BansilalRamnathAgarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

Syllabus for
T.Y.B.Tech.
Electronics & Telecommunication
(Pattern 2020)

Department of
Electronics & Telecommunication
Engineering

VISION:

- Excellence in Electronics & Telecommunication Engineering Education

MISSION:

- Provide excellent blend of theory and practical knowledge
- Establish centre of excellence in post graduate studies and research
- Prepare engineering professionals with highest ethical values and a sense of responsible citizenship

Program Educational Objectives (PEO):

1. Graduates of the program will become competent electronic engineers suitable for industry.
2. Graduates of the program will apply the mathematical and analytical abilities gained through core courses of Electronics and Communication engineering.
3. Graduates of the program will apply problem solving skills to develop hardware and/or software.
4. Graduates of the program will become responsible citizen.

Program Outcomes (PO):

A graduate of the program will have

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with theengineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Projectmanagement and finance**: Demonstrate knowledge and understanding ofthe engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO):

Graduates will be able to

1. Apply and demonstrate the usage of hardware and software platforms for variety of applications.

2. Apply different mathematical and statistical methods for analysis and design of signal processing and communication systems.

Graduate attributes:

1. Engineering knowledge
2. Problem Analysis
3. Design/Development of Solutions
4. Investigations of Complex Problems
5. Modern Tool Usage
6. The Engineer and Society
7. Environment and sustainability
8. Ethics
9. Individual and Teamwork
10. Communication
11. Project management and Finance
12. Life –long Learning

Third Year B. Tech. Electronics & Telecommunication Engineering (TYBT) –SemesterV (Pattern 2020)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ES31201ET	Design and Analysis of Algorithms	TH	3	-	2	20	20	20	40	25	125	4
ETUA31202	Internet of Things	TH	3	-	2	20	20	20	40	25	125	4
ETUA31203	Machine Learning	TH	3	-	2	20	20	20	40	25	125	4
ETUA31204	Operating System	TH	3	-	-	20	20	20	40	-	100	3
ETUA31205	Professional Elective-I	TH	3	-	2	20	20	20	40	25	125	4
ETUA31206	Project-I	CE	1	-	2	-	-	-	-	25	25	2
ETUA31207	Intellectual Property Rights	CE	2	-	-	-	-	50	-	-	50	2
HET31201	Honors Course	TH	4	-	2/-	20	30	20	30	25	125	5/4
M3	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	**-**	**18 /4**	**-**	**10/ 2/-**	**100 /20**	**150 /30**	**150/ 20**	**150/ 30**	**125/ 25**	**675/ 125**	**23/5/4**

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1 hr. = 1 Credit, Audit Course: No Credits

List of Mandatory Courses [FYBT: Induction training, SYBT: Environmental Sciences, TYBT: Essence of Indian Traditional Knowledge, and Final Year B.Tech.: Indian Constitution].

Professional Elective-I

ETUA31205A: System Programming
ETUA31205B: System Design using Verilog
ETUA31205C: Information Theory and Coding Techniques
ETUA31205D: Embedded Processors

Honors Course

HET31201A:Inferential Statistics*(Data Science)*
HET31201B:Robotic System*(Robotic Technologies)*
HET31201C:Introduction to Internet of Things *(IOT)*

BoS Chairman **Dean Academics** **Director**

Third Year B. Tech. Electronics & Telecommunication Engineering (TYBT) - Semester VI (Pattern 2020)

Course Code	Course	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
			L	T	P	CIE	ISE	SCE	ESE	PR/ OR/ TW		
ETUA32201	Computer Networks and Security	TH	3	-	2	20	20	20	40	25	125	4
ETUA32202	Power Electronics and Drives	TH	3	-	2	20	20	20	40	25	125	4
ETUA32203	Wireless Networks	TH	3	-	2	20	20	20	40	25	125	4
ETUA32204	Professional Elective-II	TH	3	-	2	20	20	20	40	25	125	4
IOEUA32205	Open Elective - I	TH	3	-	-	20	20	20	40	-	100	3
ETUA32206	Project - II	CE	1	-	2	-	-	-	-	25	25	2
HET32201	Honors Course	TH	4/3	-	2/4	20	30	20	30	25	125	5
M3	Mandatory Course	AU	-	-	-	-	-	-	-	-	-	
	Total	-	**16/ 4/3**	-	**10/ 2/4**	**100 /20**	**100 /30**	**100/ 20**	**200/ 30**	**125/ 25**	**625/ 125**	**21/5**

L: 1Hr. = 1 Credit, P: 2 Hrs. = 1 Credit, T: 1 hr. = 1 Credit, Audit Course: No Credits

List of Mandatory Courses [FYBT: Induction training, SYBT: Environmental Sciences, TYBT:,Essence of Indian Traditional Knowledge, and Final Year B.Tech.: Indian Constitution].

Professional Elective-II

ETUA32204A: Software Engineering
ETUA32204B: CMOS IC Design
ETUA32204C: Mobile Computing
Biomedical Instrumentation*(IOT)*

Honors Course

HET32201A: Big Data Analytics *(Data Science)*
HET32201B: Robotic Drives and Programming *(Robotic Tech)*
HET32201C: Communication Protocols and Devices in IOT ETUA32204D:

Open Elective - I

IOEUA32205A: Social Science & Engineering Economics *(IT)*
IOEUA32205B: Engineering Economics and FinTech *(Comp)*
IOEUA32205C: Explainable Artificial Intelligence (XAI) for Engineering Applications (*AI&DS)*
IOEUA32205D: ManagementInformationSystem *(E&TC)*
IOEUA32205E: Professional Practice, Law and Ethics *(Civil)*
IOEUA32205F: Industrial Engineering *(Mech)*
IOEUA32205G: Robotics Process Automation *(Mech)*
IOEUA32205H: Green Software Development for Sustainable IT*(Comp)*
IOEUA32205I: Industrial Automation*(E&TC)*
IOEUA32205J: Robotics and Application*(E&TC)*
IOEUA32205K: Generative AI*(AI&DS)*
IOEUA32205L: Web 3.0 *(Comp)*

BoS Chairman **Dean Academics** **Director**

Semester V

ES31201ET: Design and Analysis of Algorithms

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:
1. Data Structures

Course Objectives:
- Analyze the asymptotic performance of algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- To apply algorithmic strategies while solving problems.
- Apply important algorithmic design paradigms and methods of analysis.
- To understand the limitations of Algorithmic power.

Course Outcomes: At the end of this course, students will demonstrate the ability to
1. Analyze worst-case running times of algorithms based on asymptotic analysis.
2. Analyze a variety of divide and conquer algorithms.
3. To develop the greedy algorithms for a given problem.
4. To develop the dynamic programming algorithms for a given problem.
5. To solve problems on back tracking and branch & bound strategy.
6. To understand tractable and intractable problems.

Unit- I : Introduction

Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Masters' theorem.

Unit- II : Brute Force and Divide-and-Conquer

Brute Force: Computing an String Matching, Closest-Pair and Convex-Hull Problems,Exhaustive Search – Travelling Salesman Problem,

Divide and Conquer : Binary Search, Merge sort, Quick sort, Heap Sort, Multiplication of Large Integers , Closest-Pair and Convex, Hull Problems

Unit –III : GREEDY Technique

Greedy Method: General strategy, the principle of optimality, Knapsack problem, Prim's Algorithm, Kruskal's algorithm, Huffman code generation algorithm.

Unit IV: Dynamic Programming

General Strategy, Principle of optimality – Coin changing problem, Computing a Binomial Coefficient –

Floyd's algorithm, Multi stage graph, Optimal Binary Search Trees – Knapsack Problem and Memory functions.
Concept, Array representation of queues, Linked representation of queue, Circular queue , Applications of queue

Unit V: Backtracking, Branch and Bound

Backtracking: 8 Queen problem, Graphs Coloring,
Branch and Bound: 0/1 Knapsack. Backtracking and branch and bound general strategy,
Optimal BST , 0/1 Knapsack problem example of dynamic programming.

Unit VI : Tractable and Intractable Problems

Computability of Algorithms, Computability classes – P,
NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and
Reduction techniques, eg. Vertex cover problem, Travelling salesman prpblem,3SAT problem

Text Books :

1.Horowitz and Sahani, "Fundamentals of Computer Algorithms", 2ND Edition. University Press
2. Gilles Brassard, Paul Bratley, —Fundamentals of Algorithmics, PHI, ISBN 978-81-203-1131-2

Reference Books:

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. "Introduction to Algorithms", 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
3. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
4. Algorithms -- A Creative Approach, 3rd Edition, UdiManber, Addison-Wesley, Reading, MA.

List of Experiments:

1. Program to implement Binary Search using Divide and Conquer
2. Program to implement minimum and maximum using Divide and Conquer
3. Program to implement Merge sort using Divide and Conquer
4. Program to implement Heap sort
5. Program to implement Prim's algorithm using Greedy method
6. Program to implement Kruskal's algorithm using Greedy method
7. Program to implement coin changing problem using Dynamic Programming
8. Program to implement Knapsack problem using Dynamic Programming
9. Program to implement Graph Traversal: Breadth First Traversal
10. Program to implement Graph Traversal: Depth First Traversal
11. Program to implement 8-Queen's problem using Backtracking
12. Program to implement All Pairs Shortest Path Using Dynamic Programming

SCE: (Statement)

ETUA31202: Internet of Things

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:

2. Basic Electronics , Basic sensors and Actuators, Basics of Embedded systems etc.

Course Objectives:

- To study fundamental concepts of IoT
- To understand roles of sensors in IoT
- To Learn different protocols used for IoT design
- To be familiar with data handling and analytics tools in IoT

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

1. Understand the various concepts, terminologies, and architecture of IoT systems.
2. Use sensors and actuators for design of IoT.
3. Understand and apply various protocols for design of IoT systems
4. Understand various IP based protocols for design of IoT systems
5. Use various techniques of Bigdata storage and analytics in IoT
6. Understand various Industrial and other applications of IoT.

