Reference Books:

[1]. Robert F. Pierret, "Semiconductor Device Fundamentals", Addison-Wesley, 1995.
[2]. Yannis Tsividis, "Operation and Modeling of the MOS transistor", Oxford University Press, 2011.
[3]. Nandita Das Guptha, Amitava Das Guptha, "Semiconductor Devices Modeling and Technology", PHI Learning, 2004.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under

the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

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

CO1: interpret the carrier statistics and energy band theory of PN junction

CO2: estimate the physics of ideal and non-ideal MOS transistor

CO3: develop MOS transistor DC and dynamic modelling

CO4: examine the characteristics and applications of advance devices appropriate for industry

Course Articulation Matrix (CAM):P20EV103A SEMICONDUCTOR DEVICE MODELLING						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	P20EV103A.1	1	1	1	2	2
CO2	P20EV103A.2	2	1	1	2	2
CO3	P20EV103A.3	2	1	1	2	2
CO4	P20EV103A.4	2	1	1	2	2
P20EV103A		**1.75**	**1**	**1**	**2**	**2**

P20EV103B SYSTEM VERILOG FOR DESIGN AND VERIFICATION

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

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: test bench design using methodology

UNIT – I (9)

Introduction to System Verilog: key system verilog enhancements for hardware design, enhanced literal value assignments, external compilation unit declarations, simulation time units and precision, system verilog data types, type casting, user-defined types, enumerated data types
Processes: fork-join, fork-join_any, fork-join_none, wait-fork and disable-fork

UNIT –II (9)

System Verilog 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
System Verilog Arrays: packed and unpacked arrays, arrays of arrays, arrays in structures and unions, fixed array, dynamic array, associative arrays, and queues

UNIT– III (9)

System Verilog Procedural Blocks: 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
Functions: import & export functions; Loops- forever, foreach, repeat; Class: declaration, instantiation, object creation
Object-Oriented Programming System (OOPS): inheritance, encapsulation, polymorphism.

UNIT - IV (9)

Verification Methodology: Universal Verification Methodology (UVM)- Transaction Level Modeling (TLM), factory, phases, config_db, resource_db, callback, package, reporting functions; Coverage Types: code coverage, functional coverage- cover groups, cover points, bins- Implicit bins, explicit bins, ignore bins, illegal bins and coverage options.
Case Study: General Purpose Input Output (GPIO), Serial Peripheral Interface (SPI), ARM Advanced Microcontroller Bus Architecture (AMBA) and Universal Asynchronous Receiver Transmitter (UART) Verification IP (VIP) Development, – understanding designs, preparing test plan, preparing verification plan, test bench component coding, writing assertions, coverage model, sign off criteria.

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*)
[2] Chris Spear, *System Verilog for Verification- A Guide to Learning the Testbench Language Features*, second edition, Springer,2008

Reference Book(s):

[1] C Spear, *System Verilog for Verification-A Guide to Learning the Test bench Language Features*, Berlin: Springer Science, 2006.
[2] *Universal Verification Methodology (UVM) 1.2 User's Guide*, October 8, 2015.

Learning Resources:
1. www.testbench.in
2. https://verificationacadamy.com

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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

CO1: develop hardware modeling programs using key enhancements of system verilog
CO2: construct system verilog program for hardware modeling using arrays, structures and unions
CO3: build hardware using procedural blocks, tasks, functions and procedural statements of system verilog
CO4: design VIP for GPIO using system verilog

Course Articulation Matrix (CAM): P20EV103B SYSTEM VERILOG FOR DESIGN AND VERIFICATION

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV103B.1	1	1	1	2	2
CO2	P20EV103B.2	2	1	1	2	2
CO3	P20EV103B.3	2	1	1	2	2
CO4	P20EV103B.4	2	1	1	2	2
P20EV103B		**1.75**	**1**	**1**	**2**	**2**

P20EV103C LINUX AND PYTHON PROGRAMMING

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

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)

An Introduction to LINUX Working Environment: Linux distributions and licenses, introducing the command line, file globbing, quoting commands, 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, linux command line scripting**:** working with the command line, essential linux commands, understanding processes,signals.

UNIT –II (9)

Linux for Embedded Systems: Basic software, operating systems for embedded systems, linux-based embedded system components, reference hardware model, reference hardware model implementations. the role of the boot loader, possible scenarios, an example of boot loader operations, linux kernel, device tree, system programs, application, typical layout of the root file system. introduction, cpu – i/o interface, i/o interface with polling, i/o interface with interrupt, i/o interface, i/o interface latency, direct memory access (dma) architecture - transfer modes, i/o taxonomy, typical operations, linux devices. the yocto build system, the build system workflow-configuration files, user configuration, metadata, machine (bsp) configuration.

UNIT– III (9)

Concepts of Python Programming Language: 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)

Python Modules and Packages: Exception handling and errors, modules and packages, overview of python standard modules - math, io, sys, os, date, time, random and os.path.

File handling: reading and writing to text files, reading and writing to binary files, reading and writing to structured text files- comma separated files (CSV), HTML, XML and Java script object notation (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 Pythonlanguage,* 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 Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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): P20EV103C LINUX AND PYTHON PROGRAMMING						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20EV103C.1	2	1	1	2	2
CO2	P20EV103C.2	2	1	1	2	2
CO3	P20EV103C.3	2	1	1	2	2
CO4	P20EV103C.4	2	1	1	2	2
P20EV103C		**2**	**1**	**1**	**2**	**2**

P20EV104A EMBEDDED SYSTEM DESIGN

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

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 introduction, classification and applications
LO2: embedded processors, memory, firmware and other system components characteristic
LO3: design and development of hardware and firmware along with integration and testing
LO4: product design and development with new trends in embedded industry in terms processors

UNIT-I (9)

Embedded Systems: Introduction, classification of embedded systems, core of embedded systems, major application area of embedded systems, communication interfaces-communication protocols like SPI, SCI (RS232, RS485), I2C, CAN, Field-bus (Profibus), USB (v2.0), Bluetooth, Zig-Bee, and Wireless sensor network**,** system components, passive components, active components, characteristics of embedded system, and quality attributes of embedded systems**,** Printed Circuit Board (PCB), wearable devices
Embedded Systems Application and Domain Specific: Washing machine—application-specific embedded system and automotive–domain specific examples of embedded system

UNIT-II (9)

Embedded Hardware Design and Development: VLSI and integrated circuit design, Electronic Design Automation (EDA) tools, OrCAD EDA Tool, schematic design using OrCAD capture, PCB layout design and fabrication, Assembly
Embedded Firmware Design and Development: Embedded firmware design approaches, embedded firmware development languages, and programming in embedded C, Role of embedded software, embedded system development environment- Integrated Development Environment (IDE), types of files generated on cross-compilation, disassembler/ decompiler, emulators, debugging, target hardware debugging and boundary scan
Testing: Board bring up, unit testing, integration testing, test and measurement equipment, debugging, test software and methodologies
Hardware Software Co-Design and Program Modelling: Issues in hardware software co-design, computational models in embedded design, introduction to Unified Modelling Language (UML), hardware software trade-offs, design of automatic tea/coffee vending machine and coin operated public telephone unit based on FSM model

Unit-III (9)

Simulation in embedded development: Introduction to simulator, role of simulator for error free development, different types of simulators, transient analysis, analyzing the simulation results, simulation vs. real time comparison
Real-Time Operating System (RTOS) based Embedded System Design: Tasks, process and threads, multiprocessing and multitasking, task scheduling- examine altogether, task communication and synchronization device drivers, and embedded system design with VxWorks and MicroC/OS-II, implementation of task creation in MicroC/OS-III, Round Robbin (RR) scheduling implementation for RTX51, development of socket for creating a client application under windows OS, implementation of producer-consumer/ bounded buffer problem, and implementation of semaphore based synchronization for the 'racing' problem

Unit-IV (9)

Product Enclosure Design and Development: Introduction, Product enclosure design tools, product enclosure development techniques, Embedded Product Development Life Cycle (EDLC), Introduction Linux OS, Linux IPC usage, and basic device (drivers) usage

Standards, Alliances: Introduction to open source, various standards used in embedded system, frameworks and alliances

Trends in the Embedded Industry: Processor trends in embedded system, embedded OS trends, development language trends—beyond embedded c, open standards, frameworks and alliances, development platform trends, cloud, and Internet of Things (IoT)

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] Steve Heath, *Embedded System Design,* 2nd ed, Newnes: Elsevier Inc., 2002.

