DEPARTMENT OF ELECTRONICS

SRI RAMAKRISHNA

COLLEGE OF ARTS AND SCIENCE (Autonomous)
Formerly SNR Sons College

(Affiliated to Bharathiar University)
[Re- Accredited with 'A' Grade by NAAC]
[An ISO 9001:2015 Certified Institution] Coimbatore – 641006.

M.Sc. ELECTRONICS AND COMMUNICATION SYSTEM

SYLLABUS

EFFECTIVE FROM 2019-20

Sri Ramakrishna College of Arts and Science
(Autonomous)

(Formerly S.N.R. Sons College)
(Affiliated to Bharathiar University)
(Re-Accredited with 'A' Grade by NAAC)
(An ISO 9001:2015 Certified Institution)
Nava India, Coimbatore-641 006, Tamil Nadu, India.

"Scheme of Examination along with Distribution of Marks and Credits"

CBCS & OBE PATTERN

M.Sc. Electronics and Communication System Degree Course
(For the students admitted during the academic year 2019–2020 and onwards)

Study Components and Course Title	CIA	Comprehensive Exam		Comprehensive Exam Total	Total	Credit
		Online	Descriptive Theory			
I SEMESTER						
19MEC101: Introduction to Microcontrollers For Embedded Systems	**30**	**20**	**50**	**70**	**100**	**4**
19MEC102: VHDL Programming	**30**	**20**	**50**	**70**	**100**	**4**
19MEC103: Microwave and RADAR Navigation System	**30**	**20**	**50**	**70**	**100**	**4**
19MEC104: Digital Communication and Network Techniques	**30**	**20**	**50**	**70**	**100**	**4**
19MEC105: Practical I: Microcontrollers laboratory	**30**	-	-	**70**	**100**	**4**
19MEC106: Practical II: VHDL Programming	**30**	-	-	**70**	**100**	**4**
19CME01- MACE-I	-	-	-	**100**	**100$**	**2$**

	II SEMESTER					
19MEC201: Arduino Programming	**30**	**20**	**50**	**70**	**100**	**4**
19MEC202: Verilog Programming	**30**	**20**	**50**	**70**	**100**	**4**
19MEC203: Analysis and Processing of Signals	**30**	**20**	**50**	**70**	**100**	**4**
19MEC204: Automotive Embedded Systems	**30**	**20**	**50**	**70**	**100**	**4**
19MEC205: Practical III: Arduino Programming Lab	**30**	-	-	**70**	**100**	**4**
19MEC206 Practical IV: Verilog Programming Lab	**30**	-	-	**70**	**100**	**4**
Elective – I	**30**	**20**	**50**	**70**	**100**	**4**
19CME02- MACE-II				**100**	**100$**	**2$**
	III SEMESTER					
19MEC301: Digital Signal Processor	**30**	**20**	**50**	**70**	**100**	**4**
19MEC302: IoT using TI CC3200	**30**	**20**	**50**	**70**	**100**	**4**
19MEC303: Virtual Instrumentation	**30**	**20**	**50**	**70**	**100**	**4**
19 MEC 304: Practical V Virtual Instrumentation	**30**	-	-	**70**	**100**	**4**
19MEC305: Practical VI: Digital Signal Processor	**30**	-	-	**70**	**100**	**4**
19MEC306: Practical VII: TI CC3200 IoT lab	**30**	-	-	**70**	**100**	**4**
Inter Departmental Course – 19MECI01 Fundamentals of Embedded Systems	-	-	-	**100**	**100$**	**3$**
Elective –II	**30**	**20**	**50**	**70**	**100**	**4**

IV SEMESTER

19MEC401 Project Work and Viva Voce	**160**	-	-	**40**	**200**	**10**
19MEC402 MEMS and NEMS	**100***	-	-	-	**100$**	**4$**

List of Elective papers (Can choose any one of the paper as electives)		
Elective – I	**19MECE01**	Satellite Communication
	19MECE02	Cryptography
	19MECE03	Digital Image Processing
Elective – II	**19MECE04**	ASIC Design
	19MECE05	Mobile Communication Systems and Standards
	19MECE06	Robotics and Automation

Summary						
Subject	**Papers**	**Credits**	**Total Credits**	**Papers**	**Marks**	**Total Marks**
Core (Including Project work & Viva Voce)	19	18 * 4	82	19	100	2000
		1 * 10			200	
Electives	2	4	8	2	100	200
Open Elective	1	3$				100$
Self- Study Paper	1	4$				100$
MACE	2	2$				4$
Total			90			2200

$ - NOT INCLUDED IN TOTAL MARKS & CGPA calculations.

*** -No Comprehensive Examinations. Only Continuous Internal Assessment**

Dr. Poornima K
Chairperson, Board of Studies in Electronics
SRI RAMAKRISHNA
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19MEC101 - INTRODUCTION TO MICROCONTROLLERS FOR EMBEDDED SYSTEMS

Semester	I
Credit	4
Paper Type	Core
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- Teach basic architecture of 16-bit microcontrollers
- Understand hardware interfacing concepts to connect digital as well as analog sensors while ensuring low power considerations.
- Reviews and implement the protocols used by microcontroller to communicate with external sensors and actuators in real world.
- Understanding Embedded Networking concepts based upon connected MCUs.

UNIT-I: INTRODUCTION TO EMBEDDED SYSTEMS **[10 Hrs]**

Embedded system overview, applications, features and architecture considerations - ROM, RAM, timers, data and address bus, I/O interfacing concepts, memory mapped I/O. CISC Vs RISC design philosophy, Von-Neumann Vs Harvard architecture.

MSP430x5x series block diagram, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of 16-bit microcontroller; MSP430 specifics. Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Sample embedded system on MSP430 microcontroller.

UNIT-II: MICROCONTROLLER FUNDAMENTALS FOR BASIC PROGRAMMING **[10 Hrs]**

Memory Mapped Peripherals, programming System registers, I/O pin multiplexing & its relevance, pull up/down registers, GPIO control, Interrupt and Interrupt Programming, Watchdog Timer, System clocks. Need of low power for embedded systems, system clocks and Low power modes,. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power & reliability.

Case Study: MSP430 based embedded system application bringing up the salient features of GPIO, Watchdog timer, low power, FRAM etc.

Advance Topic: Energy and power consumption estimation for embedded board

UNIT-III: TIMERS, PWM AND MIXED SIGNALS PROCESSING **[8 Hrs]**

Timer Basic, Timer & Real Time Clock (RTC), PWM control, Timing generation and measurements, Analog interfacing and data acquisition: ADC and Comparator in MSP430, DMA for data transfer.

Power considerations: Programming for optimal power consumption while using peripherals, Using MSP430 peripheral intelligence in power management.

Case Study: MSP430 based embedded system application using ADC & PWM demonstrating peripheral intelligence. - "Remote Controller of Air Conditioner Using MSP430"

UNIT-IV: COMMUNICATION PROTOCOLS AND INTERFACING WITH EXTERNAL DEVICES [8 Hrs]

Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, I2C,),

Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.

Case Study: MSP430 based embedded system application using the interface protocols for communication with external devices: A

Low-Power Battery less Wireless Temperature and Humidity Sensor with Passive Low Frequency RFID"

UNIT-V: EMBEDDED NETWORKING AND INTERNET OF THINGS **[8 Hrs]**

IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless connectivity: NFC, ZigBee, Bluetooth, Bluetooth Low Energy, Wi-Fi.

Adding Wi-Fi capability to the Microcontroller, Embedded Wi-Fi, User APIs for Wireless and Networking applications.

Building IoT applications using CC32xx user API: connecting sensor devices

Case Study: MSP430 based Embedded Networking Application: "Implementing Wi-Fi Connectivity in a Smart Electric meter

Total Periods : 44

COURSE OUTCOME

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

- Describe architecture and operation of Microcontroller. [L1]
- Review the fundamentals of Microcontroller. [L1]
- Apply low power features during designing a model. [L2]
- Interface protocol for communicating with external devices. [L3]
- Work on embedded networking concepts. [L3]

TEXT BOOKS

1. M. Alagappan, K. Hariharan, Raghav ankur and KG. Srinivasa " Embedded System Design using MSP430", Texas instruments 2017.
2. Steven F Barrett, Daniel J Pack. " Microcontroller Programming and Interfacing Texas Instruments MSP 430" Morgan & Claypool Publishers, 2011
3. John Davies, "MSP Microcontroller Basics", Newnes First Edition.

REFERENCE BOOK:

1. MSP430 Microcontroller Projects – Dr. C. P. Ravikumar

Prepared by

[Mr V. Sathishkumar]

Approved by

[Dr. G. Senthil Kumar]

19MEC102: VHDL PROGRAMMING

Semester	I
Credit	4
Paper Type	Core
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- To enable the students to understand the basic concept of MOS technology and its fabrications and VHDL language.
- Understanding a three style of modeling such as Data flow, Behavioral, Structural in detail with elements and syntax as well as how it works under simulation and synthesis.
- To understand the various elements, operators, programming styles and applications of VHDL programming.

UNIT - I INTRODUCTION TO MOS VLSI TECHNOLOGY [11 Hrs]

Future of Microelectronics-The IC Era-MOS VLSI Technology-Basic MOS transistors-Enhancement mode transistor action-Depletion mode transistor action- nMOS Fabrication-CMOS fabrication- Thermal aspects of Processing- BICMOS Technology- Production of E-beam Masks.

UNIT - II INTRODUCTION TO VHDL [10 Hrs]

Basic terminology – Design flow – VHDL objects – Entity declarations – Architectural body – Process declarations – Architectural body – Configuration – Functions – Procedures – Package declaration – Package body – Library.