Unit I : Introduction to IOT

Introduction, Definitions & Characteristics of IoT, History of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

Unit II : Wireless Sensor Networks for IOT

Types of Wireless Sensors, Types of Actuators, Examples and Working, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

Unit III : IOT Protocols and Standards

WPAN Technologies for IoT: IEEE 802.15.4, Zigbee,
HART, NFC, Z-Wave, BLE, Bacnet, Modbus.

Unit IV: IP based Protocols for IOT

IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.
Authorization and Access Control in IOT

Unit V: BIG Data

Introduction, Bigdata, Types of data, Characteristics of Big data, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics.
Statistical Models, Analysis of Variance, Data Dispersion, Contingence and Correlation, Regression Analysis.

Unit VI: IOT Applications:
Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, IoT in Environmental Protection.
Industrial Applications in IoT

Text Books:
1.Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", WileyPublications
3. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

Reference Books:
1. Internet of Things, ArsheepBahga and Vijay Madisetti
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. https://onlinecourses.nptel.ac.in/noc17_cs22/course
5. Parikshit N. Mahalle, Shashikant S. Bhong, Gitanjali R. Shinde, "Authorization and Access Control Foundations, Frameworks, and Applications", CRC Press.

Suggested List of the Experimental Projects (Minimum 6 are to be performed):

1. Study& Survey of various development boards for IoT.
2. Study & Survey of various IoT platforms.
3. Interfacing sensors and actuators with Arduino.
4. Build a cloud-ready temperature sensor with the Arduino Uno and the any IoT Platform: This project shows the building of a temperature sensor.
5. Interfacing Sensors and actuators with Raspberry Pi 2.
6. IoT based Stepper Motor Control with Raspberry Pi: The combination of Raspberry Pi and IoT is an exciting one. Raspberry Pi has many general purpose I/O pins and has ability to control different actuators like stepper motors. In this project, an internet control of stepper motor using Raspberry Pi computer is developed. The connectivity is divided into server-side software and client-side software.
7. IoT based Web Controlled Home Automation using Raspberry Pi.
8. A Simple IoT Project with the ESP8266 WiFi module: Here is a simple project with ESP8266 wi-fi module. This project collects the temperature and is displayed on the network.
9. Implement a RFID Based IoT Project

Note: A Project based Learning approach will be followed for this course hence the experiments will be small projects to be built by the students.

ETUA31203: Machine Learning

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): 0 Practical (P): 2 hrs/week	20	20	20	40	25	--	125

Prerequisite:

1. Basics of Statistics and Probability
2. Linear Algebra

Course Objectives:

- Explore supervised and unsupervised learning paradigms of machine learning used for regression and classification.
- To design and analyze various machine learning algorithms using neural networks.
- To explore Deep learning technique and various feature extraction strategies

Course Outcomes:

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

1. Summarize the concepts of model learning.
2. Analyze mathematically the types of regression models and performance metrics.
3. Analyze mathematically the types of classification models and performance metrics.
4. Illustrate the unsupervised learning paradigms.
5. Analyze backpropagation algorithm and make use of artificial neural networks to solve complex regression and classification problems.
6. To implement convolution neural networks in recognition applications.

Unit- I : Introduction to Machine Learning

Defining and understanding Machine Learning, Types of machine learning, Model definition, Parametric and non-parametric modeling, Generalization: Concept of Training, Validation, Testing, Overfitting and Under fitting as applied to models. Concept of Bias and Variance and its importance in machine learning. Feature Engineering and Dimensionality reduction. Applications of Machine Learning

Unit –II : Supervised Learning -Regression

Linear models for regression**:** Linear Basis Function Models, Least squares and Polynomial regression, Partial least squares, Bayesian Linear Regression, Effect of noise in regression.

Principal Component Regression (How this can be placed), Error function used in regression,Regularization: Ridge and Lasso regression, Bayesian Regression,Multivariate Regression. Case Study - Regression

Unit III : Supervised Learning -Classification

Linear Models for Classification, Logistic regression, Linear Discriminant Analysis, Bayesian Classification, Support Vector Machines, Random forest classifiers, Decision Trees, Evaluation of classification performance. Case Study:Classification

Unit IV : Unsupervised Learning

Principal Components Analysis (Incremental PCA, Sparse PCA, Kernel PCA), Linear Discriminant Analysis,

Independent Component Analysis, Clustering: k-Means Clustering , Hierarchical Clustering, Density-based Clustering.

Gaussian Mixture models, Maximum Likelihood Estimation.

Unit V : Artificial Neural Networks

Biological neuron, Artificial neuron model,Concept of bias and threshold, Activation functions,Gradient descent algorithm and application of linear neuron for linear regression and classification, Stochastic Gradient Descent, RMS Prop and Adam optimization techniques. Multilayer perceptron (MLP) and back propagation algorithm, Radial Basis Function networks, Applications of MLP in classification and regression

Unit VI : Deep Neural Networks

Challenges in Machine learning: Vanishing Gradient problems, Computational Load, Architecture of ConvNet, Convolution Layer, Pooling Layer, and Applications of CNN's in Computer Vision, Case study using CNN based classification. Pretrained networks like Alex net and VGG.

Text Books :

1. Alpaydin, Ethem. *Introduction to machine learning*. MIT press, Third Edition.
2. Laurene Fausett , Fundamentals of Neural Networks: Architectures, Algorithms And Applications,
Pearson Education, Inc, 2008.
3. Phil Kim, ―MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence Press 2017.

Reference Books :

1. Christopher Bishop, "*Pattern Recognition and Machine Learning*", Springer, 2007.
2. Goodfellow, Ian, Yoshua Bengio, Aaron Courville, and Yoshua Bengio. *Deep learning*. Vol. 1. Cambridge: MIT press, 2016.

List of Experiments:

Prerequisite: Knowledge of Python programming with Scikit Learn, numpy, matplotlib, pandas, seaborn libraries.

1. Write a program for fitting a line for a given data.
2. Write a program for fitting a line for a given data with Machine learning.
3. Write a program to perform regression tasks over a given data using direct functions and evaluate its performance.
4. Write a program to perform classification tasks over a given data using direct functions and evaluate its performance.
5. Write a program to perform classification tasks over a given data using Support Vector Machine and Random forest classifier and evaluate its performance.
6. Implement K means clustering algorithm for a given data.
7. Implement a simple linear regressor with a single neuron model.
8. Implement and test Multi-layer Perceptron (MLP) trained with back-propagation algorithm.
9. Implement and test Convolutional Neural Network (CNN) for digits recognition.
10. Write a program to perform classification tasks over a given data using Decision Trees and Random forest classifier and evaluate its performance.

Mini Project.

Design and coding of regression/classification problem using ANN/Deep learning.

ETUA31204:Operating System

Teaching Scheme	Examination Scheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P): -	20	20	20	40	--	--	100

Prerequisite: Readers/students are expected to know the following concepts:

1. Basic Computer Concepts
2. Basics of Data structures
3. Knowledge of Programming Language (C++/Java/Python)

Course Objectives:

- To understand the services and support provided by operating system.
- To study process management and scheduling
- To understand various issues in Inter Process Communication (IPC) and the role of OS in IPC.
- To understand different approaches to memory management.
- To understand the working of an OS as a resource manager

Course Outcomes: At the end of this course, students will demonstrate the ability to:

1. Compare differing structures for operating system
2. Select appropriate the process scheduling algorithm.
3. Understand usage of OS API towards multi-core architecture.
4. Evaluate the requirement for process synchronization and coordination handled by operating system.
5. Analyze the memory management and its allocation policies.
6. Describe the storage and disk management policies.

Unit- I: Introduction to Operating System & System Structure

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems

System Structure: OS Services, System Calls, Structure of an OS ,Concept of Virtual Machine, Case study on UNIX and WINDOWS Operating System

Unit –II: Processes, Threads and Process Scheduling

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR

Unit III: OS support for multicore architecture

Scheduling for multicore architecture, spinlock, concept of hypervisor, concept and support for SMT and SMP, Intel oneAPI for multicore architecture: OS perspective, OS support for manycore architecture: A case study of OS support for GPU programming.

Unit IV: Inter-process Communication &Deadlocks

IPC: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson'sSolution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery

Unit V: Memory Management & Virtual Memory:

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory –Page fault, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Unit VI: Storage Management:

I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O software: Device

drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management.

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts. AddisonWesley
2. Stallings W., Operating Systems, Prentice Hall

Reference Books:

1. Andrew Tanenbaum, Modern Operating Systems, Prentice Hall.
2. Harvey M. Deitel, an introduction to operating systems. Addison-Wesley.
3. Douglas Comer, Operating System Design - The XINU Approach. Prentice-Hall.
4. Embedded Multicore: An Introduction, Freescale Semiconductor

ETUA31205A:System Programming

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Students are expected to know the concepts studied in following courses: 1. Data Structures 2. Design and Analysis of Algorithms 3. Operating Systems

Course Objectives:

- To introduce language processing fundamentals and assemblers.
- To explain design of macro processors.
- To introduce loaders and Linkers.
- To introduce compiler design process.
- To explain working of syntax analyzer.
- To introduce different code optimization methods.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Develop hypothetical assembler. (Apply)
2. Illustrate macro processors(Understand)
3. Illustrate linkers and loaders. (Understand)
4. Implement lexical analyzer using LEX tool (Apply)
5. Build parser using YACC tool (Apply)
6. Demonstrate code optimization and code generation concept (Understand)

Unit I: Introduction to Systems Programming And Assemblers

Introduction: Need of System Software, Components of System Software, Language Processing Activities, Fundamentals of Language Processing.