[3] 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*, NewDelhi: 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 Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

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

CO1: identify the basics of embedded system concepts and their applications
CO2: analyze and testing hardware components like processors and embedded software IDE for specific application
CO3: design and develop real time operating system systems using embedded 'C' programming
CO4: investigate the current trends in the embedded industry in terms of processor, coding languages and their implementation in real time environments

Course Articulation Matrix (CAM): P20EV104A EMBEDDED SYSTEM DESIGN

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20EV104A.1	2	1	1	2	2
CO2	P20EV104A.2	2	1	1	2	2
CO3	P20EV104A.3	2	1	1	2	2
CO4	P20EV104A.4	2	1	1	2	2
P20EV104A		**2**	**1**	**1**	**2**	**2**

P20EV104B WIRELESS TECHNOLOGIES IN EMBEDDED SYSTEMS

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

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 signaling schemes of wireless communications networks*
- *LO2: different wireless technologies*
- *LO3: basic characteristics of MAC protocols & outing technologies in wireless networks*
- *LO4: security issues in wireless networks and their next generation communication technologies*

UNIT-I (9)

WI-FI: Overview of wireless generations (1G to 4G), layers of OSI model, different physical layer signaling schemes, OFDM, GFDM, ISI and fading mechanisms, WLAN generations, IEEE 802.11 and IEEE 802.15.7architectures, 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, Ultra-Wide Band (UWB)-IEEE802.15.4a, specialized low power RF modules.
Wimax: Introduction to IEEE 802.16, MAC and physical layers, Software Defined Radio (SDR), UWB Radio, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network

UNIT-IV (9)

LTE & 5G: 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 andWimax*, 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 Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in

Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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 the existing technologies and standards for wireless communications
CO3: compare the characteristics of MAC protocols & routing technologies in WSNs
CO4: estimate the risk and security issues in wireless networks and their next generation communication technologies

Course Articulation Matrix (CAM): P20EV104B WIRELESS TECHNOLOGIES IN EMBEDDED SYSTEMS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV104B.1	2	1	1	2	2
CO2	P20EV104B.2	2	1	1	2	2
CO3	P20EV104B.3	2	1	1	2	2
CO4	P20EV104B.4	2	1	1	2	2
P20EV104B		**2**	**1**	**1**	**2**	**2**

P20EV104C STATIC TIMING ANALYSIS

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

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 dissipationmodeling

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*)
[2] Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic 'Digital Integrated Circuits: A Design Prespective. Second Edition, A PrenticeHall Publication Hall, 2003

Reference Book(s):

[1] R. Jayagowri, Pushpendra S. Yadav, *Static Timing Analysis for VLSI circuits*, New Delhi: MEDTECH, ADivision of Scientific International, 2018.
[2] Naresh Maheshwari and Sachin S. Sapatnekar, *Timing Analysis and Optimization of Sequential Circuits*, Berlin:Springer Science, 1999.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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 operatingconditions

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, timingcorrelation & functional correlation

Course Articulation Matrix (CAM): P20EV104C STATIC TIMING ANALYSIS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV104C.1	1	1	1	2	2
CO2	P20 VE104C.2	2	1	1	2	2
CO3	P20 VE104C.3	2	1	1	2	2
CO4	P20 VE104C.4	2	1	1	2	2
P20EV104C		**1.75**	**1**	**1**	**2**	**2**

P20EV105 DIGITAL IC DESIGN LABORATORY

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

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.
   Predicting the aspect ratio of the MOS devices to meet specifications and analyze the switching characteristics of CMOS inverter.
2. Design and analyze CMOS arithmetic circuits (Transistor level).
   design CMOS arithmetic circuits for the given specifications and evaluate the performance characteristics of CMOS arithmetic circuits.
3. Design and analyze Clocked JK flip-flop (Transistor level).
   design Clocked JK flip-flop circuit for the given specifications and analyze the performance characteristics of Clocked JK flip-flop.
4. Design and analyze CMOS Schmitt Trigger Circuit (Transistor level).
   design CMOS Schmitt Trigger Circuit for the given specifications and analyze the performance characteristics of CMOS Schmitt Trigger Circuit.
5. Design and implementation of Adders using HDL.
   design digital adders using HDL targeting speed, power dissipation, area and implement digital adders on targeted FPGA using optimal coding.
6. Design and implementation of Digital Multipliers using HDL.
   design Digital Multipliers using HDL targeting speed, power dissipation & area and implement Digital Multipliers on targeted FPGA using optimal coding.
7. Design and implementation of Arithmetic Logic Unit using HDL.
   design Arithmetic Logic Unitusing HDL targeting speed, power dissipation & area and implement Arithmetic Logic Uniton targeted FPGA using optimal coding
8. Design and implementation of Finite State Machine using HDL.
   design Finite State Machine using HDL targeting speed, power dissipation & area and implement Finite State Machine on targeted FPGA using optimal coding
9. Mini-projects-2
   Undertake the mini project based on the applications of the lab course and explore the importance of digital ICs in various application areas such as Robotics. Automotive electronics, and communication systems

Tool: Synopsys IC Compiler/Cadence

Laboratory Manual:

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

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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): P20EV105 DIGITAL IC DESIGN LABORATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV105.1	2	2	1	2	2
CO2	P20 EV105.2	2	2	1	2	2
CO3	P20 EV105.3	2	2	1	2	2
CO4	P20 EV105.4	2	2	1	2	2
P20EV105		**2**	**2**	**1**	**2**	**2**

P20EV106 MICROCONTROLLER BASED EMBEDDED SYSTEMS LABORATORY

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

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
   Interfacing of switches and LEDs to ARM Cortex-M TM4C123 and analyze the working of LED and switches
2. Initializing and displaying message on LCD display
   interfacing of LCD display to show messages and analyze the working of LCD
3. Transmitting data using UART
   establishment (transmission) of serial communication such as UART protocol and transmit the message to the external devices using UART protocol
4. Receiving data using UART
   establishment (transmission) of serial communication such as UART protocol and receive the message from the external devices using UART protocol
5. Toggling LED using SysTick counter
   toggling LED with help of SysTick counter and analyze the working of SysTick counter for toggling LED
6. Implementing delay function using Timers
   generate hardware delays with help of Timers and analyze the accuracy of Timers for providing necessary delay in multi clocking circuits
7. Using GPIOF interrupt
   invoke interrupts, acquaint them with interrupt service procedures and evaluate the performance of interrupt based IOs
8. Using SysTick interrupt
   invoke a timer interrupt and trigger a real-time clock and evaluate the performance of real-time clock employing SrysTick
9. Interrupt priority demonstration
   handle multiple interrupts occurring simultaneously to the microcontroller and analyze various priority assignments to the interrupts
10. Interfacing LM34 temperature sensor
    sense and measure physical quantities using microcontroller-based data acquisition system and analyze the interfacing of LM34 temperature sensor, ADC with micro controller
11. Communicating with Real time clock using I^2C
    establishment of communication protocol with I^2C and analyze the data transfer using I^2C protocol
12. Using PWM module to control LED intensity
    generate various digital wave forms using ARM Cortex-M TM4C123 microcontrollers and analyze the methodology for generating waveforms digitally