UNIT - III BASIC LANGUAGE ELEMENTS [10 Hrs]

Identifiers – Data objects – Data types – Scalar – Integer – Enumerators – Physical – Floating point – Composite – Array – Record – Access types – Incomplete types – File types.

UNIT - IV OPERATORS, GENERICS AND CONFIGURATIONS [11 Hrs]

Operators – Logical – Relational – Shift – Adding – Multiplying – Miscellaneous – Generics – Configurations specifications – Configuration declaration – Default rules – Conversion function – Direct Instantiation.

UNIT - V PROGRAMMING MODEL [13 Hrs]

Behavioral Modeling: Process Statement – Conditional Statement – IF, CASE, LOOP, NEXT and WAIT Statements, Assertion Statement – Exit Statement

Structural Modeling: Component declaration – Component instantiation – Signals – Variables – Delays – Inertial delay – Transport delay

Data Flow Modeling: Concurrent Statement – Concurrent versus Sequential Statement – Conditional Signal Assignment Statement.

Total Periods : 55

COURSE OUTCOME

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

- Describe the concept of MOS technology in VLSI chip fabrication. [L1]
- Create hardware models with declaration procedures. [L2]
- Develop a model with data object and data types. [L2]
- Design a digital circuit using operators. [L3]
- Design a circuit using various modeling styles. [L3]

TEXT BOOK:

1. Kamram Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems ", PHI, First Edition 2011(Unit I)
2. J. Bhasker, "VHDL Primer", PHI, 3th Edition, 2009 (Unit II – V)

REFERENCE BOOKS:

1. Dougles L. Perry, "VHDL", Tata McGraw Hill, III Edition, 2007

Prepared by

[Mr. M. Prasannakumar]

Approved by

[Dr. G. Senthil Kumar]

19MEC103 - MICROWAVE AND RADAR NAVIGATION SYSTEM

Semester	I
Credit	4
Paper Type	Core
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- To learn the concepts of Microwave and waveguide.
- To understand Microwave amplifiers and oscillators.
- To understand the principles of Radar navigation system and its applications.

UNIT - I INTRODUCTION TO MICROWAVE [14 Hrs]

Introduction – Maxwell's Equation – Ampere's Law – Faraday's Law – Gauss's law – Wave Equation – TEM/TE/TM/HE Wave Definitions – Wave Guide – Types of Wave Guides – propagation of Wave in the Rectangular Wave Guide – Propagation of TEM Waves – TE and TM Modes – Propagation of TM Waves in Rectangular Wave Guide

UNIT - II MICROWAVE AMPLIFIERS AND OSCILLATORS [11 Hrs]

Klystron – Two Cavity Klystron Amplifier - Multi Cavity Klystron – Two Cavity Klystron Oscillator-Reflex Klystron – Traveling Wave Tube(TWT) – Applications – Backward Wave Oscillators – Magnetron: Cavity Magnetron – Sustained Oscillation of Magnetron

UNIT - III MICROWAVE ANTENNAS [12 Hrs]

Quantitative Theory of Short Dipole Antenna – Characteristics Grounded Quarter Wave and Ungrounded Half Wave Antenna – Radiation Resistance and Radiation Pattern – Folded Dipole Antenna and its Applications – Arrays: Broad Side Array and End Fire Array – Loop Antenna – Direction Finding by Adhock Antenna – Rhombic Antenna – Horn Antenna – Parabolic Antenna

UNIT - IV PRINCIPLES OF RADAR SYSTEM [09 Hrs]

Radar Block Diagram and Operation - Radar Range Equation – Application of Radar System – Minimum Detectable Signal – Receiver Noise – Signal to Noise Ratio – Transmitter Power – Maximum Ambiguous Range

The Radar Receivers – Mixers – Duplexers – Displays

UNIT - V FM RADAR AND MTI SYSTEMS [09 Hrs]

Introduction to Doppler Effect – CW Radar – FM CW Radar – Multiple Frequency CW Radar – Moving Target Indicator(MTI) – Non Coherent MTI – Limitations of MTI Performance

Tracking with Radar – Sequential Lobbing – Conical Scan – Mono Pulse Tracking Radar – Comparison of Trackers

Total Periods: 55

COURSE OUTCOME

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

- Classify waveguides and its propagation. [L1]
- Compare the performance of TWT and Klystron. [L2]
- Differentiate the types of Microwave Antenna and Arrays. [L2]
- Analyze the Performance of Radar and its types. [L3]
- Compare the types of CW Radar and FM CW radar. [L2]

TEXT BOOKS:

1. M.Kulkarni, "Microwave and Radar Engineering", Umesh Publications, 5th Edition, 2014 (Unit I-II)
2. K.D.Prasad, "Antenna and Propagation", Sathyapragasan Publication, 6th Edition, 2012 (Unit III)
3. Merrill Scholnik, "Radar and Navigation", Tata McGraw Hill Publications, 3th Edition, 1992 (Unit IV- V)

REFERENCE BOOK:

1. Peter A. Rizzi, " Mirowave Engineering Passive circuits", PHI Publication.

Prepared by

[Dr.K.Poornima]

Approved by

[Dr. G. Senthil Kumar]

19MEC104 - DIGITAL COMMUNICATION AND NETWORK TECHNIQUES

Semester	I
Credit	4
Paper Type	Core
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- To understand the basics of Digital Communication in terms of various modulations and the time and frequency domain analysis of the signals.
- To use and understand the categories of networks, layer and their function.
- To Study the various components of LAN network as the operation of network security.

UNIT - I INTRODUCTION TO DIGITAL COMMUNICATION SYSTEMS [14 Hrs]

Communication Links – Data communication system – Synchronous and asynchronous data, binary data signal – Serial Vs parallel communication.

Pulse modulation: Sampling theory – PAM, PWM, PPM modulation and detection – Time division multiplexing – Frequency division multiplexing quantizing of analog signal — PCM principles – Data modulation – ASK – FSK – PSK – DPSK.

UNIT - II STRUCTURE OF NETWORK COMMUNICATION [9 Hrs]

Network Topologies – Fundamental of Communication Theory – Synchronizing Network Components – Communication Protocols –Categories of Networks- Internet Works- Transmission Mode.

UNIT - III LAYER AND THEIR FUNCTIONS [14 Hrs]

OSI Reference Model – Physical Layer – Data Layer – Network Layer – Transport Session and application layer

MODEM: Modulation Techniques – Multilevel Transmission – Advance in Modem

SWITCHING: Circuit Switching – Message Switching – Compressing.

UNIT - IV LAN NETWORK [9 Hrs]

LAN Definition – Major Components of LAN – Protocols – IEEE Standards – CSMA/CD –Token Ring –Token Bus – FDDI – Logical Link Control- Bridge-Router-Repeater-Gateway- HUB.

UNIT - V SONET/NETWORK SECURITY [9 Hrs]

Synchronous Transport signals- Physical Configuration- SONET Layers- SONET Frame-Multiplexing sts frame, VLAN, VPN- Four Aspect of Security:- Privacy- Digital Signature- PGP-Access Authorization.

Total Periods : 55

COURSE OUTCOME

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

- Analyze the performance of a digital communication system in terms of various modulations.[L2]
- List and describe the categories of Networks. [L1]
- Differentiate the OSI layers and their function. [L2]
- Identify the components of LAN implementation. [L2]
- Identify the major issues and technologies in network security. [L2]

TEXT BOOKS:

1. Behrouz A. Forouzan, " Data Communication and Networking", Tata McGraw Hill, 4th Edition,2011(Unit I – V)
2. Ulysses Black, "Data Communication and Distributed Network", PHI, 6th Edition, 2008 (Unit – V)

REFERENCE BOOK:

1. Prokis J G, "Digital Communication" TMH, 5th Edition, 2007
2. A S. Tanenbaum, "Computer Networks" PHI, 5th Edition, 2011

Prepared by

[Mr. J. Charles Babu]

Approved by

[Dr. G. Senthil Kumar]

19MEC105 - PRACTICAL I: MICROCONTROLLERS LABORATORY

Semester	I
Credit	4
Paper Type	Core
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- To train students to work on 16 – bit microcontroller and low power mode operations.
- To develop high level programming skills.
- To interface communication protocol.
- To access I/O devices with MSD430.

ANY TEN EXPERIMENTS:

1. Interfacing and programming GPIO ports in C using MSP430 (blinking LEDs , push buttons)
    - Blinking LEDs , push buttons
    - Interfacing 7 Segment Display
    - Interfacing LCD
2. Usage of Low Power Modes:
    - Use MSPEXP430 as hardware platform and demonstrate the low power modes and measure the active mode and standby mode current.
3. Interrupt programming examples through GPIOs
4. PWM generation using Timer on MSP430 GPIO
5. Interfacing potentiometer with MSP430
6. PWM based Speed Control of Motor controlled by potentiometer connected to MSP430 GPIO
7. Using ULP advisor in Code Composer Studio on MSP430
8. Connect the MSP430 to terminal on PC and echo back the data
9. Master Slave Communication between 2 MSP430s using SPI
10. A basic Wi-Fi application – Communication between two MSP430 based sensor nodes
11. Enable Energy Trace and Energy Trace ++ modes in CCS for any of the above [exp. 4-7]
12. Compute Total Energy, and Estimated life time of a battery

COURSE OUTCOME

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

- To program the 16 bit microcontroller. [L2]
- Establish communication between MSP430 and external devices by using protocol. [L3]
- To interface I/O devices with MSP430 hardware. [L2]
- Select and apply low power active and standard nodes. [L3]

Prepared by

[Mr V Sathishkumar]

Approved by

[Dr. G. Senthil Kumar]

19MEC106 - PRACTICAL – II: VHDL PROGRAMMING

Semester	I
Credit	4
Paper Type	Core
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- To enable the students to understand the various programming styles of VHDL design.
- To understand about RTL code Interface techniques in a FPGA chip design.
- To understand the software and hardware needs of VHDL.