Assemblers: Elements of Assembly Language Programming, A simple Assembly Scheme, Pass structure of Assemblers, Design of Two Pass Assembler, Single pass assembler.

Unit II: Macroprocessors

Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a macro-processor.

Unit III: Loaders And Linkers Loaders: Loader Schemes, Compile and Go, General Loader Scheme, Absolute Loader Scheme, Subroutine Linkages, Relocation and linking concepts, Self-relocating programs, Relocating Loaders, Direct Linking Loaders, Overlay Structure.

Unit IV: Introduction to Compiler Compilers and Interpreters: Structure of Compiler, Concepts of Pass, Phases, front-end and back-end, Concepts of Bootstrap compiler. The Role of the Lexical Analyzer, Input Buffering. Specification of Tokens, Recognition Tokens, Design of Lexical Analyzer using Uniform Symbol Table, Lexical Errors. LEX: LEX Specification, Generation of Lexical Analyzer by LEX.

Unit V: Parsers

Role of parsers, Classification of Parsers: Top down parsers- recursive descent parser and predictive parser (LL parser), Bottom up Parsers – Shift Reduce parser, LR parser. YACC specification and Automatic construction of Parser (YACC).

Unit VI: Code Generation and Optimization

Code Generation: Code generation Issues. Basic blocks and flow graphs, A Simple Code Generator. Code Optimization: Machine Independent: Peephole optimizations: Common Sub-expression elimination, Removing of loop invariants, Induction variables and Reduction in strengths, Use of machine idioms, Dynamic Programming Code Generation. Machine dependent Issues: Assignment and use of registers.

Text Books:

1. D. M. Dhamdhere, Systems Programming and Operating Systems, Tata McGrawHill, ISBN 13:978-0-07-463579-7, Second Revised Edition
2. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers Principles, Techniques and Tools, Addison Wesley, ISBN:981–235–885 - 4, Low Price Edition
3. John R. Levine, Tony Mason & Doug Brown, "Lex &Yacc", O'Reilly

Reference Book:

1. J. J. Donovan, Systems Programming, McGraw-Hill, ISBN 13:978-0-07-460482- 3, Indian Edition

List of Experiments:

1. Write a program to implement Pass-I of Two-pass assembler for Symbols and Literal processing
2. Write a program to implement Pass-II of Two-pass assembler for output of Assignment 1
3. Design suitable data structures & implement first pass of a two-pass Macro processor
4. Design suitable data structures & implement second pass of a two-pass Macro processor
5. Write a program to implement a lexical analyzer
6. Write a program to implement a Recursive Descent Parser

SCE: Based on experiments performed.

ETUA31205B: System Design using Verilog

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:

1. Digital System Design

Course Objectives:

- Get the knowledge of Verilog Hardware Description Language to design digital circuits.
- Explore features and architectures of various PLDs.
- Learn different modeling styles using Verilog.
- Learn to write test benches and analyze simulation results.
- Distinguish between good and bad coding practices.
- To implement digital designs on PLDs (CPLDs/FPGAs).

Course Outcomes: At the end of this course, students will demonstrate the ability to

7. Comprehend the basic concepts in the Verilog language.
8. Write efficient Verilog codes using different modeling styles.
9. Cognize switch level modeling and user defined primitives.
10. Describe and differentiate the architectures and features of PLDs like CPLDs and FPGAs.
11. Comprehend the concept of synthesizable codes and write efficient synthesizable codes of differentdigital circuits.
12. Design complex system like processor.

Unit I : Basic Verilog HDL

Introduction, HDL design flow, Design representation, Modules and Instances, Verilog features, Data types, Operators, Identifiers, Keywords, Writing basic test bench, Modeling examples.

Unit II : Modeling Styles

Dataflow modeling: Continuous assignment, Behavioral modeling: Procedural assignment, Initial and always block, Sequential statements, Loops, Blocking and non-blocking assignments, Generate block, Modeling examples.

Unit III: Advanced Verilog topics

Verilog test benches and simulation, User defined primitives: UDP basics, combinational UDP's, Sequential UDP's, guidelines for UDP design, Switch level modeling: Various switch primitives, examples.

Unit IV : Programmable Logic Devices

Basic PLDs (PAL, PLA, and PROM), CPLDs (Features and architecture), Spartan-3E FPGA (Features, IOB architecture, and CLB/Slice architecture), Overview of Artix-7 FPGA.

Unit V: Logic Synthesis with Verilog

Synthesizable Verilog: Synthesis rules, Functions and tasks in Verilog, Non-synthesizable constructs, Coding styles, Modeling finite state machines, Data path and controller design, Modeling memory and register bank.

Unit VI : Case Study (Pipelined Processor design)

Basics of pipelining, Pipeline modeling, Pipeline implementation of a processor, Verilog modeling of a processor.

Text Book :

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson.

Reference Books and Material :

1. Jayaram Bhasker, "A Verilog HDL Primer", Star Galaxy Publication.
2. Jayaram Bhasker, "Verilog HDL Synthesis: A Practical Primer", Star Galaxy Publication.
3. Spartan-3E FPGA family data sheet.
4. Artix-7 FPGA data sheet.

List of Experiments: (Any 8)

To write Verilog design and testbench code to simulate, synthesize, and implement design on FPGA.

1. 3 bit full adder.
2. 4:1 Multiplexer.
3. 4-bit up/down counter with output displayed on 7-segment display.
4. Basic ALU (any two logical and any two arithmetic operations).
5. Traffic Signal controller.
6. 4 bit shift register.
7. Random Access Memory (RAM).
8. Sequence detector.
9. Parity checker.
10. Modeling using user defined primitive and switch level modeling to implement a given function (Not synthesizable).

SCE: To write Verilog model for digital designs and verify it by simulation.

ETUA31205C: Information Theory and Coding Techniques

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3hrs./week Tutorial (T): - Practical (P):2hrs/week	20	20	20	40	25	-	125

Prerequisite: Readers/students are expected to know the following concepts:

1. Basics of Probability
2. Basics of Digital Communication
3. Basics of signals and systems(only in a specific topic of convolution encoders)

Course Objectives:

- To equip students with the basic understanding of the fundamental concept of entropy and information theory.
- To understand the theoretical framework upon which error-control codes are built
- To understand the implications and consequences of fundamental theories and laws of information theory and coding theory with reference to the application in modern communication and computer systems
- To analyze performance of communication system with coding and modulation

Course Outcomes:

1. Apply appropriate source coding techniques for the given data
2. Calculate the channel capacity of simple noisy channels and interpret the result.
3. Design linear block codes using fundamentals of linear algebra.
4. Construct the encoder and decoder for systematic and nonsystematic cyclic codes for practical implementation.
5. Design BCH and RS codes for given specification.
6. Analyze the various representations of convolution encoder to encode the message and decode it with Viterbi decoding.

Unit- I: Information Theory and Source Coding

Introduction **to probability, law of total probability, Bayes theorem**, information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm (LZW, LZ77), Arithmetic coding ,Run Length Encoding, JPEG, MPEG (as case studies for compression)

Unit –II: Information Capacity and Channel Coding

Discrete memory less channel, Mutual information, Channel capacity, types of channels, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Implications of information capacity theorem

Unit III: Linear Block Codes

Linear Block Codes : Generator matrix, parity check matrix, Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code, Interleaved code

Unit IV: Cyclic Codes

Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial,

Description of Cyclic Codes, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes, Circuit implementation of cyclic code.

Unit V: BCH and RS Codes

Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code, CRC code, FEC and ARQ systems

Unit VI: Convolutional Codes

Introduction of convolution code, State diagram, Polynomial description of convolution code, Generator matrix of convolution code, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding, Known good convolution code, Introduction to LDPC and Turbo codes, Introduction and concept of Trellis coded modulation (TCM)

Applications of coding in recent technologies (Infiniband, PCI express for clock recovery, maintain DC balance), applications in block chain, stock market, **Ethernet receiver**

Text Books :

1. Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication, 2nd Edition
2. J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition.

Reference Books :

1. Bernad Sklar, "Digital Communication Fundamentals & applications", Pearson Education. Second Edition.
2. Simon Haykin, "Communication Systems", John Wiley &Sons, Fourth Edition.
3. Shu Lin and Daniel J Cistellojr., "Error control Coding" Pearson, 2nd Edition.
4. Todd Moon, "Error Correction Coding : Mathematical Methods and Algorithms", Wiley Publication
5. Khalid Sayood, "Introduction to Data compression", Morgan Kaufmann Publishers

Information Theory and Coding Techniques (List of Practical)

1. Write a program for determination of various entropies and mutual information of a given channel. Test various types of channel such as a) Noise free channel. b) Error free channel c) Binary symmetric channel d) Noisy channel Compare channel capacity of above channels.
2. Write a program for generation and evaluation of variable length source (Huffman)
3. Write a Program for coding & decoding of linear block codes.
4. Write a Program for coding & decoding of cyclic codes.
5. Write a program for coding and decoding of convolutional codes
6. Write a program for coding and decoding of BCH and RS codes.
7. Write a program to study performance of a coded and uncoded communication system (Calculate coding gain, error probability, Bit energy vs. error performance)
8. Write a simulation program to implement ARQ techniques

Note: Perform any 6 practical Assignments out of 8

ETUA31205D: Embedded Processors

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Readers/students are expected to know the following concepts:

1. Digital Electronics,
2. Microntrollers
3. Fundamentals of programing language

Course Objectives:

- To study 32-bit architecture for an application design and implementation
- To impart philosophy of ARM core evolution
- To explore ARM7 and ARM CORTEX architecture and its impact on embedded solutions.
- To use tool chain for ARM based microcontroller software
- To design and implement software components for hardware initialization and programming.
- To impart knowledge of Multicore architecture in microcontroller

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Recognize ARM 7 architecture to provide optimal solution for embedded system.
2. Identify ARM 7 based controller features for application functionality.
3. Understand and experiment an embedded application with ARM-7 architecture.
4. Distinguish Cortex architecture philosophy and features from its predecessor
5. Develop an embedded application with Cortex M3 architecture.
6. Recognize fundamentals of Multicore Microcontrollers towards an application.