Tool: Keil *uvision 4 IDE*

Laboratory Manual:

[1]. *Microcontroller Based Embedded Systems Laboratory Manual,* Dept. of ECE, 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 Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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): P20EV106 MICROCONTROLLER BASED EMBEDDED SYSTEMSLABORATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV106.1	2	2	1	2	2
CO2	P20EV106.2	2	2	1	2	2
CO3	P20EV106.3	2	2	1	2	2
CO4	P20EV106.4	2	2	1	2	2
P20EV106		**2**	**2**	**1**	**2**	**2**

P20MC107 RESEARCH METHODOLOGY AND IPR

Class: M. Tech., I-Semester
Specialization(s): SCE, DE, EV, PE, SEDS, & 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 BiologicalSystems, 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 IndiaPvt. 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, EV,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 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, HighlightingYour 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 ofLiterature, 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 Wall work, *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'sand Don'ts*
CO3: *justify, interpret, compare and summarize results for proposed methodologies in researchpaper*
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, EV, 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 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**	**PSO 2**
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, EV, 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 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 informationact

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 informationand 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, EV, 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 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, **E**ffectiveness 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 andassessment, 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 CurriculumStudies, 36 (3): 361-379, 2004.

[3] Akyeampong K, *Teacher training in Ghana - does it count? Multi-site teacher education researchproject (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 approachesfor the improvement
CO4: exemplify the role of professional development, curriculum, assessment for effective pedagogy andidentify 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 AND COMMUNICATION ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE:: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

PRR-20

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (EMBEDDED SYSTEM AND VLSI)
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	P20EV201	Professional Core-3: Analog IC Design	3	-	-	3	8	8	8	6	10	20	60	40	100
2	PC	P20EV202	Professional Core-3: Advanced System on Chip Design	3	-	-	3	8	8	8	6	10	20	60	40	100
3	PE	P20EV203	Professional Elective-III/ MOOC-III	3	-	-	3	8	8	8	6	10	20	60	40	100
4	PE	P20EV204	Professional Elective-IV/ MOOC-IV	3	-	-	3	8	8	8	6	10	20	60	40	100
5	PC	P20EV205	Professional Core Lab-III: (*Based on Professional Core- 3*) Analog IC Design Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
6	PC	P20EV206	Professional Core Lab-IV: (*Based on Professional Core- 4)* Advanced System on Chip Design Laboratory	-	-	4	2	-	-	-	-	-	-	60	40	100
7	PROJ	P20EV207	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

[2] 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

Professional Elective-III/ MOOC-III	**Professional Elective-IV/ MOOC-IV**	**Audit Course-II**
P20EV203A: Low Power VLSI Design	P20EV204A: Embedded Systems Design with RTOS	P20AC208A: Stress Management by Yoga
P20EV203B: ASIC and System on Chip Design	P20EV204B: Multicore Architecture	P20AC208B: Value Education
P20EV203C: Model based Embedded System Design	P20EV204C: Radio Frequency IC Design	P20AC208C: Personality Development through Life Enlightenment Skills
P20EV203D: MOOCs	P20EV204D: MOOCs	P20AC208D: Disaster Management

Contact hours per week: 26; Total Credits: 19

P20EV201 ANALOG IC DESIGN

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

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: 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)

Differential Amplifiers: General considerations-single ended and differential operations, qualitative analysis of differential amplifier, common mode response, differential amplifier with MOS loads, Gilbert cell.

Operational Amplifiers: Performance parameters, operational transconductance amplifier (OTA), One stage and two stage op-amp, gain boosting, Slew rate, Power supply rejection, Noise in Op-amps, Stability and frequency 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)

CMOS data converters: Basic CMOS D/A and A/D converters- Medium and High-speed data converters, Quantization noise, signed codes, performance limitations, Over sampling converters.

Switched capacitor circuits: Switched capacitor amplifiers, filters, and integrators.

Applications of Analog ICs: Robotics, Wired and wireless communications, Consumer and automotive electronics, Biomedical Instrumentation.

Text Book(s):

[1] Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, New Delhi: Tata McGraw HillEdition, 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. NewYork: Wiley, 2009.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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): P20EV201 ANALOG IC DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV201.1	1	1	1	2	2
CO2	P20EV201.2	2	1	1	2	2
CO3	P20EV201.3	2	1	1	2	2
CO4	P20EV201.4	2	1	1	2	2
P20EV201		**1.75**	**1**	**1**	**2**	**2**

P20EV202 ADVANCED SYSTEM ON CHIP DESIGN

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

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: Programmable SoC and ARM cortex-A processors
LO2: AVMV7-A/R instruction set architecture and ARM cortex-A9 processor
LO3: AMBA bus AX14 lite GPIO peripherals and DDR memory control
LO4: AXIUART, AXI system peripherals

UNIT – I (9)

Introduction to Programmable SoCs : System on Chip (SoC) design concept, moore's law, importance of scaling, design productivity gap, bridging the design productivity gap, SoC - inside an SoC, example arm-based SoC, advantages of SoCs, limitations of SoCs, SoC vs microcontroller vs processor, SoC design flow; SoC examples: NVIDIA tegra 2, apple SoC families

Arm and Arm Processors: Arm processors and applications, arm processor families, arm processors vs arm architectures, arm and thumb instruction sets, AAPCS, processor modes, vector table, memory model, memory types example cached arm macrocell, data alignment, endianness, coprocessors, PMU, trust zone, virtualization, arm cortex-A series processors, arm cortex-A9 processor, cortex-A9 MP Core, NEON-NEON registers

UNIT –II (9)

Armv7-A/R ISA: ARM assembler, ARM assembler file syntax, single/ double register data transfer, addressing memory, pre- and post -indexed addressing, multiple register data transfer, data processing instructions, shift/rotate operations, instructions for loading constants, multiply/divide, bit manipulation instructions, byte reversal, flow control, branch instructions, interworking, compare and branch if zero, conditional instructions, if then, coprocessor instructions, PSR access, DSP instructions overview, saturated maths and CLZ, saturation, SIMD

ARM Cortex-A9 Processor: Cortex- A9 – MP core, MPE configuration, media processing engine, register renaming, virtual flags registers, small loop mode, program flow prediction, Performance Monitoring Unit (PMU), cortex A9 supports ARMv7-A architecture, caches, data cache, memory management unit, ARM v7 architecture effects

UNIT– III (9)

AMBA AXI4 Bus Architecture: Bus -types, terminology, operation, communication architecture standards, ARM AMBA system bus, AMBA 3 AXI interface, AMBA 4 specifications, AXI components and topology, transaction channels, basic signals, clock and reset, channel timing example, relationship between the channels

AXI4-Lite GPIO Peripheral and DDR Memory Controller: AMBA AX14-lite, AXI low power interface, GPIO overview, AX14-lite GPIO, computer memory, memory accessing, volatile vs non-volatile memory, types of memory, static RAM, dynamic RAM, non -volatile memory, memory controller, roles of a memory controller, single description example timing

UNIT - IV (9)

AXI UART and AXI4-Stream Peripherals: Serial communication, serial communication vs parallel communication, types of serial communication, UART overview, UART protocol, character- encoding scheme, ASCII encoded characters, AXI UART implementation, UART control, UART register block, First In First Out(FIFO), UART FIFOs, stream data transmission, AX-14 stream protocol, data streams, global signals, master signals, slave signals, clock and reset, handshake, packet boundaries

AXI4-Stream with VGA Output Peripheral: VGA overview, VGA timing, VGA interface, utilization of FIFO, hardware implementation

Text Book(s):

[1]. Steve B, Furber, *ARM System-on-Chip Architecture*.

