Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure and Syllabus of

B.Tech.

Electronics and Telecommunication Engineering

Effective from Academic Year 2023-24

Prepared by: - Board of Studies in Electronics and Telecommunication

Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Chairman – BOS

Chairman – Academic Board

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Institute Vision

"To be a globally acclaimed institute in technical education and research for holistic socio-economic development."

Institute Mission

- To ensure that 100% students are employable and employed in Industry, Higher Studies, become Entrepreneurs, Civil / Defense Services / Govt. Jobs and other areas like Sports and Theatre.
- To strengthen Academic Practices in terms of Curriculum, Pedagogy, Assessment and Faculty Competence.
- Promote Research Culture among Students and Faculty through Projects and Consultancy.
- To make students Socially Responsible Citizen.

Department Vision

"To be a centre of academic excellence in Electronics, Telecommunication and related domains through continuous learning and innovation."

Department Mission

- To provide state of art education in Electronics and Telecommunication Engineering to meet current and future needs of society, industry, and academia.
- To strengthen collaborations with industries and institutes of repute to foster research culture among faculty members and students.
- To promote ethically conscious engineers demonstrating sustainable entrepreneurship and professional maturity in a social context.

Program Educational Objectives (PEOs)

Graduates of the program will

1. Have a comprehensive knowledge of Electronics engineering fundamentals to face the challenges of real-life complex problems.
2. Be professionals imbibed with a spirit of leadership, ethical behavior, and societal commitment.
3. Be compliant to constantly evolving technology through lifelong learning.

Program Specific Objectives (PSOs)

E&TC Graduates will have the ability to:

1. Design, develop and analyze complex Electronic Systems for communication, Signal Processing, Embedded Systems, and VLSI applications.
2. Identify and apply domain-specific hardware and software tools to solve real-world problems in Electronics and Communication.

Program Outcomes (POs)

Engineering Graduate will be able to

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 the 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 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 teamwork:** 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 the engineering 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. **Project management and finance:** Demonstrate knowledge and understanding of the 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.

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Structure of

B.Tech. E&TC Engineering

"Pattern – B23"

Title: Course Structure - B22 **FF No. 653**

Branch: E&TC **Year:** S.Y. **A.Y.:** 2023-24 **Module:** III Sem1

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)										Credits
			Theory	Lab	Tut	ISA						ESA			Total	
						HA	LB	CP	PPT	GD	MSE	ESE	Prac Exam	CVV	100	
S1	MD2201	Data Science	2	2	1		10	20	20			30		20	100	4
S2	CS2221	Internet of Things	2	2	1		10	20		20		30		20	100	4
S3	CS2218	Object Oriented Programming	2	2	1		10	20					50	20	100	4
S4	CS2227	Database Management Systems	2	2	1		10	20	20			30		20	100	4
	ME2205	3-D Printing	2	2	1		10	20	20			30		20	100	4
S5	ET2290	Signals And Systems	2												100	2
S6	ET2292	Engineering Design and Innovation - III		8	0	-	-	-	-		30	70		-	100	4
S7	ET2245	Design Thinking 3		1												1
		Total	**10**	**17**	**4**											**23**

Title: Course Structure – B22 **FF No. 653**

Branch: E&TC **Year:** S.Y. **A.Y.:** 2023-24 **Module:** IV Sem1

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)										Credits
			Theory	Lab	Tut	ISA						ESA			Total	
						HA	LB	CP	GD	PPT	MSE	ESE	Prac. Exam	CVV	100	
S1	ET2270	Advanced Data Structures	2	2	1		10	20					50	20	100	4
S2	ET2271	Digital System	2	2	1		10	20					50	20	100	4
S3	ET2204	Communication Engineering	2	2	1		10	20	20			30		20	100	4
S4	ET2293	Semiconductor Devices And Circuits	2	2	1		10	20	20			30		20	100	4
S5	ET2291	Network Theory	2												100	2
S6	ET2292	Engineering Design and Innovation - III		8	0	-	-	-	-		30	70		-	100	4
S7	ET2245	Design Thinking 3		1												1
		Total	**10**	**17**	**4**											**23**

Title: Course Structure **FF No. 653**

Branch: E&TC **Year:** T.Y. **A.Y.:** 2023-24 **Module:** V, Sem1

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)										Credits
			Theory	Lab	Tut	ISA						ESA			Total	
						HA	LB	CP	PPT	GD	MSE	ESE	Lab	CVV	100	
S1	ET3002	Digital Signal Processing	2	2	1		10	20		20		30		20	100	4
S2	ET3221	Computer Vision	2	2	1		10	20					50	20	100	4
S3	ET3206	Digital Design	2	2	1		10	20	20			30		20	100	4
S4	ET3271	Embedded System Design	2	2	1		10	20					50	20	100	4
S5	ET3283	Engineering Design and Innovation – 3	0	8	0	-	-	-	-	-	30	70		-	100	6
S6	ET3282	Design Thinking 5		1												1
		Total	**8**	**17**	**4**											**23**