Unit I: ARM processor philosophy and evolution

Introduction to ARM processors and its versions, ARM7, ARM9& ARM11 features, advantages&suitability in embedded application, ARM7 data flow model, programmer's model, modes ofoperations, Instruction set, programming in assembly language

Unit II: ARM based Microcontroller

ARM7 Based Microcontroller LPC22xx: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider), Memory Map, GPIO, Pin Connect Block, timer.

Unit III: Application development with ARM7 Based Microcontroller

Interfacing the peripherals to LPC22XX: LED, LCD, GLCD, KEYPAD, GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip DAC forwaveform generation

Unit IV: ARM CORTEX Processor

Introduction to ARM CORTEX series, improvement over classical series and advantages for embeddedsystem design. CORTEX A, CORTEX M, CORTEX R processors series, versions, features, andapplications. Need of operating system in developing complex applications in embedded system,desired features of operating system & hardware support from processor, Firmware development usingCMSIS standard for ARM Cortex. Survey of CORTEX M3 based controllers, its features andcomparison.

Unit V:ARM CORTEX M3 based Microcontroller

ARM-CM3 Based Microcontroller LPC1768: Features, Architecture, System Control, Clock & Power Control, GPIO, Pin Connect Block, interfacing with RGBLED, Seven Segment, TFT Display, MOTOR control using PWM.

Unit VI: Multicore Microcontroller

Introduction to multicore microcontrollers, Selecting a multicore microcontroller development board, Example architecture (STM 32H745), Application design method with multicore microcontroller architecture.

Text Books:

1. Andrew Sloss, Dominic Symes, Chris Wright, ―ARM System Developer's Guide –Designing and Optimizing System Software‖, ELSEVIER
2. Joseph Yiu, ―The Definitive Guide to the ARM Cortex-M‖, Newness, ELSEVIER
3. https://www.st.com/en/microcontrollers-microprocessors/stm32h7

Reference Books:

5. 1. ARM architecture reference manual : - www.arm.com
   2. Trevor Martin, An Engineer's Introduction to the LPC2100 series, Hitex (UK) Ltd.
   3. https://www.st.com/resource/en/application_note/an5361-getting-started-with-projects-based-on-dualcore-stm32h7-microcontrollers-in-stm32cubeide-stmicroelectronics.pdf

List of Experiments:

I. LPC2148 ARM7 based programming

1. Interfacing LPC2148 to 16X2 LCD /128X64 dots GLCD
2. Interfacing LPC2148 UART module with GPS/ GSM
3. Interfacing LPC2148 in-built ADC for respective channel on interrupt basis.

II. LPC1768 Cortex based programming

4. Interfacing LPC1768 to seven segment/ RGB LED.
5. Interfacing LPC1768 to DC motor and control using PWM signal.
6. Interfacing LPC1768 to TFT display.Develop an application based on linear and non linear data structures.

III .STM32H7545 based programming

7. Setting up Programming environment for STM32H7545
8. IoT application design and development using STM32H7545

SCE: (Statement):

Design and development of an application (IoT/Lightning/Control/Compute/Communication) using LPC 2148/LPC 1768/ STM32H7545 based microcontroller.

Note: Application must use at least 04 on chip facilities /devices.

ETUA31206: Project-I

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 1hr./week Tutorial (T): - Practical (P):2hrs/week	--	--	--	--	--	25	25

Prerequisite: Students are expected to know the concepts studied in following courses: 1.Engineering Circuit Analysis
2.Electronics Workshop
3. Microcontroller and Applications

Course Objectives:

- To interpret the Project Development Process including budgeting through Project.
- To utilized EDA tools for development of Project and write Technicaldocumentation

Course Outcomes: At the end of this course, students will demonstrate the ability to
1. Planed Project according to Project development cycle.
2. Select EDA tools for designing, simulating the project and prepare technical documentation.

Unit- I: Project Development Cycle

Various domains, Project Selection, Project time line, Literature survey, Feasibility of project, Formulation of project definition and objectives, Detailed specifications of project, Block diagram, Synopsis guidelines. Various hardware platforms, Power Budget, Hardware design canvas, Module based design, Design process, Component selection and validation using datasheet, Selection criteria, Circuit diagram.

Unit- II: EDA Tools and Documentation

Simulation, EDA Tools, Various software development Algorithm/Flowchart guidelines, PCB design principles, PCB design rules, PCB specifications, PCB artwork,Layout of documentation, Manufacturing documentation, project team visibility and accountability ,Bill of material, Project Report Format.

Text Books:

1.Kim Fowler," Electronic Instrument Design" Oxford university press.
2.Thomas C Hayes, Paul Horowitz, "The Art of Electronics", Newens Publication

Guidelines for Mini Project

A:Project group shall consist of not more than 3 students per group.
· Mini Project Work should be carried out in the Projects Laboratory.
· Project designs ideas can be referred from recent issues of electronic design magazines, or application notes from well-known device manufacturers.
· Use of Hardware devices/components is mandatory.
· PCB Layout versus schematic verification is mandatory.
· Assembly of components and enclosure design is mandatory.
B: Following are the Domains for the mini projects but not limited to:
. Embedded Systems
. Power Electronics
. Biomedical Electronics

. Mechatronic System
· Instrumentation Systems
· Electronic Communication Systems

C: Following Activities should be completed in Project Laboratory:
1: Formation of groups, Finalization of mini project & distribution of task.
2: Circuit Design, PCB design using an EDA tool, Simulation.
3: PCB manufacturing through PCB Manufacturer, Hardware assembly and soldering, programming (if required), Testing, Enclosure Design, Fabrication etc
4: Testing of final project, Checking & Correcting of the Draft Copy of Project Report
5: Final Demonstration and Group presentations of Mini Project.

ETUA31207: Intellectual Property Rights							
Teaching Scheme	**Examination Scheme**						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 2 hrs./week Tutorial (T): - Practical (P): -	-	-	50	-	-	-	50

Course Objectives:

- Explain the importance of ideas, concept and creativity
- Transfer the knowledge about the IPR required for Engineer's
- Describe the how IPR creates National wealth
- Teach National and International IP System

Course Outcomes:

- Infer that tomorrow's world will be ruled by ideas, concept, and creativity
- Summarizing about Intellectual Property Rights which are important for students of engineering as they are tomorrow's technocrats and creator of new technology.
- Discover how IPR are regarded as a source of national wealth and mark of an economic leadership in context of global market scenario.
- Analyze national & International IP system.

Unit I:

Introduction to the concepts Property and Intellectual Property, Nature and Importance of Intellectual Property Rights, Objectives of understanding Intellectual Property Rights ,IPR and IITs.

Unit II:

Understanding the types of Intellectual Property Rights: - Patents, Designs, Trademarks (Registered and unregistered trademarks), Copyright, Traditional Knowledge, Geographical Indications, Trade Secrets, Idea Patenting, (Case Studies)

Unit III:

New Developments in IPR, Process of Patenting and Development: technological research, innovation, patenting, development, International Scenario: WIPO, TRIPs, Indian Patent Office and its Administration.

Unit IV:

Administration of Patent System – Patenting under Indian Patent Act, Patenting under PCT ,Patent Rights and its Scope, Licensing and transfer of technology, Patent information and database. Provisional and Non Provisional Patent Application and Specification

Text Books:

1. Resisting Intellectual Property by Halbert, Taylor& Francis Ltd ,2007.
2. Industrial Design by Mayall, Mc Graw Hill.
3. Intellectual Property in New Technological Age by Robert P. Merges, Peter S. Menell, Mark A. Lemley

Reference Books :

1. Intellectual Property Rights under WTO by T. Ramappa, S. Chand
2. Introduction to Design by Asimov, Prentice Hall

Semester VI

ETUA32201:Computer Networks and Security

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P): 2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:*(can be covered in Induction Programme)*

3. Data Communications, Topology, Networking, Network categories
4. Protocol layering, layers in OSI reference model, TCP / IP protocol suite, and Addressing,
5. Guided and Unguided Transmission media,
6. Switching: Circuit switched networks, Packet Switching.

Course Objectives:

- To understand state-of-the-art in network protocols, architectures, and applications
- To provide with a theoretical and practical issues in computer networks
- To outline the basic network configurations
- To discuss the transmission methods underlying LAN and WAN technologies.
- To explain security issues involved in LAN and Internet.

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

1. Understand fundamental principles of computer networking
2. Describe the hardware, software, components of a network and their interrelations.
3. Specify services and deficiencies in existing protocols, and use of new protocols.
4. Acquire the basic knowledge of the use of cryptography and network security.
5. Explain Virtual Private Network and Access Control Server Protocol
6. Idetify security threats and understand use of Intrusion Detection and prevention System (IDS/ IPS)

Unit-I: Network Layer Protocol and Addressing

Network Layer Protocol: ARP, RARP, IGMP, IPv4, IPv6, ICMPv4, ICMPv6
IP Addressing: Classful and Classless Addressing

Unit-II: Switching and Routing

Switching: Frame, Hub, Bridge, Collision Domain, Broadcast Domain, Spanning Tree Protocol
Routing: RIP, OSPF, BGP, EIGRP

Unit-III: Protocol

Transport layer: UDP, TCP, SCTP (Connection Oriented and Connectionless Protocol)

Unit-IV: Services

Application layer: WWW, HTTP/ HTTPS, SMTP, DNS, DHCP, FTP/ TFTP

Unit-V: Virtual Private Network and Access Control Server Protocol

VPN: IPsec, SSL

ACS Protocol: Radius, TACACS, AAA

Unit-VI: Security ,Threats and Intrusion Detection System (IDS/ IPS)

Security Basics - Confidentiality, Integrity, AvailabilityIntrusion Alert: Interruption, Interception, Modification, Fabrication, Access Control List (ACL) and NAT, Types of attack: Denial of service (DOS), backdoors and trapdoors, sniffing, spoofing, man in the middle, replay, TCP/IP Hacking, Phishing attacks, Distributed DOS, SQL Injection. Malware : Viruses, Logic bombsIntruders, Intrusion detection systems (IDS): host based IDS, network based IDS, logical components of IDS, signature based IDS, anomaly based IDS, network IDS components, advantages and disadvantages of NIDS, host based IDS components, advantages and disadvantages of HIDS.