[2]. William Hohl, *ARM Assembly Language: Fundamentals and Techniques.*

Reference Book(s):

[1]. Cortex-A Series Programmer's *Guide for ARMv7-A by Arm*

[2]. http://infocenter.arm.com/help/topic/com.arm.doc.den0013d/index.html

[3]. Louise H Crockett (Author), Ross A Elliot (Author), Martin A Enderwitz, *The Zynq Book Tutorials for Zybo and ZedBoard.*

Course Learning Outcomes (COs):

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

CO1: knowledge and understanding of programmable SoC and ARM processor

CO2: design ARM cortex-A based SoC's in a standard hardware designing language

CO3: analyze the AMBA AXI4 bus and AXI4perpheral and DDR memory control

CO4: model the high level applications using ARM cortex-A based SoC's

Course Articulation Matrix (CAM): P20EV202 ADVANCED SYSTEM ON CHIP DESIGN

CO		PO1	PO2	PO3	PSO1	PSO 2
CO1	P20EV202.1	1	1	1	2	2
CO2	P20EV202.2	2	1	1	2	2
CO3	P20EV202.3	2	1	1	2	2
CO4	P20EV202.4	2	1	1	2	2
P20EV202		**1.75**	**1**	**1**	**2**	**2**

P20EV203A LOW POWER VLSI DESIGN

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

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 MOSdevices
LO3: static RAM architecture & organization and energy computing & recovery techniques
LO4: sources of power dissipation in software, estimation and optimization of power for softwaredesign

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.
[2] A.P. Chandrakasan, R.W. Broderson, *Low Power design*, New York: Springer Science,1999.

Reference Book(s):

[1] Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998
[2] J.B. Kuo, J.H. Juo, *Low Voltage VLSI Circuits*, NJ: John Wiley & Sons.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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 powerdissipation using statistical techniques

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

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

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

Course Articulation Matrix (CAM): P20EV203A LOW POWER VLSI DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV203A.1	1	1	1	2	2
CO2	P20 VE203A.2	2	1	1	2	2
CO3	P20 VE203A.3	2	1	1	2	2
CO4	P20 VE203A.4	2	1	1	2	2
P20EV203A		**1.75**	**1**	**1**	**2**	**2**

P20EV203B ASIC AND SYSTEM ON CHIP DESIGN

Class: M.Tech. II – Semester

Specialization(s): ES & VLSI

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: principles of ASIC design flow, fundamentals of logic cells
LO2: Partitioning, placement , routing and DRC checking
LO3: fundamentals and concepts of SoC, designing various components on SoC
LO4: methods for validating the correctness of the design and testing methodologies.

UNIT – I (9)

CMOS Logic and ASIC Library Design: Types of ASICs, design flow, CMOS transistors, CMOS design rules, combinational logic cell, sequential logic cell, data path logic cell, transistors as resistors, transistor parasitic capacitance, logical effort, library cell design, library architecture

UNIT – II (9)

ASIC Construction: system partition, FPGA partitioning, partitioning methods, floor planning, placement, physical design flow, global routing, detailed routing, special routing, circuit extraction, DRC

UNIT – III (9)

Design Methodological for Logic Cores: architecture of the present day SoC, design issues, hardware-software codesign, SoC design flow, guidelines for design reuse, design process for soft and firm cores, design process for hard cores, designing with hard cores and soft cores, design methodology for memory and analog cores

UNIT – IV (9)

Design Validation: core level validation, core interface verification, SoC design validation, co simulation
Case Study: Validation and test of systems on chip
Testing of Digital Logic Cores: SoC test issues, cores with boundary scan, test methodology for design reuse, testing of microprocessor cores, testing of embedded memories
Case Study: integrating BIST techniques for on-line SoC testing.

Text Book(s):

[1] Smith M.J.S.,"*Application Specific Integrated Circuits*", Addison, Wesley Longman Inc.,1997.
[2] Rochit Rajsunah, "*System-on-a-chip: Design and Test*", Artech House, 2007.

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Reference Book(s):

[1] Farzad Nekoogar and Faranak Nekoogar, "From ASICs to SoCs - A Practical Approach", Prentice Hall, 2003.
[2] Prakash Rashinkar, Peter Paterson and Leena Singh L, *System on Chip Verification –Methodologiesand Techniques*, New York: Kluwer Academic Publishers, 2001.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

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Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

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

CO1: design sequential and combinational logic cells
CO2: analyze the construction of ASIC
CO3: explain the concepts of SoC and the design criteria for the logic core.
CO4: illustrate the correctness of the design using different verification and testing methodologies.

Course Articulation Matrix (CAM): P20EV203B ASIC AND SYSTEM ON CHIP DESIGN						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20EV203B.1	1	2	1	2	2
CO2	P20EV203B.2	2	2	1	2	2
CO3	P20EV203B.3	2	2	1	2	2
CO4	P20EV203B.4	2	2	1	2	2
P20EV203B		**1.75**	**2**	**1**	**2**	**2**

P20EV203C MODEL BASED DESIGN FOR EMBEDDED SYSTEM

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

Teaching Scheme:

L	T	P	C
3	–	–	3

Examination Scheme:

Continuous Internal Evaluation	60 marks
End Semester Examination	40 marks

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

LO1: modeling dynamic behaviors, discrete dynamics and behaviors
LO2: hybrid systems, composition of state machines and concurrent models of computation
LO3: embedded processors, memory architectures and scheduling
LO4: invariants & temporal logic and abstraction in model checking

UNIT – I (9)

Introduction, Applications, Design Process

Continuous Dynamics: Newtonian Mechanics, Actor Models, Properties of Systems, Feedback Control.

Discrete Dynamics: Discrete Systems, The Notion of State, Finite-State Machines, Extended State Machines, Non determinism, Behaviors and Traces.

UNIT – II (9)

Hybrid Systems: Modal Models, Classes of Hybrid Systems

Composition of State Machines: Concurrent Composition, Hierarchical State Machines.

Concurrent Models of Computation: Structure of Models, Synchronous-Reactive Models, Dataflow Models of Computation, Timed Models of Computation.

UNIT – III (9)

Embedded Processors: Types of Processors, Parallelism

Memory Architectures: Memory Technologies, Memory Hierarchy, Memory Models.

Input and Output:I/O Hardware, Sequential Software in a Concurrent World.