ANY TENEXPERIMENTS:

1. Verification of logic gates with test bench
2. Generation of signals with test bench
3. Four bit full adder and Subtractor in single module with test bench
4. Encoder and decoder with test bench
5. Multiplexer and Demultiplexer with test bench
6. Flip flop and latches with test bench
7. Memory Module both synchronous and asynchronous – RAM, ROM
8. Design a Finite state Machine and check the result with help of test bench
9. Design a Clock divider and generation in VLSI Development Kit
10. Interfacing of Seven Segment in VLSI Development Kit
11. Interfacing of key board in VLSI Development Kit
12. Interfacing of VGA in VLSI Development Kit
13. Interfacing of Audio Codec in VLSI Development Kit
14. Interfacing of UART in VLSI Development Kit
15. Digital circuit design using Xilinx ISE

COURSE OUTCOME:

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

- Design digital circuits using VHDL programming Language. [L2]
- Interface and code various devices with the development kit. [L2]
- Develop test codes for digital circuits to test their performance. [L3]

Prepared by

[Mr. M. Prasannakumar]

Approved by

[Dr. G. Senthil Kumar]

MASTERS' ABILITY AND CAREER ENHANCEMENT (MACE – I)
Subject Code: 19CME01
Common to all the PG streams admitted from AY 2018-19

Semester	I
Credit	2
Paper type	Skill based
Max. Marks	Total=100 (Online:50+Verbal Oral: 50)

Instruction Hours per Semester: 40

Aim:

To educate and enrich the students on setting goals, career planning, communication skills and professional grooming. Equip them on the techniques of listening, non-verbal communication, etiquette, written and presentation skills etc.

Course Objectives

To enable students to,

- Set goals.
- Assess individual communication skills, aptitude and employability skills
- Revise the fundamentals of English grammar
- Enhance their English language.
- Equip with techniques of listening and non-verbal communication
- Enhance techniques such as listening, non-verbal communication, verbal oral & written skills etc.

Unit I

Assessment of individual levels of communication skills, aptitude and employability skills; Psychometric test, SWOT analysis; Planning on setting goals. Introduction to Career planning; Goal setting – Introduction to Soft Skills - Presentation skills - Intra-personal skills

Unit II

Enhancement of Basic English vocabulary; Nouns, Verbs, Tenses, Phrases, Synonyms, Antonyms, and Homonyms Descriptive words - Combining sentences

Unit III

English language enhancement- Business Idioms- Indianisms in English- Common Errors in Pronunciation - Signposts in English- Verbal ability-Articles-Parts of speech-Phrases, clauses and modifiers - errors in tenses – prepositional errors – parallelism errors – mood, conditionals and multiple usages.

Unit IV

English listening- hearing Vs. listening - Nonverbal communication – Appearance, dressing and grooming - Tips to maintain good impression at work - business etiquette – basic postures and gestures and table manners, Body language - dealing with people communication - media etiquette - telephone etiquette, email etiquette.

Unit V

Basics of Writing Skills – Sentence Construction – Email Writing. Presentation Skills (Writing) – Effective organization of content – Importance of Presentation in both Writing and Speaking. Communication Process and Barriers – Elimination of stage fear – Impromptu speaking

Course Outcomes

On the successful completion of the course, the student would be able to-

- Set goals
- Learn fundamentals of English grammar, common errors of pronunciation and parts of speech.
- Understand individual communication skills, aptitude and skills required for employment
- Enhance their English language.
- Listen better, improve their body language, and adopt good manners and etiquettes.
- Write better and communicate effectively.

References:

1) A Modern Approach to Verbal and Nonverbal Reasoning by Dr. R. S. Aggarwal
2) A Modern A Modern Approach to Verbal by Dr. R. S. Aggarwal
3) A Modern Approach to Nonverbal Reasoning by Dr. R. S. Aggarwal
4) A Practical Course in Spoken English by J.K.Gangal
5) Effective English Communication for you by V.Shamala
6) Developing Communication Skills by Krishna Mohan & Meera Banerji
7) English for Competitive Exams by Bhatnagar

Verified By

Course Coordinator

19MEC201 – Arduino Programming

Semester	II
Credit	4
Paper type	Core
Max. Marks	CIA -30 CE -70 TOT =100

COURSE OBJECTIVES

- To impart knowledge on Hardware Architecture.
- To develop programs for AVR Microcontrollers using Arduino IDE.
- To gain knowledge on design development process for specific applications.
- To introduce the basic concepts of various Communication.
- To interface various sensor and motors with Arduino.

Unit I: AVR ATmega328p RISC Microcontroller Architecture 11

AVR family Architecture- The register file- ALU – Memory Access and instruction execution – EEPROM – Ports – SRAM – Timer – UART – Power down modes.

Unit II : Introduction And Programming To Arduino 13

Introduction-Getting started with Arduino IDE- C Language Basics- Functions-Arrays and Strings-Input and Output-Digital and Analog- Variables, Looping statements, Logical Operators, Mathematical operators, Programming with Arduino IDE, Compiling and Debugging using IDE.

Unit III: Library And I/O Functions 10

Standard Arduino Library- Advanced I/O- Interrupts- Data storage – LCD Displays

Unit IV: Arduino Communication 11

Network Communication(Wi-Fi) -Arduino Ethernet Programming - Serial Communication: UART Programming – I2C (Inter Integrated Circuit)-SPI(Serial Peripheral Interface).

UNIT – V: Applications – Interfacing with Sensors and Motors 10

Humidity Sensor-Temperature Sensor-Water Detector Sensor-PIR Sensor – Ultrasonic Sensor – DC Motor – Stepper Motor-Servo Motor.

Total Periods: 55

COURSE OUTCOME

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

- Describe the architecture of the AVR Microcontroller.
- Develop program using Arduino IDE.
- Configure Library and develop applications using Arduino.
- Implement Arduino Communication Techniques for real time communication.
- Interface various sensors and motors for real time applications.

TEXT BOOKS:

1. Dhananjay Gadre, Programming and Customizing the AVR Microcontroller, Tata McGraw Hill, 2012. (Unit - I)
2. Massimo Banzi, "Getting Started with Arduino: The Open Source", Shroff Publishers & Distributors Pvt., Ltd., 2014. (Unit II -III)
3. Simon Monk, "Programming Arduino: Getting Started with Sketches", McGraw-Hill Education, Second Edition,2016. (Unit II -III)
4. www.tutorialspoint.com/arduino (Unit IV-V)

REFERENCE BOOKS:

1. Muhammad Ali Mazidi, Darmad Naimi and Sepehr Naimi, "The AVR Microcontroller and Embedded Systems using Assembly and C", Pearson First Edition, 2015.
1. www.arduino.cc

Prepared by

for [Mr. Sathishkumar V]

Approved by

[Dr. Senthil Kumar G]

19MEC202 - Verilog Programming

Semester	II
Credit	4
Paper type	Core
Max. Marks	CIA -30 CE -70 TOT =100

COURSE OBJECTIVES

- To emphasis on writing synthesizable code and simulation codes.
- To make the student to write a Verilog HDL codes using Structural, Dataflow and behavioral coding styles.
- To impart the knowledge on user defined primitives and on their applications.
- To understand the verification concept in Verilog HDL.

UNIT - I Digital Design With Verilog HDL 11

Evolution of CAD - Emergence of HDLs, Typical HDL based design flow, Trends in HDLs - Hierarchical Modeling Concepts - Design methodology - modules and instances - components of a simulation - design block - stimulus block. Basic Concepts of Lexical conventions - data types - system tasks, compiler directives.

UNIT - II Gate Level Modeling & Data Flow Modeling 11

Modules and Ports- Module definition - port declaration and connecting ports - hierarchical name.
Gate Level Modeling: Gate Types – Gate Delays with Examples.
Dataflow Modeling: Continuous Assignments – Delays – Expressions, Operators and Operands – Operator Types.

UNIT - III Behavioral Modeling 11

Behavioral Modeling: Structured procedures - procedural assignments - Timing Controls - Conditional statements - Multiway branching – Loops - sequential and parallel blocks – Tasks and Functions - Differences between tasks and functions.

UNIT - IV Advanced Verilog Topics Timing And Delays 11

Types of delay models – path delay modeling – Timing Checks – Delay back annotation – Switch level modeling Elements – MOS switches and CMOS switches – Bidirectional switches - UDP basics – Combinational UDP Definition – Sequential UDP – Guidelines for UDP Design.

UNIT - V Advanced Verification Techniques 11

Verification of the gate level net list –Verilog coding style - Design partitioning – Horizontal partitioning – Vertical partitioning – Parallelizing design structure - Advanced verification techniques: Traditional verification flow – Architectural Modeling – Functional Verification Environment - Assertion checking -Formal verification.

Total Periods: 55

COURSE OUTCOME

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

- Apply the design flow concept of in creating the hardware models.
- Apply different modeling concepts in design a digital hardware models.
- Create behavioral style of modeling codes by using conditional, looping and timing functions.
- Model and synthesize the codes using delay concept for a real time applications.
- Solve architectural problems by proper partitioning and verifying it using formal verfication.

TEXT BOOKS:

1. Samir Palnitkar "Verilog HDL" Second Edition IEEE 1364-2012 Compliant (Unit I - V)

REFERENCE BOOKS:

1. J.Bhasker, "Verilog HDL Synthesis, A Practical Primer", BS Publication, 3rd Edition, 2009
2. Micheal D. Ciletti, "Advanced Digital Design with the Verilog HDL", PHI publications, Indian reprint, 2011

Prepared by

[Mr. Prasannakumar M]

Approved by

[Dr. G. Senthil Kumar]

19MEC203 - Analysis and Processing of Signals

Semester	II
Credit	4
Paper Type	Core
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES:

- To study the concepts and properties associated with the signals and systems.
- To familiarize with the techniques suitable for analyzing and synthesizing both continuous and discrete time systems.

