Teaching and Evaluation Scheme for Final Year B. Tech.

Department of Electronics and Computer Engineering

Semester: VII

Department: Electronics and Computer Engineering **Rev:** Course Structure/00/2021-22

Class: Final Year B. Tech **Semester:** VII

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					
			L	T	P	Total Hrs	CA1	CA2	MSE	ESE	Total	Credits
EC701	PCC	Embedded System Design	3	-	-	3	10	10	30	50	100	3
EC702	PCC	Advanced Data Science Visualization	3	-	-	3	10	10	30	50	100	3
EC703	PEC	Elective-IV	3	-	-	3	10	10	30	50	100	3
EC704	PEC	Elective-V	3	-	-	3	10	10	30	50	100	3
OE715	OEC	Open Elective-III	3	-	-	3	10	10	30	50	100	3
EC705	PCC	Embedded System Design Laboratory	-	-	2	2	15	15	-	20	50	1
EC706	PCC	Advanced Data Science Visualization Laboratory	-	-	2	2	15	15	-	20	50	1
EC707	PEC	Elective-V Laboratory	-	-	2	2	25	25	-	-	50	1
PROJ06	PROJ	Mega Project Phase-II	-	-	8	8	25	25	-	50	100	4
PROJ07	PROJ	Seminar	-	-	2	2	-	-	-	50	50	1
HMS09	HSMC	Values & Ethics	1	-	-	1	25	25	-	-	50	Audit
Total			16	-	16	32	155	155	150	390	850	23

Elective-IV :
A. Microwave Engineering
B. Information Theory & Coding
C. Ad-hoc Sensor Network

Elective-V :
A. VLSI Design
B. Cloud Computing
C. DATA Mining

Open Elective-III : Computer Network

Embedded System Design

EC701	PCC	Embedded System Design	3-0-0	3Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Microprocessor, Microcontroller

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

CO1	Outline about design issues & components of embedded systems , RISC architecture design philosophy of ARM7.
CO2	Develop embedded C program for interfacing I/O device like LEDs, DC Motors using LPC2148.
CO3	Make use of LPC2148 of extended features of I/Os, Timers, ADC for interfacing peripherals.
CO4	Explain real time operating concepts.
CO5	Explain hardware – software co design issues and testing methodology for embedded system.
CO6	Explain Semaphores, Mutex, Mail Box & Message Queue in µCOSII.

Course Contents:

Unit 1:Introduction to Embedded systems & ARM7 architecture Embedded systems (ES) definition, ES components, ES design flow, ES designing & development tools, Characteristics of Embedding Computing , ARM7 registers bank, status registers, pipelining concept, exceptions and vector table, data flow model.	[6]
Unit 2: ARM instruction set with assembly & C programming ARM assembly instruction set and programming, ARM C programming, LPC2148 pin layout, Input/ Output programming in C using LPC2148 port pins.	[6]
Unit 3: LPC2148 microcontroller architecture & programming LPC2148 architecture details, SFRs, Interrupts in ARM7 (ref: LPC2148), Timer/Counter module, PWM module, A/D convertor module, Serial communication module (UART), I2C and SPI communication protocols (ref: LPC2148).	[6]
Unit 4: Operating System Basic Features of an Operating System, Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt-driven System, Multi-rate System Processes and Threads, Context Switching: Cooperative Multi-tasking, Pre-emptive Multi- tasking.	[6]

Unit 5: Scheduling and Inter-process Communication Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault Tolerant Scheduling Signals, Shared Memory Communication, Message-Based Communication	[6]
Unit 6: Semaphore, Mutex, Mail box, and Message queue in µCOSII Creating and deleting a semaphore, waiting and signaling semaphore, Creating and Deleting Mutex, waiting and signaling mutex, Creating and deleting a mail box, sending and receiving a message using mail box (mail box as a binary semaphore), creating and deleting a message queue, sending and receiving a message using message queue.	[6]
Text books: 1. Embedded system design by peter marwedel, springer publication. 2. An embedded software primer, david e. Simon pearson education, asia publication. 3. Arm system developers guide designing & optimizing system software by andrew n., dominic sloss, and chris wright. 4. K.j. ayala, "the 8051 microcontrollers: architecture, programming, and applications", Penram intl, 1996.	
Reference books: 1. Embedded system design a unified hardware/ software introduction by frank vahid/ tony givargis , wiley publication 2. Real- time systems design and analysis by phillips a. Laplante, wiley insia edition 3. Embedded/ real-time systems: concepts, design & programming by dr. K v k k prasad, dream tech pres	