Text Books :

1. Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill,5thEdition
2. James F. Kurouse& W. Rouse, "Computer Networking: A Top down Approach", 6thEdition, Pearson Education.

Reference Books :

1. CCNA Security 200-300
2. Wayne Tomasi, "Introduction to Data Communication and Networking", 1/e, Pearson Education

List of Experiments

1. Study of IP Addresses Subnetting and CIDR
2. Installation of Protocol/ Packet Analyzer Tool and analysis of Network Traffic
3. Assignment on LAN & WAN simulation using Network simulator Tool.
4. Installation and configuration of Web Server, FTP server Installation and configuration of Web Server, FTP server
5. Lab assignment on Switching and Routing (based on Spanning Tree Protocol)
6. Lab assignment based on VPN
7. Case studies on Security Threats and Intrusion Detection System (IDS/ IPS)

ETUA32202: Power Electronics and Drives

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:

1. Semi-conductor Devices and Circuits
2. Basics of Electrical Engineering

Course Objectives:

- To study characterization of different power devices through its construction, operations and triggering / driving circuits.
- To understand power conversion, its driving and control mechanism
- To analyze different power converters for variety of loads.
- To apply knowledge of devices, converters and load characteristics to select / configure applications

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

1. Explain the construction and working of power semiconductor devices like SCR, MOSFET, and IGBT
2. Analyze and compare the performance of different controlled AC-DC power converters for different types of loads.
3. Analyze and compare the performance of DC-AC power converters for R and R-L loads.
4. Analyze and compare the performance of different DC-DC power converters for R and R-L loads
5. Apply the concept of power electronics for different applications such as different DC drives etc.
6. Apply the concept of power electronics for different applications such as different AC drives etc.

Unit- I: Introduction to Power Devices Objective and scope of subject.

Power Conversion Cycle, Construction, Steady state & Switching characteristics of SCR. SCR ratings: IL, IH, VBO, VBR, dv/dt, di/dt, surge current & rated current. Gate characteristics, Gate drive requirements, Construction, Steady state and switching characteristics and ratings of Power MOSFET & IGBT. Gate drive requirements, gate drive circuits for Power MOSFET / IGBT.

Unit –II: Line Commutated Converters.

Concept of line & forced commutation (Class A-E), Single phase Semi & Full converters for R, R-L loads, Performance parameters, Effect of freewheeling diode, Three phase Semi & Full converters for R load. Simulation of converters using P-Sim software.

Unit III: DC-AC Converters

Single phase bridge inverter for R and R-L load using MOSFET / IGBT, performance parameters. Different PWM techniques, single phase PWM inverters. Three phase Voltage Source Inverter (VSI) for balanced star R load. 120 and 180-degree mode of operation. Concept of harmonics, reduction techniques.

Unit IV: DC-DC converters & AC Voltage Controller

Working principle of buck and boost converters, control strategies, working with R, RL, highly inductive loads. Performance parameters, 2-quadrant & 4-quadrant (multi-phase) choppers,

SMPS: - Types i.e. half bridge, full bridge, fly-back convertors, comparison with LPS.

Single-phase full wave AC voltage controller with R and R-L load. Applications of Choppers and AC voltage controllers

Unit V: Power Electronics Applications&DC motor drives

On-line and OFF line UPS with battery.

DC motor drive: Single phase separately excited DC motor drive. Simulation of drive circuit using P-sim software.

Introduction, Basic Characteristics of DC Motors, Operating Modes.

Single phase drives. Single Phase Semi Converter Drives, Single Phase Full Converter Drives, Single Phase Dual Converter Drives, DC-DC Converter Drives, Principle of Regenerative Break Control,

Two & Four Quadrant DC-DC Converter Drives

Unit VI :Resonant Converters & AC Drives

Protection of Power Devices & Circuits Need for resonant converters, SLR half bridge DC/DC converter in low frequency, Introduction of zero current switching (ZCS) and zero voltage switching (ZVS) resonant converters. AC DRIVES: Introduction, Performance Characteristics, Rotor Voltage Control, Frequency Control, Voltage and Frequency Control, Current Control, Voltage, Current and Frequency Control, Closed Loop Control of Induction Motors. Synchronous Motor Drives

Text Books:

1. M. H. Rashid, "Power Electronics circuits devices and applications", PHI 3rd edition, 2004 edition, New Delhi.
2. R. W. Erickson, Fundamentals of Power Electronics, Kluwer Academic Publishers,
3. M.D. Singh, K.B. Khanchandani, " Power Electronics", 2nd edition, TMH, New Delhi.

Reference Books:

1. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi.
2. Ned Mohan, T. Undeland& W. Robbins, "Power Electronics Converters applications and design" 2nd edition, John Willey & Sons, Singapore.
3. M. S. Jamil Asghar, "Power Electronics", PHI, 2004, New Delhi
4. GE SCR MANUAL, 6th edition, General Electric, New York, USA.
5. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi.

List of Experiments:

List of Experiments – Perform any EIGHT of following

0. Introduction to different devices, understand ratings and interpretation of datasheets.

1. Characteristics of SCR

a. Plot V-I characteristics,

b. Observe the effect of gate current b. Measure IH & IL

2. V-I Characteristics of MOSFET / IGBT

a. Plot output characteristics

b. Plot transfer characteristics

3. Single phase Semi converter with R & R-L load

a. Observe load voltage waveform,

b. Measurement of firing angle, average o/p voltage across loads,

c. Verification of theoretical values with practically measured values.

4. Single phase Full Converter with R & R-L load

a. Observe load voltage waveform,
b. Measurement of firing angle, average o/p voltage across loads,
c. Verification of theoretical values with practically measured values.

5. Single-Phase PWM bridge inverter for R load

Observe output r.m.s. voltage waveforms,

OR

Three phase inverter for R - load (120 and 180-degree mode of operation)

Observe the line voltage and phase voltage waveforms and harmonics.

6. **Step down dc chopper** using power MOSFET / IGBT. Measure duty cycle and observe effect on average load voltage for DC chopper.

7.Find load & line regulation of given SMPS.

8. Speed control of DC motor / stepper motor / ac motor (Any One of following)

a. Speed control of DC motor using armature voltage control / field control method. Measure RPM and plot graph of speed versus armature voltage and field current
b. Study drive circuit for stepper motor- phase sequencing and micro stepping
c. Plot speed-torque characteristic of three phase induction motor.

9. **To study over voltage / over current protection circuit.**

10. **Mini Project based on above syllabus** (SCE-**Any one of the following**)

a. SCR/TRIAC based fan regulator,
b. Light dimmer
c. 12V to 5V step down converter
d. 5V to 48 V step up converter
e. SCR based battery charger

11.Simulation of converter circuits using P-Sim software.

SCE: Statement is expt. No-10

ETUA32203: Wireless Networks

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:

7. Basics of Computer network.
8. Basics of Mobile Communication.

Course Objectives:

- To study the evolving wireless technologies and standards
- To understand the architectures of various access technologies such as 3G, 4G,5G and WiFi etc.
- To understand various protocols and services provided by next generation networks.

Course Outcomes: At the end of this course, students will demonstrate the ability to

7. To apply concepts of the transmission of voice and data through various networks
8. To apply wireless trends in communication field.
9. To apply latest wireless technologies.
10. To analyze differentWiFi services in different generations.
11. To apply different Mobile services in different generations.
12. To apply knowledge of network security protocols and their countermeasures.

Unit I : Introduction to Wireless Networks

Introduction, Technology and service trends of Emerging Wireless technologies, The Amazing Growth of Mobile Communications, A Little History, Mobile Communications Fundamentals, Mobile Data, WiFi, Bluetooth, Cable Systems, Wireless Migration Options, Harmonization Process.

Unit II: WiFi and Next Generation WLAN

WiFi (802.11), Family of Wireless LAN Standards and Details (IEEE 802.11; a,b,g,n,ac,ad,af,ad,ax and introduction to 802.11be), WiFi Protocols, Frequency Allocation, Modulation and Coding Schemes, Network Architecture, Typical WiFi Configurations, Security, 802.11 Services, Hot Spots, Virtual Private Networks (VPNs), Mobile VPN, VPN Types, WiFi Integration with3G/4G, Benefits of Convergence of WiFi and Wireless Mobile.