Title: Course Structure **FF No. 653**

Branch: E&TC **Year:** T.Y. **A.Y.:** 2023-24 **Module:** VI, Sem1

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)										Credits
			Theory	Lab	Tut	ISA						ESA			Total	
						HA	LB	CP	GD	PPT	MSE	ESE	Prac. Exam	CVV	100	
S1	ET3272	Design and Analysis of Algorithms	2	2	1		10	20					50	20	100	4
	ET3207	Information Theory & Coding Techniques	2	2	1	20		20	20			20		20	100	4
S2	ET3273	Web Technologies	2	2	1		10	20					50	20	100	4
	ET3265	Control Systems	2	2	1	20		20	20			20		20	100	4
S3	ET3274	Operating Systems	2	2	1		10	20		20		30		20	100	4
	ET3277	Digital Communication	2	2	1	20		20	20			20		20	100	4
S4	ET3285	Computer Network Security	2	2	1		10	20	20			30		20	100	4

	ET3203	Power Electronics and Drives	2	2	1	20		20	20		20		20	100	4
S5	ET3283	Engineering Design and Innovation – 3	0	8	0	-	-	-	-	-	30	70	-	100	6
S6	ET3282	Design Thinking 5		1											1
		Total	**12**	**17**	**4**										**23**

Title: Course Structure **FF No. 653**

Branch: E&TC **Year:** B.Tech. **A.Y.:** 2023-24 **Module:** VII, Sem1

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)									Credits
			Theory	Lab	Tut	ISA						ESA		Total	
						HA	LB	CP	PPT	GD	MSE	ESE	CVV	100	
S1	MD4202	Project Management	2	0	0	10	-	-	-	-	30	30	30	100	2
	MD4206	Financial Management & Costing	2	0	0	10	-	-	-	-	30	30	30	100	2
	LL4001	Generative AI and It's Applications	2	0	0	10	-	-	-	-	30	30	30	100	2
	LL4003	Foundation Of AWS Cloud	2	0	0	10	-	-	-	-	30	30	30	100	2
S2	ET4205	Industrial Automation	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4230	Natural Language Processing	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4240	Power Electronics	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4241	Advanced Communication Engineering	2	0	0	10	-	-	-	-	30	30	30	100	2
	CS4217	Human Computer Interaction	2	0	0	10	-	-	-	-	30	30	30	100	2
	CS4222	Image Processing	2	0	0	10	-	-	-	-	30	30	30	100	2

	ET4232	Deep Learning	2	0	0	10	-	-	-	-	30	30	30	100	2
	IC4201	Industrial Electronics	2	0	0	10	-	-	-	-	30	30	30	100	2
	CS4272	Neural Networks	2	0	0	10	-	-	-	-	30	30	30	100	2
	IT4216	Data Management, Protection and Governance	2	0	0	10	-	-	-	-	30	30	30	100	2
	AI4015	Network Security	2	0	0	10	-	-	-	-	30	30	30	100	2

S3	ET4292	Modern Digital Communication Techniques	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4293	Applied Electromagnetics For Engineers	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4429	Biomedical Signal Processing	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4428	Industrial Automation And Control	2	0	0	10	-	-	-	-	30	30	30	100	2
S4	ET4207	Major Project	0	20	0	-	-	-	-	-	30	70	-	-	10
		Total	**6**	**20**	**0**										**16**

Title: Course Structure **FF No. 653**

Branch: E&TC **Year:** B.Tech. **A.Y.:** 2022-23 **Module:** VIII

Subject Head	Course Code	Course Name	Teaching Scheme (Hrs/Week)			Assessment Scheme (100-mark scale)									Credits
			Theory	Lab	Tut	ISA						ESA		Total	
						HA	LB	CP	PPT	GD	MSE	ESE	CVV	100	
S1	ET4222	Research Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4250	Project Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4251	Industry Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4252	International Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
		Total	**-**	**40**	**-**	**-**	**-**	**-**	**-**	**-**	**30**	**100**	**-**	**100**	**16**

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Syllabus of

Second Year B.Tech.