Advanced Data Science Visualization

EC702	PCC	Advanced Data Science Visualization	3-0-0	3Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Basic of programming language and statistics for Data Science

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

CO1	Extract different types of data sources and create effective charts using data.
CO2	Use Data transform techniques for converting unstructured to structured formatted data.
CO3	Build reports using advanced Power BI techniques for effective navigation.
CO4	Share report on Cloud and end-user easily access the report

Course Contents:

Unit1:Introduction to Power BI Fundamentals of visualization with Power BI, Data visualization, and its importance, getting to know extract the data and visualize the chart using data (Line chart, bar chart).	[6]
Unit2: Data visualizations Data transform techniques for converting unstructured to structured formatted data. Introduction to visualizations and format of each chart for example:- Line chart, Area chart, Column charts, Bar chart, Pie chart, Donut chart, table and matrix visual	[6]
Unit3: Advanced Power BI Filters (Visual, Page and Report level), Drill through filter, Slicers, Drill up-down, Bookmark.	[6]
Unit 4: Power BI Data model (Relationship between two tables) Cardinalities (One to many, many to one, one to one, Many to Many), Fact and Dim table, Star and snowflake schema.	[6]
Unit5: DAX formulas Row context and Filter context and their uses, DAX formulas :- SUM, SUMX, Time Intelligent Dax function, USERELATIONSHIP Dax function.	[6]
Unit6: Power BI service (cloud) Dashboard, Report, Dataset, Workspace and there settings, Roles (Admin, Member, Contributor, Viewer), Provide report access to user.	[6]
Text Books: 1. "Tableau Public for Data Visualization" by Ryan Sleeper. 2. "Business Intelligence Analytics and Data Science" by Sharda and Ramesh.	
Reference Books: 1. Data Science Fundamentals and Practical Approaches, Nandi, Gypsy.	

2. "Programming Skill Data Science", by Freeman and Michael.
3. Mastering Power Query in Power BI and Excel: Learning real-world Power Query and M Techniques for a better data analysis.
4. Data Visualization: Using Power BI, Orange and Excel, by Dr. Shirshendu Roy.

Elective - IV
A. Microwave Engineering

EC703A	PEC	Microwave Engineering	3-0-0	3Credits

Teaching Scheme:	Evaluation Scheme:
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Good knowledge of Engineering Fundamentals of Physics and Electromagnetic.

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

CO1	Explain the working of the waveguide.
CO2	Choose a suitable microwave measurement instrument and carry out the required measurements.
CO3	Identify the use of microwave components and devices in microwave applications.
CO4	Explain the working principles of microwave tubes
CO5	Illustrate the microwave network analysis.

Course Contents:

Unit 1: Microwave Wave Guides Introduction to Microwaves Engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave, General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide, Wave guide parameters, Introduction to the coaxial line.	[6]
Unit 2: Microwave Components Multi-port junctions: Construction and operation of E-plane, H-plane, Magic Tee, and Directional couplers. Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator, and Circulator. Strap lines: Structural details and applications of strip lines	[6]
Unit 3: Microwave Measurements Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S- parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement.	[6]

Unit 4: Microwave Tubes Two cavity Klystron: Construction and principle of operation, velocity modulation, and bunching process Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation, and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. M-type tubes Magnetron: Construction and Principle of operation, applications. Helix TWT: Construction and principle of operation, Applications.	[6]
Unit 5: Microwave Solid State Devices Varactor Diode, PIN Diode, Schottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode, and TRAPATT diode. Structural details, Principles of operation, various modes, specifications, and applications of all these devices.	[6]
Unit 6: Microwave Network Analysis Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix Scattering Matrix:- Significance, formulation, and properties. S-Matrix calculations for-2 port network junction	[6]
Text Books: 1. Microwave Engineering – Annapurna Das, Sisal K Das TMH Publication, 2nd, 2010 2. Microwave Devices and circuits- Liao / Pearson Education 3. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka, and Ahmad S Khan, 4th special Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010.	
Reference Books: 1. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008 2. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015 3. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press,2007.	