Unit III: Third Generation Mobile Services

Introduction, Universal Mobile Telecommunications Service (UMTS), UMTS Services, TheUMTS Air Interface, Overview of the 3GPP Release 1999 Network Architecture, Overview ofthe 3GPP Release 4 Network Architecture, Overview of the 3GPP Release 5, All-IP NetworkArchitecture, Overview CDMA2000, TD-CDMA, TD-SCDMA, Commonality among WCDMA,CDMA2000, TD-CDMA, and TD-SCDMA

Unit IV : LTE

LTE Ecosystem, Standards, Radio Spectrum, LTE Architecture, User Equipment (UE),Enhanced Node B (eNodeB), Core Network (EPC), Radio Channel Components, TD-LTE, Multiple Input Multiple Output,

LTE Scheduler, Carrier Aggregation, Cell Search, Cell Reselection, Attach and Default Bearer Activation, Handover (X2, S1, Inter-MME), Self-Organizing Networks (SONs), Relay Cells, Heterogeneous Network (Het NET), Remote Radio Heads (RRH), VoLTE, LTE Advanced

Unit V : Introduction to 5G Network

Introduction, Requirement of 5G, 5G overview of standardization and regulation, ITU-R activities from 3G to 5G, 5G and IMT-2020, 3GPP standardization,5G NR new Radio and its frequency bands

Unit VI : Wireless Network Security

Introduction, How Wi-Fi works, WEP, Technique of hacking wireless network, countermeasure

Text Books :

1. Clint Smith, P.E., Daniel Collins, "Wireless Networks: Design and Integration for LTE,EVDO, HSPA, and WiMAX", McGrawHill Education, Third Edition
2. EldadPerahia, Robert Stacey, "Next Generation Wireless LANs", Cambridge University Press, Second Edition.
3. William Stallings, "Network Security Essentials Applications and Standards", 5th Edition, Pearson publication

Reference Books :

1. Yi-Bang Lin, ImrichChlamtac, "Wireless and Mobile Network Architecture", Wiley India Edition.
2. DipankarRaychaudhary, Maria Gerla, "Emerging Wireless Technologies and the Future Mobile Internet", Cambridge University Press.
3. Erik Dahlman Stefan Parkvall Johan Skold, "5G NR: The Next Generation Wireless Access Technology" 1st Edition, Elsevier Publication

List of Experiments:

1. Study of different wireless network components and features (Details of any one feature used for Mobile Security Apps).
2. To configure Wireless network using packet tracer.
3. Establish Wireless connection using access points.
4. Study Wireless router configuration.
5. To configure IOT based smart home.
6. Study, analyze and compare the 3G, 4G and 5G Smart Phone system.

SCE: (Statement)

1. Certification of Cisco in packet tracer
2. Study and implement Mobile security: threat, vulnerabilities and its counter measures.

ETUA32204A: Software Engineering

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3hrs./week Tutorial (T): - Practical (P): 2hrs/week	20	20	20	40	25	-	125

Prerequisite: Students are expected to know the concepts studied in following courses: 1. Basics of Programming
2. Data Structure

Course Objectives:

- To study the stages in a software development cycle.
- To know fundamental concepts of software requirements and analysis.
- To understand the various software design methodologies
- To learn various testing of software development
- To understand project management through life cycle of the software project

1. **Course Outcomes:** At the end of this course, students will demonstrate the ability to Compare and chose a process model for a software project development.
2. Identify unique features of various software application domains
3. Analyze requirements of a software development
4. Apply design and quality attributes in software development
5. Design test cases of a software system
6. Identify risk of the project, manage and configure software projects.

Unit- I: Introduction to Software Engineering

Software Engineering Fundamentals: Nature of Software, Software Engineering Principles, Software Process, Software Myths. **Process Models:** A Generic Process Model, Prescriptive Process Models: The Waterfall, Incremental Process , Evolutionary Process, Unified Process, Concurrent

Unit- II: Advanced Process Models & Tools

Agile software development: Agile methods, Plan-driven and agile development, Extreme programming Practices, Testing in XP, Pair programming. Introduction to agile tools: JIRA, Kanban, **Case Studies:** An information system (mental health-care system), wilderness weather system

Unit –III: Software Requirements Engineering& Analysis

Requirements Engineering:User and system requirements, Functional and non-functional requirements, Types & Metrics, A spiral view of the requirements engineering process. Software Requirements Specification (SRS):The software requirements Specification document, The structure of SRS, Ways of writing a SRS, **Case Studies:** The information system case study - Mental health care patient management system (MHC-PMS).

Unit IV : Design Engineering (

Design Process & quality, Design Concepts, The design Model, Pattern-based Software Design. **Architectural Design: Design** Decisions, Views, Application Architectures, Modelling Component level

Design:component, Designing class based components**, User** Interface Design:The golden rules, Interface Design steps & Analysis.**Case Study:** Web App Interface Design

Unit V: Software Implementation & Testing

Structured Coding Techniques, Coding Styles, Coding Standards & Guidelines, Introduction to Software Testing, Principles of Testing, Testing Life Cycle, Phases of Testing, Types of Testing, Verification & Validation, Defect Management, Defect Life Cycle, Bug Reporting, GUI Testing

Unit VI: Project Management

Project Management Concepts: The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Project Scheduling: Scheduling with time-line charts, Schedule tracking Tools, Project Risk Management: Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification.

Text Books:

2. Roger Pressman, "Software Engineering: A Practitioner's Approach", Mcgraw Hill
3. Ian Sommerville, "Software Engineering", Addision and Wesley

Reference Book :

1. Rajib Mall, "Fundamentals of Software Engineering, Prentice Hall India

List of Experiments:

1. Configure software requirements in JIRA or Kanban tool and monitor the progress of the project.
2. Write Software Requirement Specifications for Mental health care patient management system
3. Apply golden rules of web interface design on any web application
4. Prepare test cases for any software application
5. Prepare project schedule for any application using any project scheduling tool.
6. Identify the risks involved in your developed software application and prepare RMMM plan for the same.

ETUA32204B: CMOS IC Design

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3 hrs./week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:

2. MOSFET
3. Digital System Design

Course Objectives:

- To get acquainted with CMOS IC fabrication technology.
- To nurture students with digital CMOS circuits and layout designs.
- To realize importance of delay and power dissipation in VLSI circuits.
- To build building blocks for a data path of a processor.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Model MOS transistor and understand static and dynamic behavior of the transistor.
2. Understand CMOS IC fabrication process.
3. Design combinational CMOS circuits for optimized area and speed.
4. Know the trade-off between delay and power dissipation.
5. Use techniques, skills, and modern engineering tools necessary for design and simulation of CMOS circuits and layouts.
6. Build building blocks of the system with design trade-offs.

Unit I : MOS Transistor Theory

Introduction, The MOS Transistor under Static Conditions: The Threshold Voltage, Resistive Operation, The Saturation Region, Channel-Length Modulation, Velocity Saturation, Subthreshold Conduction, MOS Transistor Capacitances, CMOS Latchup, SPICE Models for the MOS Transistor

Unit II: Manufacturing CMOS Integrated Circuits

Silicon wafer processing, Photolithography, Oxidation, Diffusion and Ion implantation, Deposition and Etching, Fabrication process flow

Unit III: Combinational Circuit Design

Static CMOS: CMOS inverter, DC transfer characteristic, CMOS NAND and NOR gates, Compound gates, Transistor sizing, Layout design rules, Stick diagram and layout design, Pass transistor and Transmission gate circuits.

Unit IV: Delay Models and Power Dissipation

Delays: RC delay model, Linear delay model, Logical effort, Parasitic delay, Power Dissipation: Sources of power dissipation, Dynamic power, Static power, The Power-Delay product,**Energy-Delay Product,** Technology scaling

Unit V: Sequential Circuit Design

Static versus Dynamic Memory, Latches versus Registers, Static Latches and Registers: The Bistability Principle, SR Flip-Flops, Multiplexer-Based Latches, Master-Slave Edge-Triggered Register, Dynamic Latches and Registers: Dynamic Transmission-Gate Edge-triggered Registers, True Single-Phase Clocked Register (TSPCR)

Unit VI: Designing Arithmetic Building Blocks

Datapaths in Digital Processor Architectures, Static CMOS Full Adder, Transmission Gate Full Adder, The Array Multiplier, Carry Save Multiplier, Wallace-Tree Multiplier Barrel Shifter, Logarithmic Shifter

Text Book :

1. Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic, "Digital Integrated Circuits: A design perspective," 2nd Edition, Pearson.
2. Sung-Mo Kang and Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design," TMH.

Reference Book :

1. Neil H. E. Weste, David Money Harris, "CMOS VLSI Design: A Circuit & System Perspective," 4th Edition, Pearson.

List of Experiments:

(A) To do SPICE modeling of following circuits at selected technology node.

1. NMOS and PMOS transistor characterization.
2. CMOS inverter.
3. 2-input CMOS NAND and NOR gate.
4. D Flip-flop

(B) To prepare CMOS layout in selected technology, simulate with and without capacitive load.

1. CMOS inverter.
2. 2-input CMOS NAND and NOR gate.
3. 2:1 multiplexer using transmission gates.
4. D Flip-flop

SCE: Mini Project/Seminar

ETUA32204C:Mobile Computing

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3hrs/week Tutorial (T): - Practical (P): 2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:
Analogue and Digital Communication

Course Objectives:

- To learn about various wireless & cellular communication networks and various telephone and satellite networks.
- To build knowledge on various adhoc and sensor networks routing protocol and energy efficient protocol.
- To build skills in working with Cognitive radio networks and recent telecommunication networks
- To design and development of various network protocol using simulation tools.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Understand the working principles of mobile networks and Contrast different types of telecommunication networks.
2. Study on location, handoff management and wireless fundamentals.
3. Study on MANET and Sensor networks including architecture, routing and power optimization technique.
4. Study on cognitive ratio networks and its applications.
5. Assess the recent telecommunication networks, resource management
6. Study of various wireless network protocols using simulation tools

Unit I: Fundamentals Wireless communication

Introduction to narrow and wideband systems; Spread spectrum; Frequency hopping; Introduction to MIMO; MIMO Channel Capacity and diversity gain; Introduction to OFDM; MIMO-OFDM system; Multiple access control (FDMA, TDMA, CDMA, SDMA); Wireless local area network; Wireless personal area network (Bluetooth and zigbee)

.

Unit II: Location and handoff management

concepts on cellular architecture; location management Mobility models characterizing individual node movement Mobility models characterizing the movement of groups of nodes; and Dynamic location management schemes Terminal; Location management and Mobile IP; Overview of handoff process and performance evaluation metrics

Unit III: Mobile Ad-hoc networks

Characteristics and applications; Coverage and connectivity problems; Routing in MANETs.