UNIT - I Signals and Systems 10

Signals: classification of signals: Continuous time signals- discrete time signals- singularity function

Systems: Classification of systems: Continuous time systems- Discrete time systems- Representation of systems.

UNIT - II Convolution and Correlation 11

Discrete convolution- Properties of Convolution-Linear convolution- Circular convolution- Graphical method- Linear convolution Vs Circular Convolution.

Correlation: Cross correlation – Auto Correlation.

UNIT - III DFT 10

DFT – Properties of the DFT– Notation and formula of the real DFT – DFT basic functions – Synthesis and analysis of DFT –Synthesis and calculating the inverse DFT- Applications of the DFT.

UNIT - IV FFT & Filters 12

FFT- Radix 2FFT-Working Principle of FFT – Speed and precision comparison - FIR Filter: Introduction-Design techniques: Fourier series method- Frequency sampling method IIR Filter: Introduction-Design techniques- Impulse invariant method – Bilinear transformation method.

UNIT - V Applications 12

Audio processing – Human hearing – Timbre – Sound quality Vs Data rate – High fidelity audio – Compounding – Speech synthesis and Recognition – Image formulation and Display: Digital image structure – Cameras and End Eyes – Television video signals – Other image acquisition and display – Brightness and contrast adjustments – Warping.

Total Periods: 55

COURSE OUTCOME:

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

- Compare various types of signals and systems.
- Compute and interpret convolution and correlation systems for random process.
- Use Fourier transform to analyze continuous time signals and systems.
- Use discrete time Fourier transform to analyze discrete time signals and systems. Structure for realization of IIR and FIR filters.
- Demonstrate the production of speech, voice recognition and Image capturing.

TEXT BOOKS:

1.S. Salivahanan, A. Vallavaraj, C. Gnanapriya "Digital Signal Processing", TMH, 2th Edition, 2010 (Unit I– IV)

2. Steven. W. Smith, "The Scientist and Engineers guide to DSP", California Technical Publishing California, 1999 (Unit V)

REFERENCE BOOK:

1. John. G. Proakis and Dimities G. Manolaks, "Digital Signal Processing", PHI Publications, 2003

Prepared by

[Ms. Indira S]

Approved by

[Dr. Senthil Kumar G]

19MEC204- Automotive Embedded Systems

Semester	II
Credit	4
Paper type	Core
Max. Marks	CIA -30 CE -70 TOT =100

COURSE OBJECTIVES

- To enable the students to understand the various architecture and technologies used in automotive vehicles.
- It also helps them to learn the embedded communications used in Automotive.

UNIT-I: Automotive Architecture 11

General Context - Functional domains - Standardized components, Models and Processes – Certification issue of safety critical in Vehicle embedded systems – ESD.

UNIT-II: Intelligent Vehicle Technologies 10

Road transport and its evolution – New technologies LiDAR remote sensing – Dependability Issues – Autonomous Car - Wireless car

UNIT-III: Automotive Protocols 10

Automotive communication Systems - Characteristics and constraints – In Car Embedded Networks – Middleware Layer – Open issues for Automotive Communication Systems.

UNIT-IV: Embedded Communications 15

FLEXRAY

Introduction - Event driven verses Time driven communication-Objectives of flex ray-Flex ray communication-Frame format -Communication cycle-Static segment-Dynamic segment.

FLEXCAN

Main requirements of Automotive Networking - Network technologies - CAN features and limitations-Control system - Flex CAN architecture-Flex CAN address CAN limitations-Flex CAN applications.

UNIT – V Embedded Software 9

Product Lines in Automotive Electronics- Characteristics of Automotive Product Lines – Basic Technology – Global Coordination of Automotive Product line variability – Artifact level variability.

Total Periods: 55

COURSE OUTCOME

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

- Design and develop automotive embedded systems.
- Analyze various embedded products used in automotive industry.
- Evaluate the opportunities involving technology, a product or a service required for developing a startup idea used for automotive applications
- Interface devices and build a complete system.

TEXT BOOK:

1. NICOLAS NAVET, FRANCAISE SIMONOT –LION, "Automotive Embedded Systems Hand Book" , CRC Press 2009 (Unit I – V)

Prepared by

[Dr. Sidharthan V]

Approved by

[Dr. Senthil Kumar G]

19MEC205 - Practical – III: Arduino Programming Lab

Semester	II
Credit	4
Paper type	Core
Max. Marks	CIA -30 CE -70 TOT =100

COURSE OBJECTIVES

- To develop programs for AVR Microcontrollers using Arduino IDE.
- To enhance the skills of interfacing sensor and motors with Arduino.
- To develop the construction and programming skills for Robots.

ANY TEN EXPERIMENTS:

1. Interfacing LED & Seven Segment Display
2. Interfacing matrix keypad
3. Interfacing DC / Stepper / Servo motor
4. Voltmeter reading
5. Pulse rate monitor
6. Interfacing LCD
7. Interfacing IR Obstacle Sensor
8. Interfacing Gas / Fire sensor
9. Interfacing Pressure Sensor
10. Interfacing Temperature sensor
11. Interfacing Humidity Sensor
12. Interfacing Ultrasonic Sensor
13. Assembly of Robot
14. Line follower Robot
15. Object lifting Robot

Total Periods: 50

COURSE OUTCOME

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

- Interface AVR Microcontrollers with sensors and communication devices.
- Assemble and control the movement of Robot.
- Interface various sensors with Arduino development kit
- Develop applications for the real time projects.

Prepared by

for

[Mr. Sathishkumar V]

Approved by

[Dr. Senthil Kumar G]

19MEC206 - Practical – IV: Verilog Programming Lab

Semester	II
Credit	4
Paper type	Core
Max. Marks	CIA -30 CE -70 TOT =100

COURSE OBJECTIVES

- To enable the students to understand the various programming styles of Verilog design.
- To understand about RTL code in various hardware components interface in a FPGA chip.
- To understand the software and hardware needs of Verilog.

ANY TEN EXPERIMENTS:

1. Verification of logic gates with test bench.
2. Four bit full adder and Subtractor in single module wit test bench.
3. Encoder and decoder with test bench.
4. Multiplexer and Demultiplexer with test bench.
5. Memory Module RAM and ROM.
6. Design a Finite State Machine and check the result with help of test bench.
7. Design a Clock divider and generation in VLSI Development Kit.
8. Design a Counter and display it in the Seven Segment of VLSI Development Kit.
9. Interfacing of key board in VLSI Development Kit.
10. Interfacing of VGA in VLSI Development Kit.
11. Interfacing of Audio Codec in VLSI Development Kit.
12. Design an UART module.
13. Interfacing of Liquid Crystal Display.
14. Interfacing of GLCD.
15. Interfacing of Camera Module.

Total Periods: 50

COURSE OUTCOME:

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

- Write codes in Verilog HDL for synthesis and simulation of digital circuits.
- Design a module for a real time applications.
- Write Verilog test benches codes for testing the circuit.
- Interface modules with FPGA by writing appropriate codes.

Prepared by

[Mr. Prasannakumar M]

Approved by

[Dr. Senthil Kumar G]

19MECE01 - Satellite Communication

Semester	II
Credit	4
Paper Type	Elective
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- To introduce the basic overview of satellite systems.
- To learn the orbit and launching methods.
- To study the Global Orbiting Navigation Satellite system.
- To understand the design of GPS Receivers and Basic concepts of DGPS.

UNIT - I Overview of Satellite Systems 11

Introduction - Frequency Allocations for Satellite Service-INTELSAT - U.S. Domsats-Polar Orbiting Satellites-Argos System- Cospas-Sarsat - Orbits and Launching Methods: Kepler's First Law-Kepler's Second Law - Kepler's Third Law-Definitions of Terms for Earth-Orbiting Satellites-Orbital Elements-Apogee and Perigee Heights- Orbit Perturbations-Inclined Orbits-Local Mean Solar Time and Sun-Synchronous Orbits-Standard Time.

UNIT - II GPS Satellite Constellation and Signal Structure 10

GPS System Segments – GPS Signals – GPS Signal Generation - GPS Signal Characteristics – Signal Power Levels – GPS Errors and Ionospheric Effects on GPS Signals: GPS Error Sources – Error Correction Models – Receiver Noise – Ionospheric Effects on GPS Signals.

UNIT - III Global Orbiting Navigation Satellite Systems 12

GLONASS Components – GLONASS Constellation Details – GLONASS Signal Structure – Time and Coordinate Systems – Current Status of GLONASS – Satellite Based Augmentation Systems (SBASs): The need for GPS Augmentation – Wide Area Augmentation System (WAAS) – European Geostationary Navigation Overlay Service (EGNOS) – GPS Aided GEO Augmented Navigation (GAGAN)-MTSAT Satellite-based Augmentation System (MSAS) – COMPASS/Beidou-Status of Various SBASs – Regional Satellite-Based Navigation Systems – Current International Signal Plans.

UNIT - IV Differential GPS 11

Basic Concept of DGPS – Local Area DGPS – Extension of Range of Accurate DGPS – Real-Time and Post-Processing DGPS –Data Link – RTCM Format – GPS Receivers: Signal and its Components –Signal Conditioning – Signal Acquisition – Carrier and Code Tracking – Converting Tracking Outputs to Navigation Data – Sub frame Matching and Parity Check – GNSS Antennas – Weak Signals and their Acquisition.