B. Information Theory & Coding

EC703B	PEC	Information Theory & Coding	3-0-0	3Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Understanding of analog and Digital Communication

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

CO1	Understand Behaviour of noise in communication System stability on that basis.
CO2	Illustrate the probability theory along with mathematical analysis.
CO3	Explain basics of Information & Coding theories
CO4	Develop codes Using different source coding techniques
CO5	channel capacity for discrete channels
CO6	Apply coding knowledge for error detection and correction

Course Contents:

Unit 1: Noise in Communication Systems Behaviour of analog and digital communication systems in the presence of noise, Sources of Noise, Noise representation, Noise filtering, Noise bandwidth, Performance of analog and digital communication systems in the presence of noise.	[6]
Unit 2: Theory of Probability and Random Processes Concept of probability, random variables, random process, power spectral density of a Random process, probability models, statistical averages, central limit theorem, correlation, Linear mean square estimation.	[6]
Unit 3: : **Information Theory** Information Theory: Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Mark off Sources	[6]
Unit 4: **Source Coding** Source encoding, Shannon-Fano coding and Huffman coding, Huffman codes, Extended Huffman coding, Shannon's first and second fundamental theorems, Channel capacity theorem.	[6]
Unit 5: Communication Channels Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of: Binary Symmetric Channel, Binary Erasure Channel, Continuous Channels	[6]

Unit 6: Error Control Coding Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes, Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes. Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction	[6]
Text Books: 1. Taub, Schilling, Principles of Communication Engineering (2 nd Edition), TMH. 2. R.P.Singh, S.D. Sapre; Communication systems: Analog and Digital; TMH. 3. Digital Communications- John G. Proakis, 5th ed., , TMH 2008.	
Reference Books: 1. B. P. Lathi; Modern Digital and Analog Communication Systems; Oxford Publication 2. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, Wiley Inter science.	

C. Ad-hoc Sensor Network

EC703C	PEC	Ad-hoc Sensor Network	3-0-0	3Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Wireless Network.

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

CO1	Illustrate Ad hoc network and Sensor Network fundamentals
CO2	Demonstrate different routing protocols
CO3	Analyze sensor network architecture and design issues
CO4	Identify the transport layer and security issues possible in Ad hoc and Sensor networks
CO5	Choose different programming platforms and tools
CO6	Discuss different applications of WSN

Course Contents:

Unit 1: Ad Hoc Networks – Introduction And Routing Protocols Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).	[6]
Unit 2: Sensor Networks – Introduction & Architectures Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.	[6]
Unit 3: WSN Networking Concepts And Protocols MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts – S-MAC, The Mediation Device Protocol, Contention based protocols – PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols- Energy Efficient Routing, Challenges and Issues in Transport layer protocol.	[6]

Unit 4: Sensor Network Security Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.	[6]
Unit 5: Sensor Network Platforms And Tools Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – Tiny OS, nes C, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.	[6]
Unit 6: Applications Of WSN WSN Applications: Home Control, Building Automation, Industrial Automation, Medical Applications, Reconfigurable Sensor Networks, Highway Monitoring, Military Applications , Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Target detection and tracking, Contour/edge detection, Field sampling.	[6]

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Second Edition, Pearson Publication, 2015.
2. Holger Karl and Andreas Willig, "Protocol and Architecture for Wireless Sensor Networks", First Edition, John wiley publication, 2011.

Reference Books:

1. Carlos de Morais Cordeiro and Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks : Theory and Applications", Second Edition, World Scientific Publishers, 2011
2. Prasant Mohapatra and Sriramamurtyhy, "Ad Hoc Networks: Technologies and Protocols", Springer, International Edition, 2009
3. Protocols & Architectures for Wireless Sensor Networks, Wiley, 2005.