Unit IV: Wireless sensor networks

Concepts, basic architecture, design objectives and applications; Sensing and communication range; Coverage and connectivity; Sensor placement; Data relaying and aggregation; Energy consumption; Clustering of sensors; Energy efficient Routing (LEACH).

Unit V: Cognitive radio networks

Fixed and dynamic spectrum access; Direct and indirect spectrum sensing; Spectrum sharing; Interoperability and co-existence issues; Applications of cognitive radio networks.

Unit VI: D2D communications in 5G cellular networks

Introduction to D2D communications; High level requirements for 5G architecture; Introduction to the radio resource management, power control and mode selection problems; Millimeter wave communication in 5G, Recent Trends

Text Books:

1. Jochen Schiller, Mobile Communications. Pearson Education, 2009.
2. Andrea Goldsmith, Wireless Communications. Cambridge University Press, 2012.

Reference Books:

1. Ivan Stojmenovic, Handbook of Wireless Networking and Mobile Computing, Wiley, 2002.
2. Ezio Biglieri, Andrea J. Goldsmith, Larry J. Greenstein, Narayan Mandayam and H. Vincent Poor,
3. Principles of Cognitive Radio. Cambridge University Press, 2012.

Lab Experiments

Study of different wireless network protocols using network simulators such as NS2/NS-3 /OMNET++.

ETUA32204D: Biomedical Instrumentation

Teaching Scheme	Examination Scheme						
Credits: 4	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 3hrs/week Tutorial (T): - Practical (P):2 hrs/week	20	20	20	40	25	--	125

Prerequisite: Readers/students are expected to know the following concepts:
Basic electronic systems, basics of biology

Course Objectives:

- To understand the basic theory of biomedical signals and study of different sensors used to acquire these signals
- To understand various noise and artifacts in measurement of biomedical signals
- To study Human Physiological Systems from Engineering Perspectives
- To study major health care devices currently used in medical field
- To understand use of bio signals in diagnosis, patient monitoring and physiological investigation
- To apply basic engineering methods in designing and building of innovations in medical field.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Understand the basics of biomedical signals, resemble biological process in terms of electronic process.
2. Understand physiology and anatomy of cardiovascular system and method of acquisition and recording of ECG signal.
3. Apply knowledge of various EEG patterns for diagnosis of neural disorders.
4. Design a biomedical system for acquisition and processing of ECG signals.
5. Understand the principle and working of various medical devices
6. Understand the application of the electronic systems in biological and medical applications

Unit- I : Biomedical Signals

Bioelectric Signals and Electrodes: Bio-potentials and their origin: ECG, EEG, EMG, ENG,ERG, EOG, MEG. Classification of biomedical signals, Biomedical Instrumentation System (man-machine interface), biomedical transducers, electrodes and their characteristics. Sources and contamination of noise in bio-signals, Motion artifacts and skin Impedance.

Unit –II : Cardio Vascular System

Cardiovascular system: Coronary and Peripheral Circulation, Electrical Activity of the heart, Lead configurations , ECG data acquisition, ECG recorder, Heart Sounds and Murmurs

Unit III: Central Nervous System

Nervous System, Structure and functions of Neurons, Electrical activity of nerve cell, Synapse, Reflex action and Receptors.Electroencephalogram – Structure of brain, EEG signal acquisition,10-20 electrode placement, EEG rhythms & waveform - categorization of EEG activity - recording techniques – EEG applications- Epilepsy, sleep disorders, brain computer interface. Use of Fourier Transform in EEG Signal Analysis.

Unit IV:Biomedical Instrumentation: Basics of Instrumentation Amplifier, Isolation amplifier, Right leg drive mechanism, Design of ECG amplifier, Grounding and shielding techniques, filter design for removal of noise and artifacts.

Unit V : Medical devices:
Blood Pressure measurement, Pulse Oximeter, Life saving Devices: Pacemakers and Defibrillators, Bedside Monitors, heart lung machine, artificial kidney.

Unit VI : Biomedical innovations
Case studies: Prostheses (Jaipur Foot factory), Smart-cane for blind, Bempu wristlet designed for babies, Innovations by young entrepreneurs in medical field.

Text Books :

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology",4th Edition, Prentice Hall, 2000.
2. R.S.Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003, Edition-II.

Reference Books :

1. J.G. Webster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
6. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.

Biomedical Electronics (Practicalminimum 6 to be performed)

1. A study of biomedical transducers available commercially, exploring the detailed characteristics (can use internet search engines for acquiring literature)
2. Design of an ECG amplifier for acquiring ECG signal
3. Study of ECG recorder and acquisition of ECG signals with various lead configurations
4. Study of digitized ECG signal (readily available at http://physionet.org), expected to observe spectrum, and time domain characteristics like peak amplitudes, identify fiducial points (P,Q,R,S,T,U) (usage of MATLAB expected)
5. Study of EEG recorder and acquisition of EEG signals using 10-20 electrode placement system
6. Study of BP measurement system using Sphygmomanometer /and automatic BP machine
7. Design and implementation of Pulse amplifier.
8. Studyof a defibrillator/pacemaker as per given specifications.
9. Model a biomedical system for measurement of any bio-signal like body temperature/bio-impedance/respiration/any other

Note: Use of Multisim/ORCAD PSpice/Proteus or any SPICE based simulation program can be made for initial design and verification

ETUA32205D:ManagementInformationSystem

TeachingScheme	ExaminationScheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture(L):3hrs./weekTutorial (T):- Practical(P): - -	20	20	20	40	-	-	100

Prerequisite: Readers/studentsareexpectedtoknowthefollowingconcepts:

1. BasicsterminologyofInformationTechnology/Internet/MSExcel,
2. EngineeringFundamentals
3. BusinessProcess/SupplyChainLifeCycle

CourseObjectives:

- TounderstandtypesofMISapplicationsinorganizations
- Tounderstandinformationsystemanditscomponents,itsassociationinbigpicture
- Toanalyzetherequirementofusersanddraftspecificationsofsystem
- Tostudydatabasesanditsimportanceinsystemandbusinessprocess
- Todevelopbroadunderstandingofethicsandcodeofconduct
- Tostudy processofdecisionmakinganditsphases

CourseOutcomes:

Aftercompletionofthiscoursestudentshouldbeableto

1. AppreciatewhatasupplychainisandwhatitdoesUnderstandtheroleofITinEngineeringandbusinessprocess
2. Describeabusinessprocessandlinkittoinformationsystem
3. ApplyMISconceptstoreachtodecisioninthetaskshe/sheundertake
4. Applyethicalpracticesinday-to-daylife

Unit-I:InformationTechnologyanditsImpact

InformationTechnology-
Definition,Data,Information,Knowledge,Dataflow,system,Apps.ITCapabilitiesandtheirimpactonIndustrial,Educational,BusinessandProfession.
Telecommunication andNetworks – Need, Basicsof networkingand internet,Concept of cloud and datacenters,VideoConferencingandvirtualmeetings
ITenabledservicessuchasCallCentres,GeographicalInformationSystems,ECommerce,etc.

Unit-II:InformationSystemAnalysisandDesign

Userrequirementanalysis,Feasibilitystudy,SoftwareDevelopment/Productdevelopmentlifecycle,systemsstudy andsystemsdesign,Resourceutilization,implementation,audit,operation,maintenance andmodification.

Unit–III:DatabaseManagementSystem

Introduction,Types,Advantagesusingdatabasemodels,Basicsofdatamodels,Queries,generatingareport,Excelas adatabasefortrendanalysis.

UnitIVFunctionalMIS: MISwithin functionalareas such asHuman Resources,Marketing& Sales,Production,Accounting&Finance,CustomerRelationshipsManagement(CRM),ProductSupplyChain Managementsystems,LogisticManagement,LearningManagementSystem

UnitV:DecisionSupportSystemandstrategicmanagement: Decisionssupportsystems,expertsystems,officeautomationsystemsandknowledge-basedsystems,Structureddecisionmaking,unstructureddecisionmakingandsemistructureddecisionmaking,Setting upStrategyfortheorganization/situation
UnitVI:EthicalandSocialIssuesinInformationSystems: MoraldimensionsofInformationAge,Conceptofresponsibility,accountability andliability,Professional codeofconduct,Informationrights:Privacyandfreedom,EthicalDilemma
TextBooks: 1. KennethC.Laudon&JaneP.Laudon,EssentialsofManagementInformationSystems,16thEdition,PearsonPrentice-Hall,2012.ISBN978-0132668552 AnalysisandDesignofInformationSystems,Rajaraman,PrenticeHall
ReferenceBooks: 1. ManagementInformationSystems,LaudonandLaudon,7thEdition,PearsonEducation 2. ManagementInformationSystems,DavisandOlson,TataMcGrawHill DecisionSupportSystemsandIntelligentSystems,TurbanandAronson,PearsonEducationAsia

IOEUA32205I: Industrial Automation

TeachingScheme	ExaminationScheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture(L):1 hr/weekTutorial(T):- Practical(P): 4 hrs/week	20	20	20	40	--	--	100

Prerequisite:

- Students will have PCs / laptops with ETH connection to connect to the PLC and will be able toinstall CODESYS there
- Basic knowledge of Electrical engineering of Programming of Network technology

Course Objectives:

- To enable the learner to understand the basic concepts involved in industrial automation so as to get its better and broader perspective and equip them to set up an automation system using ifm components.

CourseOutcomes:

After the successful completion of the course, the students should be able to

1. Illustrate the concepts of industrial automation
2. Design independently a typical automation system
3. Build an automation system based on ifm components
4. Execute the automation system built using PLC programming from Codesys environment
5. Demonstrate the functioning of the real time industrial automation systems

Introduction to Process Control System

Examples of typical types of process control systems, Block diagram representation of a process control loop and identification of elements such as Process, Error detector, Controller, Sensors etc. Study typical process control systems, understand the process mechanism

Types of relays,sensor and their characteristics

Different types of sensors and their operating principles, Basic Characteristics such as linearity, sensitivity, accuracy, resolution, hysteresis and reproducibility etc. Sensor time response.