UNIT - V Satellite Communication 11

History of Communication Satellites – Basic Satellite Communication System – Satellite Orbits – Types of Satellites – Satellite Communication Systems – System Design Specific Performance – Geo informatics Using Photogrammetry, Remote Sensing and GPS: Geo informatics – Measurement Tools –Aerial Photogrammetry - Satellite Remote Sensing – Global Positioning System (GPS).

Total Periods: 55

COURSE OUTCOME

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

- Foster ability to work using Instrument Landing System.
- Acquired knowledge about Satellite Navigation System.
- Characterize the GPS Signal generation

TEXT BOOK

1. Dennis Roddy, "Satellite Communications", Tata McGraw-Hill Publishing Company Limited, 4th Edition, New Delhi, 2008. (Unit I-III)
2. G.S Rao, "Global Satellite Navigation Systems", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2010. (Unit IV, V)

REFERENCE BOOK

1. Tri T Ha,"Digital Satellite Communication", Tata McGraw-Hill Publishing Company Limited, Fourth Edition, New Delhi, 2008.

Prepared by

[Dr. Senthil Kumar G]

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[Dr. Senthil Kumar G]

19MECE02 - Cryptography

Semester	II
Credit	4
Paper Type	Elective
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES:

- To understand the basic concept of cryptography and network security their function.
- To be familiar with cryptographic techniques for secure communication of two parties over an insecure channel.
- To illustrate how network security and management mechanisms employ cryptography to prevent, detect, and mitigate security threats against the network

UNIT - I Introduction **10**

Computer security concepts – The OSI Security Architecture – Security attacks- Security Services – Security Mechanisms – A Model for Network security.

UNIT - II Cryptography **13**

Symmetric Encryption Principles – Symmetric Block Encryption Algorithms – Random and Pseudorandom Numbers – Stream Ciphers and RC4 – Cipher Block modes of operation.

Approaches to message authentication – Secure Hash Functions – Message authentication codes – Public key cryptography Principles - Public key cryptography Algorithms - Digital Signature.

UNIT - III Network Security **11**

Symmetric key Distribution using symmetric encryption – Kerberos – key distribution using asymmetric encryption – x.509 certificates – Public key infrastructure – Federated identity management.

UNIT - IV Wireless Network Security **11**

IEEE 802.11 wireless LAN overview – IEEE 802.11 I wireless LAN Security – Wireless Application Protocol overview – wireless transport layer security - WAP End to End Security.

UNIT – V IP Security **10**

IP Security – IP Security policy – Encapsulating security associations – Internet key exchange – Cryptographic suites.

Total Periods: 55

COURSE OUTCOME

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

- Account for the cryptographic theories, principles and techniques that are used to establish security properties.
- Analyze and use methods for cryptography.
- Reflect about limits and applicability of methods for network security. Acquired the concept cryptanalysis in a wireless techniques.
- Analyze the principle of Cipher technology in IP security.

TEXT BOOK:

1. Willaim Stallings, "Network Security Essentials", PHI, 4th Edition,2011 (Unit I – V)

REFERENCE BOOK:

1. Douglas Stinson, "Cryptography Theory and Practice", 2nd Edition, Chapman & Hall/CRC.
2. B. A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hil

Prepared by **Approved by**

[Mr. Ashok Kumar K] [Dr. Senthil Kumar G]

19MECE03 - Digital Image Processing

Semester	II
Credit	4
Paper Type	Elective
Max. Marks	CIA:30 CE:70

COURSE OBJECTIVES

- To impart the knowledge of image fundamentals and mathematical transforms necessary for image processing.
- To understand the image enhancement techniques.
- To study image restoration and compression procedures.
- To study the image segmentation and representation techniques.

UNIT - I Digital Image Fundamentals 11

Elements of digital image processing systems - Elements of visual perception - Psycho visual model - Brightness - Contrast - Hue - Saturation - Mach band effect - Color image fundamentals - RGB - HSI models - Image sampling - Quantization - Dither - Two - dimensional mathematical preliminaries.

UNIT - II Image Transforms 10

1D DFT- 2D transforms - DFT- DCT- Discrete Sine, Walsh- Hadamard - Slant- Haar Wavelet Transform.

UNIT - III Image Enhancement and Restoration 12

Spatial domain enhancement: gray level transformations - histogram modification and specification techniques - Image averaging - Directional Smoothing - Median - Geometric mean - Harmonic mean - Contra harmonic and Yp mean filters - Homomorphic filtering - Color image enhancement. Image Restoration - Degradation model - Unconstrained and Constrained restoration - Inverse filtering: Removal of blur caused by uniform linear motion - Wiener filtering - Geometric transformations: spatial transformations - Gray - Level interpolation.

UNIT - IV Image Segmentation and Representation 10

Point- Line and edge detection - Edge linking - Region based segmentation: Region splitting and merging. Image representation: chain codes - Polygonal approximations - Signatures - Boundary segments – Skeletons.

UNIT - V Image Compression 12

Need for data compression - Error free compression: variable length coding, bit plane coding, LZW coding. Lossy compression: Transform coding, wavelet coding compression standards: binary image compression standard, still image compression standards, video compression standards.

Total Periods: 55

COURSE OUTCOME

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

- Demonstrate the fundamentals of digital image processing and image transforms. Perform Gray level transformations for Image enhancement.
- Apply histogram equalization for image enhancement.
- Use and implement order-statistics image enhancement methods.

TEXT BOOKS

1. Rafael C Gonzalez and Richard E Woods, "Digital Image Processing", Pearson Education Inc, 2 Edition, 2004.

2. Anil K Jain, "Fundamentals of Digital Image Processing", Pearson/Prentice Hall of India, 7th Edition, 2002.

REFERENCE BOOKS

1. David Salomon, "Data Compression", The Complete Reference Springer Verlag New York Inc, 2 nd Edition, 2001.

Prepared by

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MASTERS' ABILITY AND CAREER ENHANCEMENT (MACE – II)
Subject Code: 19CME02
Common to all the PG streams admitted from AY 2019-20

Semester	I
Credit	2
Paper type	Skill based
Max. Marks	Total=100 (Online:50+Verbal Oral: 50)

Instruction Hours per Semester: 40

Aim:

To educate and enrich the students on quantitative ability, arithmetic reasoning, and verbal ability. Enhance the students on group behavior and team building skills.

Course Objectives

To enable students to,

- Improve their quantitative ability.
- Ability of arithmetic reasoning
- Enhance their verbal ability through vocabulary building and grammar
- Enhance their group behavior and team building skills.
- Build resumes, speak in public, debate and discuss in groups

Unit I

(Quantitative Ability)

Speed Maths – Simple Conversion – Square roots and Cube roots – Vedic Maths – Short cuts – Special Concepts. Number Properties – Divisibility rules – Unit digit – HCF and LCM – Simplification. Percentage –Fundamentals – Increase and decrease concepts – Basics of Averages. Profit and Loss – Finding CP, MP, SP. Discount – Flat & Successive

Unit II

(Arithmetic Reasoning)

Data Arrangements – Linear and Circular arrangement – Alpha & Numeric series – Analogy. Blood Relation – Family Tree – Statement based. Coding & Decoding – Alpha coding and Numeric coding

Unit III

(Verbal Ability)

Vocabulary – Etymology, Root words, Verbal Analogy. Reading Comprehension: Workshop on Reading – Sub-skills of Reading, Techniques of Reading, Jumbled Paragraphs. Application of Grammar concepts – Parts of Speech, Tenses

Unit IV

Group discussion, interviews and presentation skills - Group behaviour – Team Work – Team building – Open and Closed group discussions.

Unit V

Exercises on Resume writing - Public speaking, Group discussion, debate, extempore, quiz and contemporary group play and role play.

Course Outcomes

On the successful completion of the course, the student would be able to-

- Enhance their ability to deal with quantities
- Understand and improve arithmetic reasoning.
- Build better vocabulary and grammar
- Improve the group behavior and team building.
- Prepare resumes, speak in public, debate and discuss in groups

References

1. Quantitative Aptitude for Competitive Exams by R. S. Agarwal
2. Quantum CAT by Sarvesh Verma
3. A Modern Approach to Logical Reasoning by R. S. Agarwal
4. Verbal Ability and Reading Comprehension by Arun sharma
5. Word Power Made Easy by Norman Lewis
6. High School English Grammar by Wren and Martin
7. English Conversation Practice by Grant Taylor
8. Group Discussion and Interviews by Anand Ganguly
9. Art of Social Media by Guy Kawasaki

Verified By

Course Coordinator

19MEC301 - Digital Signal Processor

Semester	**III**
Credit	**4**
Paper type	**Core**
Max. Marks	**CIA = 30** **CE = 70** **TOT =100**

COURSE OBJECTIVES:

- To introduce the concepts of DSP Processor and its architectures.
- To program DSP Processor for various applications and to fulfill the specific needs of real time embedded applications.

UNIT I: INTRODUCTION To DSP **[14 Hrs]**

Introduction –TMS320DSP family overview-Applications for the TMS320DSPs-TMS320C54X DSP key features- Architecture Overview – Bus Structure- Internal Memory Organization – CPU – Pipeline Operation-Interrupt and the Pipeline – Dual access memory and Pipeline.

UNIT II: PROGRAM AND DATA MEMORY ADDRESSING **[12 Hrs]**

Immediate addressing – Absolute addressing – Accumulator addressing- Direct addressing – Indirect addressing – Memory mapped register addressing – Stack addressing – Data types – Program memory addressing.

UNIT III: ON CHIP PERIPHERALS **[12 Hrs]**

Available on Chip peripherals – Peripheral memory mapped registers – General purpose I/O - Timer – Clock generator – HPI.