Elective-V

A. VLSI Design

EC704A	PEC	VLSI Design	3-0-0	3Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Fundamentals of Digital circuits

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

CO1	Explain VLSI Design flow, VHDL features, attributes, operators.
CO2	Design combinational logic circuits using VHDL.
CO3	Design sequential circuits like counter, serial adder, sequence detector
CO4	Make use of verilog features to design Adder, Decoder, Encoder, MUX
CO5	Explain basics of MOS transistor theory
CO6	Explain basics of PLD architecture, testing and fault finding methods

Course Contents:

Unit1: Introduction to VHDL Need of HDL, VLSI Design flow, Levels of abstraction Features and capabilities of VHDL, Elements of VHDL, data objects, data types, operators, attributes.	[6]
Unit 2: Combinational logic design using VHDL Concurrent statements, Adder, Subtractor, decoder, encoder, tri-state buffer, multiplexer, parity generator, parity checker, comparator, parallel shifter	[6]
Unit3: FSM Design Using VHDL Impediments to synchronous design, clock jitter, skew, gating the clock, asynchronous inputs, meta-stability and synchronizer failure. VHDL implementation of counter, shift register, LFSR, Serial adder. Bus arbiter, sequence detector	[6]
Unit4: Introduction to Verilog Basic verilog naming conventions, verilog operators, data types, assignment statements, control statements, behavioural modelling in verilog HDL, combinational logic design using verilog.	[6]
Unit no5: MOS Transistor theory Physical structure of MOS transistor, MOS transistor under static conditions, Introduction to CMOS inverter and its V-I characteristics.	[6]

Unit6: PLD Architectures and Testing Basic architecture of Xillnx 9500 series CPLD (XC9572), Spartan II FPGA (XC3s400)Testing: Fault models, path sensitizing, random test, design for the stability, Built-in self test and Boundary scan.	[6]
Text Books: 1. Volnei A. Pedroni, "Circuit Design with VHDL",third edition, MIT press 2. Douglas Perry, "VHDL", Tata MC-Graw Hill 3. Verilog HDLA Guide To Digital Design And Synthesis, Edition:2bySamirPalnitkar 4. J. Bhasker, "AVHDL Primmer", Prentice Hall PTR, 1999. 5. A.Anand Kumar, "Fundamentals of Digital Circuits", second edition, PHI	
Reference Books: 1. Stephen Brown and Zvonko Vranesic "Fundamentals of Digital Logic with VHDL design", Tata-Mc Graw Hill 2. D. A. Pucknell and K. Eshraghian, "Basic VLSI Design", Prentice Hall India, 3rdEdition,2003	

B. Cloud Computing

EC704B	PEC	Cloud Computing	3-0-0	3Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Basics of networking and different Types of cloud.

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

CO1	Learn how to use Cloud Services.
CO2	Know the Architecture of cloud computing.
CO3	Learn how to use cloud services and storage.
CO4	To have knowledge on the various issues in cloud computing.
CO5	Know the administration and risk factor of cloud computing.
CO6	Know the Adoptioning cloud computing.

Course Contents:

Unit No.01:**Introduction to Cloud Computing** Introduction, Evolution of computing developments, Components of cloud computing, computing services delivery models, Parallel v/s distributed computing, Cloud Characteristics Virtualization Introduction and benefits, Implementation levels of Virtualization, Virtualization structure, Virtualization of CPU	[6]
Unit No.02:Cloud Computing Architecture Cloud Architecture, Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public Private and Hybrid Clouds - laaS – PaaS – SaaS, Architectural Design Challenges, private versus hybrid cloud.	[6]
Unit No.03:Cloud services and storage Services mechanism – Iaas, Paas, SaaS, Database as a service (DBaas), benefits to cloud adoption among users and providers, Levels of business value.Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage	[6]
Unit No.04: Cloud development and security Factors for cloud implementation, Cloud network topologies, automation in cloud development, self-services features in cloud development, cloud performance and monitoring, Improving cloud database performance, host security for Saas, host security IaaS, data security threats, cloud data challenges and security.	[6]

Unit No.05: Administration for cloud and Risk factor The AAA model, Single sign- on for clouds, SAML, risk in cloud computing, risk assessment and management, Risk of failure and inadequate SLA, risk of malware and internet attack, risk management in cloud, risk in physical infrastructure, risk with software and application licensing.	[6]
Unit No.06: Adoption of cloud Benefits of cloud in SMB's, roles and responsibilities towards SMB's, service management capabilities, financial management capabilities, success factor for cloud consumers, Issues with SMB's using cloud services, question for cloud vendor.	[6]

Text Books:

1. Kailash Jayaswal, Jagannath kallakurchi, Donald j. houde, Dr. deven shah- DT Editorial services "Cloud Computing "2015
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, ―Mastering Cloud Computing‖, Tata Mcgraw Hill, 2013.