Signal Conditioning

Necessity/purpose of signal conditioning with examples Types of signal conditioning such as analog and digital, Principles and Design guidelines with analog signal conditioning, Digital signal conditioning and data acquisition system.

Control System and controller principles

Overview of various types of control systems, stability, sensitivity and mitigation of the desired performance specifications with the controller. Types of controllers such as PID controller

PLC Basics and Programming

Block diagram of PLC with description of its various modules and their functions in brief, Basic overview of the various ways of PLC programming

Industrial Communication

Overview of field buses and communication systems :CAN + HLPs (CANopen, J1939, ISOBUS) , Profibus / Profinet, AS-I, (IOLink), OPC / OPC-UA, MODBUS. CAN: Introduction, History, Advantages/Benefits, Physical Layer. Physical connections. Signal processing. Termination

resistor: Data Link Layer. Data-Frame Structure, Bus arbitration, Concept of the message-oriented protocol, Easy Communication : Practical, Send and receive Layer 2 messages, Establish communication between 2 CAN Devices . Use of CANFox und first CAN Analysis o Higher Layer Protocols, Use of the identifiers in CANopen (COB-ID) , Services (PDO, SDO, EMCY, NMT). Advantages and Disadvantages. Profile ,Practical , Integration of the CANOpen sensor , Data processing.

SPS:First program on ifm control : Visualization Fundamentals. Practical: Create a Visualization with Codesys, I/O Handling o Symbolic addressing, Inputs and typical sensor types :Digital , Analog . Practical: Read input and process analogue and digital signals on ifm controller, Outputs: Digital, Analog. H-Bridge. Practical: Set all output modes and control suitable actuators on ifm controller.

HMIs: Fundamentals of HMI Design. Ergonomic design (should not be a big design course). Fundamentals of Software Architeture. Separation of data processing and visualization. Introduction to Camera and Optical Sensors, Practical, Create meaningful and intelligent visualization with full use of the display function, Ethernet UDP connection between display and control.

Functional Safety : Fundamentals and terms, Requirements of the european market: EN ISO 13849, EN62061. Typical applications, E-Stop , Secure Stop, Secure Position. Safety and Security.

Text Books :

1. Curtis D. Johnson, Process Control Instrumentation Technology, Pearson New International Edition .
2. Introduction to Industrial Automation" by Alok N. Verma and B. D. Nandwana

Reference Books :

1. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd Edition
2. Marco Di Natale, Haibo Zeng, Paolo Giusto, Arkadeb Ghosal, "Understanding and Using the Controller Area Network Communication Protocol"
3. Industrial Automation and Process Control" by Jon Stenerson and Mark Nixon
4. Automating Manufacturing Systems with PLCs" by Hugh Jack
5. Practical Industrial Data Networks: Design, Installation, and Troubleshooting" by Steve Mackay and Edwin Wright
6. High-Performance HMI handbook by Bill Hollifield

List of Experiments:

1. To study ifm network setup and Assembly(All Connections and overall orientation of hardware)
2. To implement CAN layer 2 Communication.
3. Design I/O Initialization and Interfacing LED/Lamp, Motor,Fan.
4. To implement CANOpen Communication with Sensors.
5. Design Visualization on display HMI Interface.
6. To Study used case of ifm (behavior model/Flow chart)

IOEUA32205J: Robotics and Application

Teaching Scheme	Examination Scheme						
Credits: 3	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 1 hr./week Tutorial (T): - Practical (P): 4 hrs./week	20	20	20	40	--	--	100

Prerequisite: Students are expected to know the concepts studied in following courses:

1. Microcontrollers and Microprocessors
2. Programming Language C, Python
3. Control System and Basic Electronics Fundamental

Course Objectives:

- To understand the basics of robotic system.
- To justify the use of sensors and actuators in robotic system.
- To study various hardware and software tools for developing robotic applications
- To develop small application based assignment using robotic system.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Explain and classify the type of robotic system.
2. Explain and classify the type of robotic architecture with its component.
3. Design the robotic drive for industrial robotic application.
4. Demonstrate simulation and programming for various robotic case studies.

Unit- I: Introduction to Robotic System(3Hrs)

Brief History, Basic Concepts of Robotics such as Definition , Three laws, Elements of Robotic Systems i.e. Robot anatomy, DOF, Misunderstood devices etc., Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc., Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

Unit- II: Grippers and Sensors for Robotics (3Hrs)

Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper systems. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

Unit- IiI: Drives and Control for Robotics: (3Hrs)

Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control.

Unit –IV: Programming and Languages for Robotics (3Hrs)

Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Generations of Robotic Languages,
Introduction to ROS1, creating publisher and subscriber nodes in ROS1. Programming for ROS application using C, Python,

Text Books :

1. S. K. Saha, Introduction to Robotics 2e, TATA McGraw Hills Education (2014)
2. Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press (2006).
3. Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, (2019).

4. K. Mittal, I. J. Nagrath, Robotics and Control, TATA McGraw Hill Publishing Co Ltd, NewDelhi (2003).

Reference Books :

1. S. B. Niku, Introduction to Robotics – Analysis, Control, Applications, 3rd edition, JohnWiley & Sons Ltd., (2020)
2. J. Angeles, Fundamentals of Robotic Mechanical Systems Theory Methods and Algorithms, Springer (1997).
3. R. D. Klafter, Thomas A. Chmielewski, and Mechael Negin, Robotic Engineering

After completion of this course, student should be able to

1. Design and simulate industrial application using the open source robotic tools. Demonstrate modern engineering tools necessary for simulating, configuring and monitoring robotic system (BT-3, Applying)
2. Design and Built robotic system with real world (BT-6 Creating)

List of Experiments (Any 8 experiments from 1 to 10)*PBL compulsory

I. Programming and Simulation over Open Source Software

Program using Robot studio software :

1. Robot Programming using Flex Pendant- Lead through programming including Coordinate systems of Robot,
2. Wrist Mechanism-Interpolation-Interlock commands
3. VAL language commands motion control, hand control, program control, pick and place applications,
4. Palletizing applications using VAL,
5. Object detection and Sorting
6. Robot welding application using VAL program-
7. RAPID Language and AML
8. ROS based robot navigation

Program using ROS1/ ROS2 software :

1. Nodes, topics in ROS
2. Simulation of 3-dof manipulator in ROS
3. Simulation of autonomous vehicle in ROS

III. Project Based LearningMini Project/Seminar (SCE)

Implementation of Simulation and real world implementation of specific robotic application.

ETUA32206: Project-II

Teaching Scheme	Examination Scheme						
Credits: 2	CIE	ISE	SCE	ESE	PR/OR	TW	Total
Lecture (L): 1hr./week Tutorial (T): - Practical (P): 2hrs/week	--	--	--	--	--	25	25

Prerequisite: Students are expected to know the concepts studied in following courses:

1.Microcontroller and Applications
2. Employability Skills – I Innovation Design Project-I
3. Data Communication

Course Objectives:

- To interpret the Project Management Process using tools and platforms
- To utilized Firmware and technologies for development of Project.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Select tools and platforms for Project development.
2. Select Firmware and technologies for developing the project.

Unit- I: Project Management

Introduction Industry 4.0, technology involvement, Introduction to Embedded Security, Need of security over different platform such as IoT, Real-time system design concepts and decomposition of functions and identification of key services, Design and construct a solution for a OS native integrated with an embedded system to verify and demonstrate system synchronization using real world application, Introduction to project management Tools and Platforms

Unit-II: Embedded Application Development

Developing application using recent technologies, Firmware selection and design for the real world application, architectural inclusion of IoT in the applications. Understanding the design consideration for Web Server and Cloud architecture with secure communication for embedded application development.

Text Books:

1. Project Management A Systems Approach To Planning Scheduling And Controlling 12Th Edition by Harold R Kerzner , John Wiley
2. Gary Stringham, Hardware/Firmware Interface Design: Best Practices for Improving Embedded Systems Development, Newnes publisher, ISBN-10 -1856176053
3. Pascal Formann, Real-Time Systems: Design and Applications ,Clanrye International, ISBN: 9781632404398, 9781632404398
4. Raj Kamal, Embedded Systems - SoC, IoT, AI and Real-Time Systems, 4th Edition, McGraw Hill Publication, ISSN-10- 9353168023
5. Web Server Farm in the Cloud: Performance Evaluation and Dynamic Architecture, Huan Liu &Sewook Wee , Lecture Notes in Computer Science book series (LNCCN,volume 5931)

Guidelines for Mini Project

A:Project group shall consist of not more than 3 students per group.
· Mini Project Work should be carried out in the Projects Laboratory.

· Project designs ideas can be referred from recent issues of electronic design magazines, or application notes from well-known device manufacturers.
· Use of Hardware devices/components is mandatory.
· PCB Layout versus schematic verification is mandatory.
· Assembly of components and enclosure design is mandatory.
B: Following are the Domains for Mini projects but not limited to:
. Embedded Systems
. Power Electronics
-IOT
. Biomedical Electronics
. Mechatronic System
· Instrumentation Systems
· Electronic Communication Systems

C: Following Activities should be completed in Project Laboratory:
1: Formation of groups, Finalization of Mini project & Distribution of task.
2: Circuit Design, PCB design using an EDA tool, Simulation.
3: PCB manufacturing through PCB Manufacturer, Hardware assembly and soldering, programming (if required), Testing, Enclosure Design, Fabrication etc
4: Testing of final project, Checking & Correcting of the Draft Copy of Project Report
5: Final Demonstration and Group presentations of Mini Project.

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