Scheduling: Basics of Scheduling, Rate Monotonic Scheduling, Earliest Deadline First, Scheduling and Mutual Exclusion, Multiprocessor Scheduling.

UNIT – IV (9)

Invariants and Temporal Logic: Invariants, Linear Temporal Logic.

Equivalence and Refinement: Models as Specifications, Type Equivalence and Refinement, Language Equivalence and Containment, Simulation.

Reachability Analysis and Model Checking: Reachability Analysis, Abstraction in Model Checking.

Quantitative Analysis: Programs as Graphs, Factors Determining Execution Time, Basics of Execution Time Analysis.

Textbook:

[1]. Edward Ashford Lee and Sanjit Arun kumarr Seshia, "*Introduction to Embedded Systems: A Cyber-Physical Systems Approach*", Second Edition, LeeSeshia.org, 2015. http://LeeSeshia.org, 2011.
[2]. David E.Simon, "*An Embedded Software Primer*", first Edition, USA, 1999.

Reference Books:

[1]. Marwedel P, "*Embedded System Design - Embedded Systems Foundations of Cyber- Physical Systems*", Second Edition, Springer, 2011.
[2]. http://www.cis.upenn.edu/~alur.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page
Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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

CO1: select the required dynamic behaviors &discrete dynamics based on the application
CO2: classify the modal models of hybrid systems and identify concurrent models of computation
CO3: identify suitable embedded processorand summarize memory architectures & scheduling
CO4: identify the invariants & temporal logic and illustrate abstraction in model checking

Course Articulation Matrix(CAM): P20EV203C MODEL BASED DESIGN FOR EMBEDDED SYSTEM						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	P20EV203C.1	**1**	**1**	**1**	**2**	**1**
CO2	P20EV203C.2	**2**	**2**	**1**	**2**	**2**
CO3	P20EV203C.3	**2**	**2**	**1**	**2**	**2**
CO4	P20EV203C.4	**2**	**2**	**1**	**2**	**2**
P20EV203C		**1.75**	**1.75**	**1**	**2**	**1.75**

P20EV204A EMBEDDED SYSTEM DESIGN WITH RTOS

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

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: 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- sharing data among RTOs tasks, shared-data problems, reentrancy, applying the reentrancy rules; Semaphores and shared data- RTOS semaphores, initializing semaphores, reentrancy semaphores, multiple semaphores, semaphores as a signaling device, semaphore problems; Operating system services- message queues, mailboxes and pipes, timer functions, events, memory management, interrupt routines in RTOS environment

UNIT – II (9)

Basic Design using a Real-Time Operating System: Overview, Principles- general operation, interrupt routines, priority and encapsulation, task structure; A system design example: Underground tank monitoring system, encapsulating semaphores and queues, hard and soft real-time scheduling considerations, saving memory space, saving power, component configuration.

UNIT – III (9)

µC/OS-II: Features, Kernel structure- critical selections, task states, task control blocks function, ready list, task scheduling, task level context switch function, locking and unlocking the scheduler, idle task, statistics task, interrupts under µC/OS-II; clock tick, µC/OS-II initialization, starting µC/OS-II, Task management functions- creating a task, task stacks, stack checking, deleting a task, changing task's priority, suspending a task, resuming a task, getting information about task; Time management functions- delaying a task, resuming a delayed task, system time

UNIT – IV (9)

µC/OS-II Inter task communication and synchronization: Event control blocks- placing and removing a task in/from ECB wait list, list of free ECBs, initializing an ECB, making a task ready because of timeout; Semaphore management- creating and deleting a semaphore, waiting and signaling semaphore; Message mailbox management- creating and deleting message mailbox; Message queue management- creating and using message queue; Memory management- memory control blocks, creating and using memory partitions; Porting µC/OS-II- development tools, directories and files, testing a port;

Text Books:

[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.
[3]. Colin Walls, Embedded RTOS Design: Insights and Implementation, Newnes Publications 2020

Reference Books:

[1]. Rajkamal, *Embedded Systems: Architecture, Programming and Design, 2nded.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 Free RTOS 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 Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

On 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: evaluate the principles of scheduling mechanism for inter task synchronization in RTOS
CO4: design embedded applications with principles of inter task communication and synchronization

Course Articulation Matrix (CAM): P20EV204A EMBEDDED SYSTEM DESIGN WITH RTOS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV204A.1	1	2	1	2	2
CO2	P20EV204A.2	2	2	1	2	2
CO3	P20EV204A.3	2	2	1	2	2
CO4	P20EV204A.4	2	2	1	2	2
P20EV204A		**1.75**	**2**	**1**	**2**	**2**

P20EV204B MULTICORE ARCHITECTURE

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

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 multicore processors, and their architecture.
LO2: challenges in parallel and multi-threaded programming.
LO3: various parallel programming paradigms.
LO4: developing multicore programs and design parallel solutions.

UNIT –I (9)

Multi-core processors: Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures Latency and bandwidth – Cache coherence- False sharing, Performance Issues –Distributed-memory, Parallel program design–Foster's methodology, Parallelizing the serial program

UNIT - II (9)

Parallel program challenges: Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives -mutexes, locks, semaphores, barriers – deadlocks and livelocks – communication between threads -condition variables, signals, message queues and pipes

UNIT - III (9)

Shared memory programming with openmp: OpenMPExecution Model, The Trapezoidal Rule – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism –Handling Loops, Producers and Consumers – Performance Considerations, Thread-Safety, Programming Assignments

UNIT - IV (9)

Distributed memory programming with mpi: MPI program execution – MPI constructs – libraries – MPI send and receive – Point to-point and Collective communication – MPI derived data types – Performance evaluation,Parallel program development Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations, Programming Assignments

Text Book(s):

[1] Peter S. Pacheco, *An Introduction to Parallel Programming*‖, Morgan Kauffman/Elsevier, 2011.
[2] Darryl Gove, *Multicore Application Programming for Windows*, Linux, and Oracle Solaris‖, Pearson, 2011 (unit 2).

Reference Book(s):

[1] Michael J Quinn,*Parallel programming in C with MPI and OpenMP*, Tata McGraw Hill, 2003.
[2] Shameem Akhter and Jason Roberts,*Multi-core Programming,* Intel Press, 2006.

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes (COs):

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

CO1: describe multicore architectures and identify their characteristics and challenges.

CO2: analyze the issues in programming Parallel Processors

CO3: program using Open MP and MPI

CO4: design parallel programming solutions to common problems.