Reference Books:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach‖, Tata Mcgraw Hill, 2009.
2. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009

C. DATA Mining

EC704C	PEC	DATA Mining	3-0-0	3Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3 hrs/week	CA-I : 10 Marks CA-II : 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-requisites: Basic of programming language and statistics for Data Science

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

CO1	Explain the fundamentals of Data Mining
CO2	Compare OLAP Systems and Data Warehouse
CO3	Make use of data pre-processing techniques
CO4	Demonstrate data visualization technique
CO5	Apply basic techniques to mine the data
CO6	Analyse the output generated by the process of data mining

Course Contents:

Unit 1: Introduction to data mining An introduction to data mining, scope of data mining, Data mining goals, Data Fundamentals: Introduction to Data Warehouse, DBMS, machine learning, Statistics, installing data mining system Stages in data mining process	[6]
Unit 2: OLAP Characteristics of OLAP, Steps in the OLAP Creation Process, Advantageous of OLAP,OLAP Architectures, Differences between OLAP Systems and Data Warehouse,	[6]
Unit 3 Data Pre-Processing Data pre-processing an overview, Data cleaning, data integration, data transformation, data reduction, discretization and generating concept hierarchies, , Data mining techniques-An overview, Association rules, Classification, Regression, Clustering, knowledge representation methods, Applications	[6]
Unit 4: Data Mining Knowledge Representation Task relevant data, Background knowledge, Interestingness measures, Representing input data and output knowledge, Visualization techniques	[6]
Unit 5: Data mining Algorithms: Association Rules Motivation and terminology, Basic idea of item sets, generating item sets and rules efficiency, correlation analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets	[6]
Unit 6: Data Mining Algorithms: Classification Basic learning, Introduction to: Classification and Regression for Predictive Analysis, Decision Tree Induction, covering rules, Rule-Based Classification: using IF-THEN Rules	[6]

for Classification, Rule Induction Using a Sequential Covering Algorithm. Mining tasks, and Inferring rudimentary rules: 1R algorithm	
Text Books: 1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN: 9780070139909 0070139903 2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X	
Reference Books: 1. Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847 2. Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086	

Embedded System Design Laboratory

EC705	PCC	Embedded System Design Laboratory	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2hrs/week	CA-I : 15 Marks CA-II : 15 Marks End Semester Exam: 20 Marks

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

CO1	Use C for reading data from port pins.
CO2	Understand the interfacing of data I/O devices with ARM controller.
CO3	Understand serial communication, port RTOS on ARM controller.

Experiment List: Minimum 08 experiments should be conducted.

01.	Introduction to Embedded System
02.	Program for turning ON LEDs sequentially.
03.	Program for controlling DC Motor.
04.	Program for controlling stepper Motor.
05.	Program for generating saw-tooth wave using DAC. Program for generating sine wave using DAC
06.	Program for Polled Loops
07.	Program for Rate Monotonic Scheduling
08.	Program for Earliest Deadline Scheduling
09.	Program for Shared Memory Communication

Advanced-Data Visualization Laboratory

EC706	PCC	Advanced-Data Visualization Laboratory	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2hrs/week	CA-I : 15 Marks CA-II : 15 Marks End Semester Exam: 20 Marks

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

CO1	Extract different types of data sources and create effective charts using data.
CO2	Build reports using advanced Power BI techniques for effective navigation.
CO3	Share reports on Cloud and end users easily access the report

Experiment List: Minimum 08 experiments should be conducted.