UNIT IV: SERIAL PORTS **[12 Hrs]**

Introduction – SPI – BSP – TDM.

UNIT V: EXTERNAL BUS OPERATION **[10 Hrs]**

External Bus Interface – External Bus Priority- External bus control- External Bus Interface timing- Start up access sequence – Hold mode.

Total Hours: 60

COURSE OUTCOME

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

- Describe DSP computational building blocks and knows how to achieve speed in DSP architecture or processor.
- Classify the addressing modes of DSP TMS320C54XX and program DSP processor.
- Design application using peripheral interfaces.
- Implement the serial and parallel communication.
- Prioritize and control the operation of External bus interface.

TEXT BOOK:

1. TMS 320C54X DSP reference set volume I: CPU and Peripherals from Texas Instruments(Unit I– V).

REFERENCE BOOK:

1. B. Venkataramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications" by Tata McGraw Hill Education Pvt. Ltd., Second Edition 2011.

Prepared by

[Ms Indira S]

Approved by

[Dr Poornima K]

19MEC302: IoT using TI CC3200

Course Objective

1. To provide a good understanding of Internet of Things (IoT) and it's envisioned deployment domains.
2. To provide an understanding of smart sensors/actuators with their internet connectivity for experimentation and designing systems.
3. To provide a overview about the various protocol standards deployed in the Internet of Things (IoT) domain and to make informed choices.
4. To impart knowledge in the design and development of IoT systems with enablement ensuring security and assimilated privacy

Semester	**III**
Credit	**4**
Paper type	**Core**
Max. Marks	**CIA = 30** **CE = 70** **TOT =100**

UNIT I - Introduction to IoT **[12 Hrs]**

Introduction to IoT and Cyber-Physical Systems- IoT Enabling Technologies; Different Levels of IoT Systems- IoT Design Methodology- Introduction to IoT Platforms and End Devices- Introduction to IoT Network and Cloud Services- IoT Applications – Design Challenges- Basic Architecture and Components

UNIT II - Wireless Communication & Network protocols **[12 Hrs]**

Wireless Communication & Network protocols – 802.11, BLE, NFC, LORA, Zigbee- Wireless Sensor and Ad hoc networks- Cross-Layer protocol optimization- Industrial and Automotive Networks, VANETS, Security issues and QoS in IoT Systems

UNIT III - System Design of Connected Devices **[12 Hrs]**

Embedded Devices- Embedded Hardware- Connected Sensors and Actuators- Controllers- Battery Life Conservation and designing with Energy Efficient Devices- SoCs- CC32XX- Architecture- CC32XX Launchpad for Rapid Internet Connectivity with Cloud Service Providers

UNIT IV - IoT Software Architecture **[12 Hrs]**

Operating Systems for IoT Applications- Building Android Applications- Building IoT Applications using CC32XX - Building Server Side Components for IoT Applications- Embedded Linux

UNIT V - Management of data in the context of the Internet of Things **[12 Hrs]**

Data sources in IoT and Data Types in IoT- Data-centric IoT products- Flow of Data- Challenges in managing IoT Data- Data Models and Data acquisition in Sensor Networks- Query Processing and Query Optimization in sensor networks- Sensor Data Cleaning and Storage- Mining Data Streams – Clustering- Classification- Frequent Pattern Mining- Change Detection- Dimensionality Reduction- Forecasting.

Total Hours:60

COURSE OUTCOME

On successful completion of the course, the student will be able to

- Explain the concepts of Internet of Things
- Analyze basic protocols in wireless sensor network
- Identify sensor technologies for sensing real world entities
- Classify IoT hardware and software
- Develop basic IoT applications on embedded platform

Text Books:

1. Joe Biron & Jonathan Follett, Foundational Elements of an IoT Solution – The Edge, The Cloud and Application Development, Oreilly,1st Edition, 2016.
2. Designing Connected Products, Elizabeth Goodman, Alfred Lui,Martin Charlier, Ann Light, Claire Rowland,1st Edition.
3. The Internet of Things (A Look at Real World Use Cases and Concerns), Kindle Edition, Lucas Darnell, 2016

References

1. The Internet of Things – Opportunities and Challenges
http://www.ti.com/ww/en/internet_of_things/pdf/14-09-17-IoTforCap.pdf
2. Single Chip Controller and WiFi SOC
http://www.ti.com/lit/ds/symlink/cc3200.pdf
3. Wireless Connectivity Solutions http://www.ti.com/lit/ml/swrb035/swrb035.pdf
4. Wireless Connectivity for the Internet of Things – One size does not fit all
http://www.ti.com/lit/wp/swry010/swry010.pdf

Prepared by

[Mr Sathishkumar V]

Approved by

[Dr. Poornima K]

19MEC303 - Virtual Instrumentation

Semester	**III**
Credit	**4**
Paper type	**Core**
Max. Marks	**CIA = 30 CE = 70 TOT =100**

COURSE OBJECTIVES

- To Understand Virtual Instruments programming techniques using software tools
- Study the principles of operation and limitations of measuring instruments.
- To understanding Virtual Instrument concepts and Creating Virtual Instruments for practical works.
- Develop real time applications using LabVIEW.

UNIT – I INTRODUCTION **[11 Hrs]**

Introduction - Graphical system design (GSD) model - Design flow with GSD - Virtual instrumentation virtual instrument and traditional instrument - Hardware and software in virtual instrumentation – Virtual instrumentation for test, control and design - Virtual instrumentation in the engineering process -Virtual instruments beyond personal computer - Graphical system design using LabVIEW - Graphical programming and textual programming.

UNIT- II LABVIEW **[11 Hrs]**

Introduction - Advantages Of LabVIEW - Software Environment - Creating and Saving a Vi - Front Panel Toolbar - Block Diagram Toolbar - Palettes Shortcut Menus - Property Dialog Boxes - Front Panel Controls and Indicators - Block Diagram - Data Types - Data Flow Program - LabVIEW Documentation Resources – Keyboard Shortcuts.

UNIT - III PROGRAMMING TECHNIQUES **[11 Hrs]**

Modular programming in lab view: Build a Vi front panel and block diagram - Icon and connector pane - creating an icon - Building a connector pane. Repetition and Loops: For Loops - While Loops Structure Tunnels - Terminals Inside or Outside Loops - Shift Registers.

UNIT - IV ARRAYS AND PLOTTING DATA **[11 Hrs]**

Arrays: Arrays in LabVIEW - Creating One Dimensional Array Controls, Indicators - Constants – Creating Two Dimensional Arrays and Multidimensional Arrays- Initializing Arrays – Deleting and Replacing Elements, Rows, Columns and Pages Within Arrays - Inserting Elements, Rows, Columns and Pages into Arrays. Plotting Data: Types of Waveforms - Waveform Graphs - Displaying a Single Plot on Waveform Graphs Displaying Multiple Plots on Waveform Graphs - Waveform Charts - Displaying a Single Plot On Waveform Charts - Displaying Multiple Plots on Waveform Charts - Waveform Data Type - XY Graphs.

UNIT - V DATA ACQUISITION **[11 Hrs]**

Transducers - Signals - Signal Conditioning - DAQ Hardware Configuration - DAQ Hardware – Analog Inputs- Analog Outputs - Counters - DAQ Assistant - Channels and Task - Configuration - Selecting and Configuring a Data Acquisition Device - Components of Computer Based Measurement System.

Total Hours: 55

COURSE OUTCOMES

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

- Create the knowledge on systems for virtual instruments and use for software programming.
- Use software concept for virtual instruments and create blocks.
- Recognize the components of Virtual instrumentations and use them for programming techniques.
- Use LabVIEW software for instrument control, measurement, data acquisition and data handling.
- Create a test and instrumentation setup for any given application by DAQ systems.

TEXT BOOK

1. Jovitha Jerome,"Virtual Instrumentation using LabVIEW", PHI Learning Pvt. Ltd, New Delhi, 2010.

REFERENCE BOOKS:

1. Steve Mackay, Edwin Wright, John Park and Deon Reynders, "Industrial Data Networks", Elsevier, 2004.

2. Gary Johnson and Richard Jennings, "LabVIEW Graphical Programming", McGraw Hill Inc., 2006.

Prepared by

[Mr Ashokkumar K]

Approved by

[Dr. Poornima K]

19MEC304: Practical V - Virtual Instrumentation

Course Objective:

Semester	**III**
Credit	**4**
Paper type	**Core**
Max. Marks	**CIA = 30 CE = 70 TOT =100**

- To Understand Virtual Instruments programming techniques using software tools.
- Study the principles of operation and limitations of measuring instruments.
- To understanding Virtual Instrument concepts and Creating Virtual Instruments for practical works.
- Develop real time applications using MyDAQ.

Any TEN Experiments:

1. Getting started with MyDAQ
2. Design Graphical code for data types using LabVIEW
3. Design Graphical code for Loops using LabVIEW
4. Design Graphical code for arrays using LabVIEW
5. Design Graphical code for data types using LabVIEW
6. Design Graphical code for charts and graphs using LabVIEW
7. Phase Shift in an RC Circuit using MyDAQ
8. Current Divider using MyDAQ
9. Low and High Pass Filters using MyDAQ
10. Band Pass Filter using MyDAQ
11. Comparator Circuit using MyDAQ
12. Integrator Circuit using MyDAQ
13. R-2R Resistive DAC using MyDAQ
14. Wave Generator using MyDAQ
15. Pulse-Width Modulator using MyDAQ

Total Hours: 50

COURSE OUTCOME

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

- Know about different types of data types and operators available in LABVEIW
- Design Graphical programming language using LABVEIW
- Develop Graphical Programming language for interfacing of hardware device.
- Design real time interfacing techniques with help of MyDAQ

Prepared by

[Mr Ashok Kumar K]

Approved by

[Dr Poornima K]

19MEC305 – Practical – VI: Digital Signal Processor

Semester	**III**
Credit	**4**
Paper type	**Core**
Max. Marks	**CIA -30** **CE -70** **TOT =100**

COURSE OBJECTIVES

- Familiarize the students in introducing and exploring Matlab Software.
- Provide a foundation in use of Matlab software for real time applications.
- Give students an introduction to real time DSP requirements by exposing them to use of TI TMS320C54X DSP kit.
- To enhance the skills of using DSP Kit for signal processing applications.