Course Articulation Matrix (CAM): P20EV204B MULTICORE ARCHITECTURE						
CO		**PO1**	**PO2**	**PO3**	**PSO1**	**PSO2**
CO1	P20EV204B.1	2	1	1	1	2
CO2	P20EV204B.2	2	1	1	1	2
CO3	P20EV204B.3	2	1	1	1	2
CO4	P20EV204B.4	2	1	1	1	2
P20EV204B		**2**	**1**	**1**	**1**	**2**

P20EV204C RADIO FREQUENCY IC DESIGN

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

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: 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 thereal 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 Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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): P20EV204C RADIO FREQUENCY IC DESIGN

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV204C.1	1	1	1	2	2
CO2	P20EV204C.2	2	1	1	2	2
CO3	P20EV204C.3	2	1	1	2	2
CO4	P20EV204C.4	2	1	1	2	2
P20EV204C		**1.75**	**1**	**1**	**2**	**2**

P20EV205 ANALOG IC DESIGN LABORATORY

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

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
   Plot V-I characteristics of MOSFET and analyze the transfer and drain characteristics of NMOS, PMOS, and CMOS
2. Design of Single-stage amplifiers for the given the specifications
   design and analysis of various single stage amplifiers for different loads and analyze the frequency response of the Single-stage MOS amplifiers for the given the specifications.
3. Design of various current mirrors (basic, cascode and low-voltage cascode)
   design and implement the current mirror circuits and able to address the advantages and disadvantages between various current mirror circuits in terms of voltage head room and output current.
4. Design of various single stage differential amplifiers (5-Transistor amplifier, Telescopic and folded cascode)
   Design and implement the single stage differential amplifier and able to find out the tradeoff between CMRR, power dissipation, and noise. To find out the minimum and maximum values of the input voltage and output swing from the DC analysis. Also, to verify the variation in frequency response for different topologies.
5. Design of Miller compensated two-stage operational amplifier for the given Specifications
   design and implement the conventional and miller compensated two stage amplifiers for the given specifications. The significance of the transient analysis to find the speed of operation between two op-amps.
6. Design of Voltage Reference and Current Reference Circuits
   demonstrate the CMOS bandgap reference and current reference generator circuit which produces an output reference voltage and an output current, for the given supply voltage.
7. Modeling and design of Successive Approximation Register ADC
   design and implement the SAR ADC for given reference voltage and input voltage.
8. Modeling and design of Current-steering DAC
   Demonstrate the design and implementation of current steering n-bit DAC that explains the importance of higher sampling frequency for high-speed applications.
9. Mini-projects-2
   Undertake the mini project based on the applications of the lab course and explore the importance of analog ICs in various application areas such as Robotics. Automotive electronics and communication systems.

Tool: Synopsys IC Compiler/Cadence

Laboratory Manual:

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

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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): P20EV205 ANALOG IC DESIGN LABORATORY

CO		PO1	PO2	PO3	PSO 1	PSO 2
CO1	P20EV205.1	2	2	1	2	2
CO2	P20EV205.2	2	2	1	2	2
CO3	P20EV205.3	2	2	1	2	2
CO4	P20EV205.4	2	2	1	2	2
P20EV205		**2**	**2**	**1**	**2**	**2**

P20EV206 ADVANCED SYSTEM ON CHIP DESIGN LABORATARY

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

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: realizing the instruction processing of a computer
LO2: cache based memory hierarchies
LO3: branch prediction and SIMD instruction processing
LO4: co-processors, busses and multi-core processing

LIST OF EXPERIMENTS:

1. MIPS VHDL model and with the used design tools, refresh VHDL skills by coding small units *simulate* MIPS *designs using VHDL coding and implement the synthesized design in FPGA*
2. Pipelining.
   A. hazard detection,
   B. stalling,
   C. forwarding

   design of pipeline for checking hazard detection, stalling and forwarding
3. Caching
   A. direct-mapped I-cache,
   B. 2-way set-associative D-cache,
   C. replacement strategies

   implement different styles of cache-based memory hierarchies, and examine advanced strategies
4. Branch prediction.
   analyze the Branch prediction
5. Multi-threading.
   *analyze the m*ulti-threading *process and examine the characteristics of Multi-threading*
6. SIMD instruction processing.
   verify the SIMD instruction processing
7. Co-processors, busses.
   verify the functionality of Co-processor and buses
8. Multi-/many-core processing
   implement the Multi-/many-core processing in ARM
9. Out-of-order execution
10. Mini Project-3

LaboratoryManual:

[1]. *Advanced System on chip design Laboratory Manual,* Dept. of ECE, KITSW

Text Book(s):

[1]. John L. Hennessy, David A. Patterson, *Computer Organization and Design - The Hardware/Software Interface*, 4th Edition, Morgan Kaufmann, 2009.

[2]. Antonio Gonzalez, Fernando Latorre, Grigorios Magklis, *Processor Microarchitecture - An Implementation Perspective*, Synthesis Lectures on Computer Architecture, 2011.

[3]. John L. Hennessy, David A. Patterson, *Computer Architecture - A Quantitative Approach*, 5th Edition, Morgan Kaufmann, 2012.

[4]. Peter J. Ashenden, *The Designer's Guide to VHDL*, 3rd Edition, Elsevier, 2008.

[5]. The Zynq Book: http://www.zynqbook.com

Course Learning Outcomes (COs):

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

CO1: realize efficient instruction-processing of a computer processor

CO2: implement forwarding, different styles of cache-based memory hierarchies, and examine advanced strategies

CO3: design mid-size hardware projects by coding synthesizable VHDL and writing test benches or using on-FPGA logic analyzers

CO4: verify and manage mid-size hardware modules by coding synthesizable VHDL and writing test benches or using on-FPGA logic analyzers

Course Articulation Matrix (CAM): P20EV206 ADVANCED SYSTEM ON CHIP DESIGN LABARATORY

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV206.1	2	2	1	2	2
CO2	P20EV206.2	2	2	1	2	2
CO3	P20EV206.3	2	2	1	2	2
CO4	P20EV206.4	2	2	1	2	2
P20EV206		2	2	1	2	2

P20EV207 MINI PROJECT WITH SEMINAR

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

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): **P20EV207 MINI PROJECT WITH SEMINAR**						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	P20EV207.1	2	-	2	2	2
CO2	P20EV207.2	2	-	2	2	2
CO3	P20EV207.3	-	2	-	1	1
CO4	P20EV207.4	-	2	-	1	1
P20EV207		**2**	**2**	**2**	**1.5**	**1.5**

P20AC208A STRESS MANAGEMENT BY YOGA

Class: M.Tech. II–Semester

Specialization(s): SCE, DE, EV, 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 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 : SwamiVivekananda 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, EV, 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 behavior 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, EV, 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: 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, 48chapter3-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 SanskritSansthanam
[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, EV, 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 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*(Chapters1- 5,7,9 &10)*

[2] N. G. Dhawan, A. S. Khan, *Disaster Management and Preparedness*, 1st ed., New Delhi: CBSPublication, 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: RawatPublications, 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 AND COMMUNICATION ENGINEERING
KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE:: WARANGAL – 15
(An Autonomous Institute under Kakatiya University, Warangal)

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

PRR-20

[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	P20EV301	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	P20EV303	Dissertation *Phase-I* / Industrial Project (*to be continued in IV – semester also*)	-	-	18	9	-	-	-	-	-	-	100	-	100
4	PROJ	P20EV304	Internship Evaluation	-	-	2	-	-	-	-	-	-	-	100	-	100
			Total	6	-	20	15							320	80	400

[3] 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, ATLP = Assignments, CRP = Course Research Paper, CP = Course Patent, PPT = Course Presentation, Minor=Minor Examination, MSE=Mid Semester Examination and ESE=End Semester Examination]

Professional Elective-V/ MOOC-V	**Open Elective-I/ MOOC-VI**
P20EV301A: Embedded System for Industrial Applications	P20OE302A: Business Analytics
P20EV301B: Artificial Intelligence and Machine Learning	P20OE302B: Industrial Safety
P20EV301C: Internet of Things and Applications	P20OE302C: Operations Research
P20EV301D: MOOCs	P20OE302D: Cost Management of Engineering Projects
	P20OE302E: Composite Materials
	P20OE302F: Waste to Energy
	P20OE302G: Renewable Energy Sources
	P20OE302H: MOOCs

Contact hours per week: 26; Total Credits: 15

P20EV301A EMBEDDED SYSTEM FOR INDUSTRIAL APPLICATIONS

Class: M.Tech III-semester **Specialization(s):** ES & VSLI

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: understanding automotive fundamentals and applications
LO2: design of various electronic systems as well as embedded automotive protocols.
LO3: sensors, actuators, embedded Controllers and industrial applications of robots
LO4: various embedded systems applications in ECG, EMG and IOT

UNIT – I (9)

AUTOMOTIVE APPLICATIONS: Automotive Fundamentals – Vehicle functional domains and requirements – The systems approach to control and automotive instrumentation – Sensors and actuators in various vehicle domains. Systems in Power train Electronics: Engine Management Systems: Spark Ignition, Petrol/ Diesel Injection Systems, Transmission Systems. Systems in Chassis control: ABS, ESP,TCS, Active Suspension Systems, Cruise control and adaptive cruise control systems – Drive-by wire systems..