01.	**Connecting to data sources :** in Power Bi you can connect various data sources such as Excel, CSV, databases (SQL Server, MySQL, Oracle, etc.), and cloud platforms (Azure SQL, Azure Synapse, Google Analytics, Sales force, etc.).
02.	**Data Model: -** In Power BI using model view connect two tables using relationships with using cardinalities.
03.	**Building visualizations:** In Power BI tool Microsoft provide us various visualization to represent the data such as Bar chart, column chart,, Line chart, area chart, tree map and many more.By using only Drag-drop visual and add the data and represent the chart on report view.
04.	**Creating Report:** Report is a collection of multiple visualizations that allow you to present and analyze data in a consolidated manner. You can combine various charts, tables, filters, and parameters to create inter active and informative dashboards.
05.	**Adding calculations and fields:** Power BI provide you create calculated fields using DAX formula language, you can create you DAX by using calculated column, Measure and calculated table as per the requirement.
06.	**Applying filters and Advance technique:** Filters can be used to restrict the data displayed in your visualizations to specific conditions. In Power BI you can use level of filters using conditions. And use advance techniques in representing data like as Bookmark, drill through etc.
07.	**Hierarchy:** Power BI provide us auto Hierarchy for Date column (Year, Quarter, Month, Day) you can choose your granularity and represent data using drill up-down, also as per requirement we can create our own hierarchy.
08.	**Table and Matrix:** Power BI provide us two visual representing table and matrix level data (Table: column level grouping) and Matrix (ROW and column level grouping)
09.	**Power BI cloud:** After developed the report we need to share to end user (client) using power BI service

VLSI Design Laboratory

EC707A	PEC	VLSI Design Laboratory	0-0-2	1Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2hrs/week	CA-I : 25 Marks CA-II : 25 Marks

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

CO1	Develop VHDL code for Adder, mux, decoder, encoder, comparator
CO2	Make use of VHDL statements and operators and FSM design basics to build code for sequential circuits (sequence detector, serial adder, counter)
CO3	Build verilog code for mux, decoder, counter.

Experiment List: Minimum 08 experiments should be conducted.

01.	Make use of appropriate modelling style and Write VHDL code to verify truth table of Half Adder, Full Adder, Half Subtractor, Full subtractor
02.	Develop VHDL code for decoder, encoder
03.	Build VHDL code to verify truth table of 4:1 ,2:1,8:1 MUX Design 16: 1 mux using 4:1 mux develop VHDL code using structural modeling
04.	Develop code for comparator, parity generator, parity checker
05.	Make use of VHDL shift and rotate operators to Develop code for barallel shifter
06.	Develop FSM to detect sequence 1010 and write VHDL code
07.	Design FSM for serial adder and show simulation using VHDL code
08.	Build VHDL code for LFSR, bus arbiter
09.	Design Universal Shift Register use load and shift line to control operation to Simulate (SISO, SIPO, PIPO, PISO) modes of operation make use of VHDL structural modelling
10.	Design FSM for even and odd counter simulation in VHDL
11.	Develop verilog code to demonstrate behavior of Decoder, encoder, mux
12.	Build verilog code to demonstrate counter operation

Cloud Computing Laboratory

EC707B	PEC	Cloud Computing Laboratory	0-0-2	1Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2hrs/week	CA-I : 25 Marks CA-II : 25 Marks

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

CO1	Understand fundamental concepts of cloud computing
CO2	Make use of cloud platforms
CO3	Analyze cloud computing applications

Experiment List: Minimum 08 experiments should be conducted.

01.	Demonstration of Cloud Console
02.	Create EC2 Instance in cloud computing
03.	Create AWS Elastic Beanstalk
04.	Perform Experiment on Scale and load balance your architecture
05.	To Perform experiment on working with EBS
06.	Build a database server using cloud computing
07.	Build your VPC & launch a web server
08.	To perform experiment with introduction to AWS IAM services

Data Mining Laboratory

EC707C	PEC	Data Mining Laboratory	0-0-2	1Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2hrs/week	CA-I : 25 Marks CA-II : 25 Marks

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

CO1	Explain the fundamentals of Data Mining.
CO2	Make use of data pre-processing techniques
CO3	Apply basic techniques to mine the data

Experiment List: Minimum 08 experiments should be conducted.