Any TEN Experiments:

1. Generation of signals using MATLAB
2. Convolution of Discrete signals using MATLAB
3. Correlation of Discrete signals using MATLAB
4. FIR filter Design using MATLAB
5. IIR Filter Design using MATLAB
6. Generation of DFT and AM using MATLAB
7. Tone generation using PCM3002 codec module
8. Generation of ASK using TMS 320C5416 kit
9. Generation of FSK using TMS 320C5416 kit
10. Linear and Circular convolution using TMS 320C5416 kit
11. Generation of signals using TMS 320C5416 kit
12. Cross and Auto correlation using TMS 320C5416 kit
13. Interfacing A/D Converter
14. Object Counter using TMS320C5416 kit
15. Display blink using TMS320C5416 kit

Total Hours: 50

COURSE OUTCOME

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

- Write basic mathematical and electronic problems in Matlab.
- Articulate importance of Software's in research by simulation work.
- Demonstrate the real time applications with DSP.
- Carry out simulations of TMS320C54X DSP using Code composer studio.

Prepared by

[Ms Indira S]

Approved by

[Dr Poornima K]

19MEC306: Practical VII: TI CC3200 IoT lab

Semester	**III**
Credit	**4**
Paper type	**Core**
Max. Marks	**CIA -30 CE -70 TOT =100**

Course Objective

1. To develop and work on webserver
2. To experiment MQTT Protocol.
3. To work on different cloud server
4. To develop send and receive mail.
5. To develop real time application.

LIST OF EXPERIMENTS
Any 10 Experiments

1. UNDERSTANDING HTTP WEB SERVER
2. Creating_Own_WEB SERVER
3. Experiment_MQTT_IBM_CLOUD
4. Experiment_MQTT_Eclipse_cloud_mobile_app
5. Experiment HTTP_Thingspeak cloud server
6. Experiment Freeboard io cloud server
7. Experiment HTTP_PubNub cloud server
8. Experiment AT&T Cloud server
9. Experiment SMS_Alert
10. Experiment Sending Email
11. Experiment Weather Application
12. Experiment Get Time Application

Total Hours: 50

Course Outcome

- To create and work web server.
- To work with MQTT protocol.
- To send and receive data with different cloud server.
- To send and receive mail trough IoT.
- To develop real time application.

Prepared by

[Mr Sathishkumar V]

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[Dr Poornima K]

19MECE04 - ASIC Design

Semester	**III**
Credit	**4**
Paper type	**Elective - II**
Max. Marks	**CIA = 30 CE = 70 TOT =100**

COURSE OBJECTVES

- The course focuses on the semi-custom IC Design and introduces the principles of design logic cells, I/O cells and
- Interconnects architecture, with equal importance given to FPGA and ASIC styles.
- The entire FPGA and ASIC design flow is dealt with from the circuit and layout design point of view.

UNIT I: INTRODUCTION TO ASIC **[10 Hrs]**

ASIC Design – Introduction- ASIC Examples- Advantages – Types- Full custom ASIC, Semicustom ASIC – Standard cell Based ASIC – GATE Array based ASIC -Channels gate array- Structured gate array – Field Programmable Gate array- Programmable logic devices structure –PALs –PLDs – Programming of PALs – ASIC design flow.

UNIT II: PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS **[12 Hrs]**

Anti fuse- Static RAM- EPROM and EEPROM technology, PREP benchmarks - Actel ACT-Shannon's Expansion theorem - ACT2 and ACT3 logic module – Xilinx LCA – Altera FLEX – DC output – AC output - DC input - AC input - Clock input- Power input – Xilinx I/O Block – Other I/O cells.

UNIT III: PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN ENTRY **[10 Hrs]**

Actel ACT – Xilinx LCA – Xilinx EPLD – Altera MAX 5000 and 7000 –Altera MAX 9000 – Altera FLEX

– Design systems – logic Synthesis – half gate ASIC - Schematic entry – Low level design language – PLA Tools

– EDIF – CFI Design representation.

UNIT IV: ASIC CONSTRUCTION & FLOOR PLANNING **[12 Hrs]**

Physical Design- CAD tools - System partitioning – Estimating ASIC size –Power Dissipation – FPGA partitioning – Partitioning methods – Ratio cut algorithms – Look ahead algorithms - Floor planning – Floor planning tools – I/O power Planning – Clock planning.

UNIT V: PLACEMENT AND ROUTING **[11 Hrs]**

Placement –Measurement of placement – Placement algorithms – Simulated annealing – Timing driven Placement methods - physical design flow –Routing - Global routing – Detailed routing – Special routing.

Total Hours: 55

COURSE OUTCOME

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

- Describe the circuit design aspects at the next transistor and block level abstractions of FPGA and ASIC design.
- Identify the programmable ASIC logic cells and I/O Cells to carrying out in FPGA and ASIC designs.
- Design a logic synthesis tool for mapping RTL onto a cell library in the ASIC designs.
- Describe the back-end physical design flow, including floor planning, placement and routing.

TEXT BOOK:

1.M.J.S. Smith," Application Specific integrated circuit" – Addison – Wesley Longman Inc, 3 edition, 2014 (Unit I – V)

REFERENCE BOOKS:

1.Andrew Brown, "VLSI circuits and systems in silicon", Tata Mc Graw Hill Publications, 2010.

2. S.D Brown, R.J.Francis, J.Rox , Z.G.Uransesic, " Field Programmable gate arrays" Khuever academic publisher, 2014

3. S.Y.Kung, H.J.Whilo House, T.Kailath, "VLSI and Modern Signal Processing" PHI Publications,

Prepared by

[Dr Thamarai Selvan M]

Approved by

[Dr Poornima K]

19MECE05 - Mobile Communication Systems and Standards

Semester	**III**
Credit	**4**
Paper type	**Elective - II**
Max. Marks	**CIA = 30** **CE = 70** **TOT =100**

COURSE OBJECTIVES

- To make students familiar with fundamentals of mobile communication systems.
- To choose system (TDMA/FDMA/CDMA) according to the complexity, installation cost, speed of transmission, channel properties etc.
- To identify the limitations of 2G and 2.5G wireless mobile communication and use design of 3G, 4G and 5G beyond mobile communication systems.

UNIT - I INTRODUCTION TO MOBILE COMMUNICATION SYSTEMS [11 Hrs]

Evolution of Mobile radio communications – Mobile radio systems in the U.S. and around the world – Examples of Mobile radio systems.

UNIT - II CELLULAR CONCEPT [11 Hrs]

Cellular concept – Frequency reuse – Channel Assignment strategies – Handoff strategies – Interference and System capacity – Trunking and Grade of service – Improving capacity in cellular systems.

UNIT - III MOBILE RADIO PROPAGATION [11 Hrs]

Small-scale multipath propagation – Impulse response of a multipath channel – Parameters of mobile multipath channel – Types of small-scale fading – Rayleigh and Rician distributions – Statistical models for multipath fading channels.

UNIT - IV GSM, GPRS, 3G STANDARDS [11 Hrs]

GSM services and features – GSM system architecture – GSM radio subsystem – Frame structure for GSM – Signal processing in GSM – GPRS network architecture – GPRS services and features – 3G UMTS network architecture – UMTS services and features.

UNIT -V MULTIPLE ACCESS TECHNIQUES,WIRELESS NETWORKING 4G AND 5G [11 Hrs]

Multiple access techniques – FDMA, TDMA, CDMA– Design issues in personal wireless systems – Cordless systems and Wireless Local Loop (WLL) - WIMAX, HSPA, 4G standard - LTE - LTE Advanced standards - Advantage of LTE – 3GPP standard and its advantage

Total Hours: 55

COURSE OUTCOME

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

- Describe the various generations of mobile communications.
- Apply the concept of cellular communication and wireless communication in mobile applications.
- Demonstrate the GSM mobile communication standard, its architecture, logical channels, advantages and limitations.
- Configure different network architecture.
- Analyze different types of access techniques.

TEXT BOOK:

1.Rappaport, T.S., "Wireless Communications, Principles and Practice", 3rdEdition, Prentice Hall, NJ, 2014.

REFERENCES BOOKS:

1.William Stallings, "Wireless Communications and Networks", 2ndEdition, Pearson Education, 2009.
2.Siegmund M. Redl, Mathias K. Weber, Malcolm W. Oliphant, "An Introduction to GSM", Artech House Publishers,1998

Prepared by

[Mr Prasannakumar M]

Approved by

[Dr Poornima K]

19MECE06 - Robotics and Automation

Semester	**III**
Credit	**4**
Paper type	**Elective - II**
Max. Marks	**CIA = 30 CE = 70 TOT =100**

COURSE OBJECTIVES

- To be familiar with the automation and brief history of robot and its applications.
- To give knowledge about kinematics of robots.
- To give knowledge about robot end effectors and their design.
- To learn about Robot Programming methods & Languages of robot.
- To give knowledge about various Sensors and their applications in robots.

UNIT – I: ROBOT ORGANIZATION **[10 Hrs]**

Coordinate transformation - Kinematics and inverse Kinematics, Trajectory planning and remote manipulation.