UNIT – II (9)

ELECTRONIC SYSTEMS: Power Generation/ Storage, starting motor systems, Vehicle wirir systems, HVAC, Automotive alarm systems, Vehicle immobilization &deactivation, Driver informatic systems, Parking systems, Central locking system – electric windows – Occupants and driver safe systems: Seat belt lighteners and air-bags – Diagnostics Systems. Electric/Hybrid Vehicles and the configurations – Autonomous Vehicles and their challenges. Introduction to Embedded automotiv protocols: LIN, CAN, Flex Ray, MOST - AUTOSAR standard and its applications – OSEK/VDX Ope Systems in Automotive Networks

UNIT – III (9)

Embedded Systems For Robotics: Sensor categories, binary sensor, analog versus digital sensors, shaft encoder; a/d converter, position sensitive device; compass, gyroscope, accelerometer, inclinometer, digital camera;robotics control elements :actuators - dc motors, h-bridge, pulse width modulation, stepper motors, servos. control – on-off control, pid control, velocity control and position control; embedded controllers for robots: embedded controllers, interfaces, operating system - industrial robots.robot kinematics evolution of robotics, robot anatomy, design and control issues, manipulation and control. direct kinematic model - denavit-hartenberg notation, kinematic relationship between adjacent links, manipulator transformation matrix, inverse kinematic model, autonomous robots

UNIT – IV (9)

Embedded systems In Patient Monitoring-ECG, EEG, EMG, Blood pressure, respiration, pulse oximeters, diagnostic devices

Embedded systems in IOT applications

POS machines, ticketing machines, GPRS based billing meters , IOT based agriculture monitoring systems, IOT based home automation and monitoring systems, industrial machine monitoring systems ,Cloud based Data loggers ,GSM/GPS based Vehicle tracking systems

Text Books:

[1] William B. Ribbens, "Understanding Automotive Electronics - An Engineering Perspective", Eight Edition, Elsevier Inc., 2017.
[2] V. A. W. Hillier and David R. Rogers, "Hillier's Fundamentals of Motor Vehicle Technology on Chassis

and Body Electronics", Fifth Edition, Nelson Thrones, 2007
[3] Thomas Bräunl, "Embedded Robotics: Mobile Robot Design and Applications with Embedded Systems", Third Edition, Springer-Verlag Berlin Heidelberg, 2008.
[4] R.K.Mittal and I.J.Nagrath, "Robotics and Control", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2003.

Reference Books:

[1] Robert Bosch GmbH, "Bosch Automotive Electricsand Automotive Electronics - Systems and Components, Networking and Hybrid Drive", Fifth Edition, Springer Vieweg, 2007.
[2] Joseph Lemieux, "Programming in the OSEK/VDX Environment", CMP Books, USA, 2001.
[3] Tom Denton, "Automobile Electrical and Electronic Systems", Third Edition, Elsevier Butterworth-Heinemann, 2004.
[4] John J. Craig, "Introduction to Robotics: Mechanics and Control", Third Edition, Pearson/Prentice Hall, 2005.
[5] AnisKoubaa, "Robot Operating System (ROS) The Complete Reference", First Volume, Springer, 2016.
[6] K.S. Fu, R.C. Gonzalez and C.S.G. Lee, "Robotics: Control, Sensing, Vision, and Intelligence", McGraw-Hill, New York, 1987

Course Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

Course Learning Outcomes(COs):

After completion of this course, the students will be able to

CO1: analyze automotive based applications.
CO2: develop various electronic systems and embedded automotive protocols
CO3: make use of various embedded system sensors, actuators for the design of robots in the industry
CO4: apply embedded system concepts for the design of ECG, EEG, EMG and IOT applications

Course Articulation Matrix (CAM): P20EV301A EMBEDDED SYSTEM FOR INDUSTRIAL APPLICATIONS

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV301A.1	2	1	1	2	2
CO2	P20EV301A .2	2	2	1	2	2
CO3	P20EV301A .3	2	2	1	2	2
CO4	P20EV301A .4	2	1	1	2	2
P20EV301A		**2**	**1.5**	1	**2**	**2**

P20EV301B ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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

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)

Mathematics for Machine Learning: Linear Algebra (Vectors & Matrices), Concepts of Descriptive statistics and probability (PDF,CDF), Higher order differential equations. Python Libraries for Machine Learning**:** NumPy, Pandas, Matplotlib, Scikitlearn, SciPy.
Artificial Intelligence(AI): Essentials of Artificial intelligence, Proposing and evaluating AI applications, Case study: Google Duplex.
Search and Planning: Problems paces and search, Heuristic search strategies, Adversarial search, Planning and scheduling,
Case studies: Playing chess, Probabilistic reasoning, Ontologies, Bayesian reasoning, Medical diagnosis.

UNIT-II (9)

Machine learning: Classification of machine learning algorithms, supervised vs. unsupervised learning supervised methods: Gradient descent, Regression linear, logistic, ridge;
Case study: Linear regression on Agricultural field data. Logistic regression: medical diagnosis. Classification–Decision trees, SVM, random forests; Model performance evaluation, Shopping portal, Classification of images, Bank failure prediction

UNIT-III (9)

Unsupervised Methods: Unsupervised learning and data clustering, dimensionality reduction, principal component analysis, independent component analysis, clustering k-means, K nearest neighbor (KNN), hierarchical clustering, Semi-supervised methods, case study: customer segmentation for business strategies. Case study: Genetics, clustering DNA learning patterns in a real-estate (PCA).

UNIT-IV (9)

Reinforcement learning: Markov chains, markov process and markov decision process (MPD), rewards and returns policies, concepts of exploration and exploitation of the agent, bell man equation for reinforcement learning, Q-learning, concepts of deep Q learning, Actor and critic reinforcement learning algorithm.
Case Study: Role of AI and ML in the menace of communications systems. (MDP): Industry automation with Reinforcement Learning, reinforcement learning applications in trading and finance, network Traffic Signal Control.

Text Book(s):

[1] Russell, S. & Norvig, *Artificial Intelligence: A Modern Approach*, 4th ed. New York:Pearson Education Publications, 2010.
[2] Good fellow, I., Bengio, Y. and Courville, A., *Deep Learning*, Cambridge: MIT Press,2016.

Reference Book(s):

[1] Vinod Chandra S. S, Anand Hareendran S, *Artificial Intelligence and MachineLearning*, 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.