01.	Installation of WEKA Tool
02.	Creating new Arff File
03.	Data Processing Techniques on Data set
04.	Data cube construction – OLAP operations
05.	Implementation of Apriori algorithm
06.	Implementation of FP- Growth algorithm
07.	Implementation of Decision Tree Induction.
08.	Calculating Information gains measures.
09.	Classification of data using Bayesian approach.
10.	Implementation of K-means algorithm

Mega Project Phase -II

PROJ06	PROJ	Mega Project Phase -II	0-0-8	4 Credits

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2hrs/week	CA-I : 25 Marks CA-II : 25 Marks

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

CO1	Demonstrate the sound technical knowledge of the selected technical topic.
CO2	Demonstrate the technical presentation skill.
CO3	Compose the progress report.

Course Contents:

Since Mega Project Phase-II is in continuation to Mega Project Phase-I, the students are expected to complete the total project by the end of semester VII. After completion of project work, they are expected to submit the project report including the work done in Phase-I and Phase- II.

The report shall be comprehensive and presented typed on A4 size sheets and **hard bound**. The number of copies to be submitted is number of students plus two. The assessment would be carried out by the panel of examiners (Guide and Project Evaluation Members) for both, term work and oral examinations.

The project work should be published in any one of the national/international quality conference or reputed journal.

Report shall summarize the literature survey; spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student

Seminar

PROJ07	PROJ	**Seminar**	0-0-2	1Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2hrs/week	End Semester Exam: 50 Marks

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

CO1	Demonstrate the sound technical knowledge of the selected technical topic.
CO2	Demonstrate the technical presentation skill.
CO3	Compose the progress report.

Values and Ethics

HMS09	HMS	Values and Ethics	1-0-0	Audit

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 1 hr/week	CA-I : 25 Marks CA-II : 25 Marks

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

CO1	Understand the Ethics & Human interface.
CO2	Understand Attitude, Morals, Aptitude, Integrity towards Society.
CO3	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO4	Understand the significance of value inputs in a classroom and start applying them in their life and profession.
CO5	Understand Publication ethics.
CO6	Understand Business ethics in professional careers.

Course Contents:

Unit No.01: Ethics and Human Interface: Ethics and Human Interface, Essence, determinants and consequences of ethics in human actions; Dimensions of ethics; ethics in private and public relationships Human Values – lessons from the lives and teachings of great leaders, reformers and administrators, Role of family, society in inculcating values, role of educational institutions in inculcating values.	[2]
Unit No.02: Attitude, Morals, Aptitude, Integrity towards Society Attitude: content, structure, function, Attitude and its influence and relation with thought and behavior, Aptitude and foundational values towards society, integrity, impartiality and non-partisanship, empathy, tolerance and compassion intelligence-concepts.	[2]
Unit No.03: Understanding Harmony in the Human Being - Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body', Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Programs to ensure Sanyam and Swasthya.	[2]
Unit No. 04: Value Education Need, Guidelines, content and process for Value Education, Self-exploration - Natural Acceptance and Experiential Validation, Continuous Happiness and Prosperity, Relationship and Physical Facilities, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	[2]
Unit No.05: Publication Ethics Publication Ethics: Introduction, Scope & importance, best practices/standards initiatives & Guidelines: COPE, WAME, etc., Conflict of Interest, Publication Misconduct:	[2]

definition, concept, problems that lead to unethical behavior &Vice versa, complaints & appeals	
Unit No.06: Business Ethics Ethics - Meaning, Importance, & Types of Ethics, Nature and Relevance to Business ethics, Values and Attitudes of Professional Engineers, Seven Principles of Public Life, Ethics in Business: Features, Principles, Need & Importance, Improving ethical behavior in Business.	[2]

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
3. Neeraj Kumar, "Lexicon for Ethics, Integrity & Aptitude", Chronicle Publication, 2016.
4. Santosh Ajmera, Nand Kishor Reddi, "Ethics - Integrity and Aptitude", Tata Mc Graw Hill Publication, 2014.
5. M. Karthikeyan"Ethics, Integrity and Aptitude", Tata Mc Graw Hill Publication, 2015.

Reference Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. A N Tripathy, 2003, Human Values, New Age International Publishers.
3. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
4. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
5. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.