UNIT – II: ROBOT HARDWARE **[13 Hrs]**

Robot sensors – Proximity sensors – Range sensors – Visual sensors – Auditory sensors – Robot manipulators - Manipulator dynamics – Manipulator control – Wrists – End efforts – Robot grippers.

UNIT – III: ROBOT AND ARTIFICIAL INTELLIGENCE **[10 Hrs]**

Principles of AI – Basics of learning – Planning movement – Basics of knowledge representations – Robot programming languages.

UNIT – IV: ROBOTIC VISION SYSTEMS **[11 Hrs]**

Principles of edge detection – Determination optical flow and shape – Image segmentation – Pattern recognition – Model directed scene analysis.

UNIT – V: ROBOT CONTROL AND APPLICATIONS **[11 Hrs]**

Robot control using voice and infrared – Overview of robot applications – Prosthetic devices – Robots in material handling-Processing assembly and storage.

Total Hours: 55

COURSE OUTCOME

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

- Describe the Robot organization of remote manipulations.
- Describe the kinematics motions of robot.
- Classify the various types of sensors using robot hardware of their design concepts.
- Illustrate the Programming methods & various Languages of robots.
- Design the various application of Robot control using voice and infrared.

TEXT BOOKS:

1.Vokopravotic, "Introduction to Robotics", Springer, 2002 (Unit – I)
2.Rathmill K., "Robot Technology and Application", Springer, 2002 (Unit – II)
3. Charniak & McDarmott, "Introduction to Artificial Intelligence", McGraw Hill,2009 (Unit -III)
4. K.S.Fu, R.C.Gonzally, C.S.G.Lee, "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Company, 1997 (Unit – IV)
5. Mikell P. Groover, Mitchell Weiss, Roger. N, Nagel, Nicholas G. Odrey, "Industrial Robotic Technology Programming and Applications", McGraw Hill Book Company, 2012 (Unit – V)

Prepared by **Approved by**

[Dr Thamarai Selvan M] **[Dr Poornima K]**

19MECI01 - Fundamentals of Embedded Systems

Inter Department Course Subject to be offered for Other Department

Semester	**III**
Credit	**3$**
Paper type	**IDC**
Max. Marks	**CE - 100 TOT =100**

COURSE OBJECTIVES

- To acquaint about embedded hardware and software architecture.
- To develop the embedded programming knowledge.
- To acquaint the knowledge on real time OS.

UNIT – I: ARCHITECTURE OF EMBEDDED SYSTEMS **[9 Hrs]**

Categories of Embedded Systems - Specifications of Embedded systems - Recent trends in Embedded Systems - Hardware Architecture - Software Architecture - Communication software - Process of generation of executable image –Development /testing tools

UNIT – II: PROGRAMMING FOR EMBEDDED SYSTEMS **[11 Hrs]**

Getting the most of C - data types - manipulating bits in memory and I/O ports - accessing memory mapped I/O devices - structures - variant access - mixing C to assembly - register usage - use of addressing options - Instruction sequencing - Procedure call and return - Parameter passing - Retrieving parameters memory management - scope - Automatic allocation - Static allocation - Dynamic allocation - Shared memory - Recognizing shared objects - Re-entrant functions - Accessing shared memory device drivers – productivity tools.

UNIT – III: HARDWARE PLATFORM **[8 Hrs]**

PIC microcontroller - Architecture of PIC 16c6x/7x- FSR - Reset action - Oscillatory connection – Memory organization - Instructions - Addressing modes - I/O ports - Interrupts - Timers - ADC-Assembly language programming.

UNIT – IV: REAL-TIME OPERATING SYSTEM **[8 Hrs]**

Architecture of the Kernel - task and task scheduler - Interrupt Service Routines - Semaphores - Mutex Mailboxes - Message Queues - Event Registers - Pipes - Signals - Timers - Memory Management – Priority Inversion Problem.

UNIT – V: REAL-TIME OPERATING SYSTEM TOOLS AND CASE STUDIES **[8 Hrs]**

Use of µC/OS - II - Case study of coding for an Automatic Chocolate Vending Machine using MUCOS RTOS - Case study of an Embedded system for an Adaptive Cruise Control Systems in a Car - Case study of an Embedded Systems for a Smart Card.

Total Hours: 45

COURSE OUTCOME

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

- Describe the difference between the general computing system and embedded system and also recognize the classification of embedded systems.
- Describe the architecture of the Processor or Controller.
- Design real time embedded system using the concepts of RTOS.
- Analyze various examples of embedded system.

TEXT BOOKS:

1. Prasad K.V.K.K, "Embedded/Real Time Systems: Concepts, Design and Programming", Dream tech, Wiley 2003.
2. Daniel W Lewis, "Fundamentals of Embedded Software", Pearson Education, 2001.
3. Ajay V Deshmukh, "Microcontroller Theory and Applications", Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. David E Simon, "An Embedded Software Primer", Pearson Education, 2003.
2. Raj Kamal, "Embedded Systems Architecture Programming and Design", Pearson, 2005.
3. Peatman, "Designing with PIC Micro Controller", Pearson 2003.

Prepared by

[Mr Sathish Kumar V]

Approved by

[Dr Poornima K]

19MEC401 – Project Work & Viva Voce

Semester	IV
Credit	10
Paper type	Core
Max. Marks	CIA -160 CE -40 Total =200

COURSE OBJECTIVES

- To estimate the ability of the student in transforming the theoretical knowledge studied so far into real time applications.
- To understand and gain the knowledge of Lab practices so has to participate and produce project in future.
- To create research and development knowledge for Post graduate students using electronics components and devices along with different types of application software related to electronics field.
- To impart knowledge on electronics and implement in the working world.

GUIDELINE TO STUDENTS

The students should strictly adhere to the following points while preparing their project reports

- Students are expected to undergo project work individually and submit individual project report.
- Students can do project in Industry or in our Lab.
- Publication of paper in journal/ Presentation of paper in Conference are highly appreciable.

Tentative Dates regarding Review Meeting

I Meeting : Confirmation of Project Title on or before 19/01/2021

II Meeting : Block Diagram and Description on or before 10/02/2021

III Meeting : Circuit Diagram and Description on or before 28/02/2021

IV Meeting : Preliminary Demo and report submission on or before 12/03/2021

V Meeting : Final Demonstration with three copies of project report submission on or before 29/03/2021

VI Meeting : Final Submission of the bounded project as per specifications 12/04/2021.

Note: For each Meeting, internal marks will be awarded based on their Performance and Quality of Work.

COURSE OUTCOMES

On completion of this project, the students will be able to

- Improve self-learning capacity and accomplish responsibilities.
- Identify and analyses the hardware problems.
- Apply learned methodologies and techniques to solve the problems.
- Design, develop, test and debug hardware circuits in their project.
- Demonstrate the developed project and present the report.
- To design a project for the real world problems.

Prepared by

[Mr. M Prasannakumar]

Approved by

[Dr. K. Poornima]

SELF STUDY PAPER
19MEC402 - MEMS and NEMS

Semester	IV
Credit	4[$]
Paper type	Core
Max. Marks	CIA -100 TOT =100

COURSE OBJECTIVES

- To enable the students to learn about various materials used in MEMS and NEMS.
- To study the operation of various MEMS sensors, fabrication techniques and their applications.
- To impart Knowledge on NEMS Properties and Applications.

UNIT I: OVERVIEW OF MEMS AND WORKING PRINCIPLES OF MICROSYSTEM

MEMS as Micro sensor-Micro actuator- Microsystems products –Comparison of Microsystems and Microelectronics – Multi disciplinary nature of Microsystems design and manufacturing – Applications of Microsystems.

Micro sensors: Bio medical and Biosensor– Chemical Sensor – Thermal sensor.

Micro Actuation: Actuation by Thermal Forces, Shape Memory Alloys, Piezo Electric Crystals and Electrostatic Force-Micro motors –Micro valves – Micro pumps- Micro Accelerometer.

UNIT II: MATERIALS FOR MEMS

Substrates And Wafer – Czochralski method for growing single crystal- Crystal structure– Silicon Compounds – Silicon Dioxide – Silicon Carbide –Silicon Nitride – Poly Crystalline Silicon-Polymers –The Longmuir Blodgett (LB) Film.

UNIT III: MICROSYSTEM FABRICATION PROCESS

Photolithography – Ion Implantation – Diffusion – Oxidation –CVD-PVD– Sputtering – Deposition by Epitaxy – Etching.

UNIT IV: MICROMANUFACTURING AND MICRO SYSTEM DESIGN

Micro Manufacturing: Bulk Micro Manufacturing – Surface Micro Machining – The LIGA process

Microsystems Design: Design consideration –Computer Aided Design (CAD).

UNIT V: NEMS PROPERTIES AND APPLICATIONS

Properties of Nano material: Mechanical properties-Melting of Nano particles- Electrical conductivity-Optical properties-Carbon nano tubes.

Applications: Electronics- Automobiles-Domestic appliances-Bio-technology and Medical field-Space and Defense.

COURSE OUTCOME

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

- Describe the types of micro sensor and actuator.
- Understand the properties of material used for micro system.
- Describe fabrication process and sequences.
- Differentiate Micro Manufacturing technique.
- Apply the properties of Nano Material in different applications.

TEXT BOOKS:

1. Tai – Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata McGraw Hill Edition 2002, ISBN 0 – 07-048709- X (Unit I – IV)

2. Sulabha K. Kulkarni, "Nano technology: Principles and Practices", Capital publishing company (Unit V)

3. P.K. Sharma, "Understanding Nano Technology", Vista Publications, I Edition, 2008 (Unit V).

Question Paper Pattern

5 Essay type Questions

Each questions carry 20 Marks (5*20=100Marks)

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