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Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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): P20EV301B ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

CO		PO1	PO2	PO3	PSO1	PSO2
CO1	P20EV301B.1	2	1	1	2	2
CO2	P20EV301B.2	2	1	1	2	2
CO3	P20EV301B.3	2	1	1	2	2
CO4	P20EV301B.4	2	1	1	2	2
P20EV301B		**2**	**1**	**1**	**2**	**2**

P20EV301C INTERNET OF THINGS AND APPLICATIONS

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

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: publishing messages to a MQTT broker and phone
LO4: use cases of IoT applications in industry automation

UNIT-I (9)

Internet of Things (IoT): Introduction, applications and challenges, IoT protocol stack, 6LoWPAN adaptation layer, Application layer protocols-HTTP, CoAP, MQTT, AMQP, XMPP, REST architectures.
IoT architecture and design methodology: IoT platform design methodology, IoT reference architecture-functional view, information view, deployment and operational view, other relevant architectural views.
Basics of Raspberry Pi: Introduction to Raspberry Pi (RPi) 4B, GPIO pin description and on-board components, installation and configuration of Raspbian OS, remote access using VNC viewer, introduction to Linux OS, setting up python tools, introduction to sensors, identification of characteristics and specifications using datasheet.
Practical applications - Interfacing of different sensors with RPi, interfacing of actuators with RPi.

UNIT-II (9)

IoT Communication Protocols: Introduction to ZigBee Protocol**,** ZigBee-Pro Series 2 hardware module, pin out, specifications, X-CTU software tool, configuration of ZigBee-Pro Series 2 modules in AT and API mode.
Case study- Perform coverage range test with ZigBee-Pro Series 2 devices in indoor (NLOS) and outdoor (LOS) environments, introduction to LoRa LPWAN protocol, Semtech SX1278 LoRa chip, block diagram, pin configuration, and specifications, Visual Studio Code software tool-installation, python programming.
Case study-conduct coverage range test using SX1272 LoRa modules in indoor (NLOS) and outdoor (LOS) environments, introduction to ESP8266 Node-MCU, pinout, setting up Arduino IDE, embedded C programming.
Case studies - Creating webapp, home automation and temperature logging system.
Cloud Application Architecture: Cloud services for IoT, edge computing, cloud to fog computing, security and privacy in fog, Software Defined Networks (SDN).
Practical Applications of 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 dash board. Case studies-upload the sensor data to Thing Speak cloud, publish sensor data to Adafruit IO cloud using MQTT protocol.

UNIT-III (9)

IoT Design using Raspberry Pi 4B: Introduction to Node-RED, Installation process, MQTT brokers, Publishing messages to a MQTT broker with a Python client, Sending text message from RPi to phone using twilio, Creating a door bell button using Bluetooth, Home appliance control with blynk app, operating system requirements for IoT environment, study of mbed, RIoT, and Contiki operating systems, concepts of big data for IoT applications, Case study-real time big data visualization dashboard using Node-RED.

UNIT-IV (9)

IoT Applications for Industry: Value creation and challenges, future factory concepts, brown field IoT-technologies for retrofitting, smart objects, smart applications, and smart grid.
Retailing industry - Inventory management, smart payment and smart vending machines.
Health care - health and fitness monitoring, wearable electronics, IoT for oil and gas industry, supply chain optimization, Connected cars IoT transportation, smart irrigation, green house control, machine diagnosis and prognosis, security and legal consideration, IT act 2000 and scope for

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: PacktPublishing, 2018.

Reference Book(s):

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

[2] David Hanes et al, *IoT Fundamentals: Networking Technologies, Protocols, and UseCases 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 Research Papers: Research papers (Journal/Conference papers) relevant to the course content will be posted by the course faculty in Course Web page

Course Patents: Patents relevant to the course content will be posted by the course faculty in Course Web page

Course Projects: Course project is an independent project carried out by the student during the course period, under the supervision of course faculty. Course faculty will post few course projects titles in Course Web page. Students are encouraged to come up and experiment with the ideas that interest them.

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

CO1: identify various protocols for implementing IoT applications
CO2: analyze the sensors interface process to RPi using python
CO3: examine MQTT protocol to publish message using a broker
CO4: develop the real-time applications of IoT in industry

Course Articulation Matrix (CAM): P20EV301C INTERNET OF THINGS AND APPLICATIONS						
CO		PO1	PO 2	PO3	PSO1	PSO2
CO1	P20EV301C .1	1	1	1	2	2
CO2	P20EV301C .2	1	1	2	2	2
CO3	P20EV301C .3	1	1	2	2	2
CO4	P20EV301C .4	1	1	2	2	2
P20EV301C		**1**	**1**	**1.75**	**2**	**2**

P20EV304 INTERNSHIP EVALUATION

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

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

(i) 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

(ii) 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

(iii) (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): P20EV304 INTERNSHIP EVALUATION						
CO		**PO 1**	**PO 2**	**PO 3**	**PSO 1**	**PSO 2**
CO1	P20EV304.1	2	-	2	2	2
CO2	P20EV304.2	2	-	2	2	2
CO3	P20EV304.3	-	2	-	1	1
CO4	P20EV304.4	-	2	-	1	1
P20EV304		**2**	**2**	**2**	**1.5**	**1.5**

P20OE302A BUSINESS ANALYTICS

Class: M. Tech., III –Semester **Specialization(s):** SCE, DE, EV, PE, SE, DS & 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, EV, PE, SE,DS & 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., NewDelhi., 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 EngineeringHandbook*, 7th ed., New York: Mc Graw Hill International, 2008

[2] Mohammed Ben–Daya.,UdayKumar., Prabhakar Murthy D.N., *Introduction to MaintenanceEngineering*, 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 formaintenance

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	P20OE302B.3	1	1	1	-	-
CO4	P20OE302B.4	1	1	1	-	-
P20OE302B		**1**	**1**	**1**	**-**	**-**

P20OE302C OPERATIONS RESEARCH

Class: M.Tech. III – Semester

Specialization(s): SCE, DE, EV, PE, SE,DS & 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: 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, EV, PE, SE, DS & 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, EV, PE, SE, DS & 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 andapplications

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	P20OE302E.1	1	1	1	-	-
CO2	P20OE302E 2	1	1	1	-	-
CO3	P20OE302E.3	1	1	1	-	-
CO4	P20OE302E.4	1	1	1	-	-
P20OE302E		**1**	**1**	**1**	**-**	**-**

P20OE302F WASTE TO ENERGY

Class: M.Tech. III–Semester **Specialization(s)**: SCE, DE, EV, PE, SE,DS & 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 energyplant 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**	**PSO 1**	**PSO 2**
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, EV, SE,DS & 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 ystems
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	PSO 1	PSO 2
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**	**-**	**-**

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

SCHEME OF INSTRUCTION & EVALUATION OF M.Tech. (EMBEDDED SYSTEMS AND VLSI)
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	P20EV401	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

P20EV401 DISSERTATION PHASE-II

Class: M.Tech. IV - Semester

Specialization(s): ES & VLSI

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 atheir 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): P20EV401 DISSERTATION PHASE-II

CO		PO 1	PO 2	PO 3	PSO 1	PSO 2
CO1	P20EV401.1	2	-	2	2	2
CO2	P20EV401.2	2	-	2	2	2
CO3	P20EV401.3	-	2	-	1	1
CO4	P20EV401.4	-	2	-	1	1
P20EV401		**2**	**2**	**2**	**1.5**	**1.5**

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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)**