Electronics & Telecommunication Engineering

"Pattern – B23"

Module - III

FF No.: 654

MD2201: DATA SCIENCE

Course Prerequisites:

1. Linear Algebra Basics
2. Central Tendency & Measures of Dispersion – Mean, Mode, Median
3. Probability
4. Some exposure to programming environment – C programming; Python

Course Objectives:

1. Understand data processing pipeline
2. Perform dimensionality reduction operations
3. Optimize the performance of functions
4. Apply descriptive statistics tools
5. Deduce meaningful statistical inferences
6. Use unsupervised classification algorithms
7. Use supervised classification algorithms
8. Utilize the data science principles for an entire project life cycle as a case study

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance:

The course is offered in S.Y. B.Tech. to all branches of Engineering. Data Science is a multidisciplinary field. It uses scientific approaches, procedures, algorithms, and frameworks to extract knowledge and insight from a huge amount of data. Data Science uses concepts and methods which belong to fields like information technology, Mathematics, Statistics, Computer Science etc. Data Science influences the growth and improvements of the product by providing a lot of intelligence about customers and operations, by using methods such as data mining and data analysis. The course is relevant to all branches of Engineering and beyond since data is generated as an obvious outcome of many processes.

SECTION-1

Introduction to Data Science
Role of data scientist, introduction to R, R studio; introduction to univariate and multivariate systems, understanding databases, Data Processing - Data collection; Data preparation; Data visualization techniques and inferences - scatter plot, scatter matrix, histogram, box plot.
Normal distribution, evaluating normal distribution, Binomial distribution, confidence Intervals, central limit Theorem, hypothesis testing, inference for numerical data – t-distribution, paired data, ANOVA, Vector norms, distances & projections, discriminants, least squares, Singular Value Decomposition, Principal Component Analysis, Optimization: constrained and unconstrained, Gradient Descent

SECTION-2

Supervised Learning – line fitting, residuals, correlation; line fitting by least squares regression; outliers in linear regression; Inference for linear regression; Multiple regression; Model selection; Logistic regression, Nearest Neighbor Classification – Knn; Naïve Bayes Classification – Bayesian methods, Bayes algorithm; Classification using decision trees and learners.
Unsupervised Clustering - K-means clustering; Evaluation of model performance – Confusion matrices, sensitivity, specificity, kappa statistics, precision, recall, F-measure, ROC curve, etc.; Methods of cross-validation, Bootstrapping; Meta-learning through ensemble approach – Bagging, boosting, Random Forests strategies.
Applications of Data Science – Predicting default cases in the Banking Industry, Predict passengers' survival in a Ship mishap evaluation technique, Classify Junk emails based on probability, Classify malicious websites, SMS Spam collection data, Gender recognition by voice, Store Item Demand Forecasting:
Predict 3 months of item sales at a different store

List of Tutorials:

1. Data Visualization
2. Distances and Projections
3. Singular Value Decomposition
4. Principal Component Analysis
5. Optimization
6. Normal & Binomial Distribution
7. Hypothesis Testing
8. ANOVA test
9. Linear Regression

10. Logistic Regression
11. Nearest Neighbor Classification
12. Decision Trees based classification
13. Naive Bayes classification
14. Clustering
15. Evaluation of model performance
16. Bagging & Boosting approaches

List of Practicals:

1. Data visualization
2. Unconstrained Optimization
3. Hypothesis Testing
4. Linear regression
5. Logistic Regression
6. Nearest Neighbor classification
7. Naive Bayes classification
8. Clustering
9. Classifier performance using Confusion matrix and other attributes
10. Cross Validation methods

List of Projects:

1. Movie recommendation system
2. Customer Segmentation using Machine Learning
3. Sentiment analysis
4. Uber Data analysis
5. Loan prediction
6. HVAC needs forecasting
7. Customer relationship management
8. Clinical decision support systems
9. Development of machine learning solutions using available data sets (multiple projects)
10. Fraud detection

List of Seminar Topics:

1. Data wrangling
2. Predictive modeling
3. Data analytics in life science (multiple topics)
4. Ensemble modeling techniques
5. Text pre-processing
6. Feature scaling for machine learning
7. Multivariate normal distribution applications
8. Distance metrics and their applications
9. Visualization techniques such as Chernoff's faces
10. Tree based algorithms
11. Ridge regression
12. LASSO

List of Group Discussion Topics:

1. PCA and ICA
2. Hierarchical and nonhierarchical systems
3. Linear - Nonlinear regression
4. Parametric-nonparametric estimation
5. Overfitting and underfitting in the context of classification
6. Linear and Quadratic discriminant analysis
7. Regression v/s classification
8. Classifier performance measures
9. Supervised and unsupervised learning
10. Various clustering approaches
11. Classifiers and classifier combinations
12. Balancing errors in hypothesis testing
13. Standard sampling practices for a successful survey for reliable sample data

List of Home Assignments:

Case Study:

A very large number of resources are available for data generated out of case study. Unique Home assignments will be set up for all groups

Surveys:

Principles of surveying will be implemented by groups to demonstrate use of data science principles in home assignments

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks

Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Textbooks:

1. 'A Beginner's Guide to R' – Zuur, Leno, Meesters; Springer, 2009
2. 'Introduction to Data Science' – Igual, Segui; Springer, 2017
3. 'Mathematics for Machine Learning' – Diesenroth, Faisal, Ong; Cambridge University Press, 2017
4. 'Machine Learning with R' – Lantz, Packt Publishing, 2018

Reference Books:

1. 'Elements of Statistical Learning' - Hastie, Tibshirani, Friedman; Springer; 2011
2. 'Data Science from Scratch' - Grus; Google Books; 2015
3. 'The art of Data Science' - Matsui, Peng; 2016
4. 'Machine Learning for absolute beginners' - Theobald; Google Books; 2017

MOOCs Links and additional reading material:

1. www.nptelvideos.in
2. www.edx.org/course/machine-learning-fundamentals-2
3. www.edx.org/course/foundations-of-data-analysis-part-1-statistics-usi
4. www.coursera.org/learn/statistical-inference/home/welcome
5. www.coursera.org/learn/data-scientists-tools/home/welcome

Course Outcomes:

Upon completion of the course, the student will be able to –

1. Apply Data processing & data visualization techniques.
2. Implement dimensionality reduction & optimization techniques for enhancing data suitability.
3. Perform Descriptive and Inferential statistical analysis for building reliable predictions.
4. Implement Supervised algorithms for classification and prediction.
5. Implement Unsupervised classification algorithms.
6. Evaluate the performance metrics of supervised and unsupervised algorithms.
7. Demonstrate complete Data Science life cycle with case studies.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	0	0	0	0	0	0	0	0	0	0	0	0
2	3	3	0	0	0	0	0	0	0	0	0	0	0	0
3	3	3	0	0	0	0	0	0	0	0	0	0	0	0
4	3	3	0	0	0	0	0	0	0	0	0	0	0	0
5	3	3	0	0	0	0	0	0	0	0	0	0	0	0
6	3	3	0	0	0	0	0	0	0	0	0	0	0	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO Attainment Level:

CO1: Level 3
CO2: Level 4
CO3: Level 5
CO4: Level 4
CO5: Level 3
CO6: Level 2

Future Courses Mapping:

1. Deep Learning
2. Reinforcement Learning
3. DBMS
4. Big Data
5. Data Mining
6. Information Retrieval
7. Recommendation Systems
8. Cloud Computing – AWS
9. IOT
10. Artificial Intelligence
11. Pattern Recognition
12. Natural Language Processing
13. Computer Vision
14. Machine Vision
15. Fault Diagnosis
16. Optimization
17. Bioinformatics
18. Computational Biology
19. Econometrics
20. Supply Chain
21. Ergonomics

22. Operations Research
23. Nano-informatics

Job Mapping:

Job opportunities that one can get after learning this course

Data Scientist, Data Analyst, AI Engineer, Data Architect, Data Engineer, Statistician, Database Administrator, Business Analyst, Business Intelligence Developer, Infrastructure Architect, Enterprise Architect, Machine Learning Engineering, Machine Learning Scientist

F No.: 654

CS2221: INTERNET OF THINGS

Course Prerequisites:

Students should have a basic knowledge of Communication and Basic Electronics.

Course Objectives:

The student will be able to

1. Understand IoT Architecture and framework.
2. Analyze multiple types of sensors and their principle of operation.
3. Learn about fundamental concepts of networking and protocols.
4. Understand IoT Physical and Data link layer Protocols.
5. Explore Higher layer IoT Protocols.
6. Apply theoretical knowledge for Cloud computing.

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance:

Internet of Things is a system of interrelated computing and sensing devices and can transfer data over a network without requiring human-to-human or human-to-computer interaction. IoT is highly relevant in this growing ecosystem of internet-enabled devices. IoT offers increasing opportunities to collect, exchange, analyze and interpret data in real-time. This robust access to data will result in opportunities to further enhance and improve operations.

SECTION-1

Topics and Contents

Introduction to Internet of Things: Definitions and Frameworks, IoT Architecture: topologies, client-server architecture, P2P, M2M, IoT functional blocks, Characteristics of IoT, Physical and Logical design of IoT, Different hardware platforms for IoT, Challenges in IoT.
Sensors: Working Principle, Selection of sensors for Practical Applications, Introduction to different types of Sensors such as Displacement, Force, Pressure, Position, Proximity, Motion, Force, Pressure, Temperature, Light sensors etc., Signal Conditioning, Interfacing, Smart Sensors.
Introduction to Networking: Network Architecture, layered architecture, functions of each layer, Communication Protocols, TCP/IP protocol, IoT Communication model

SECTION-2

Topics and Contents

IoT Data Link Layer and Network Layer protocols: IoT Data Link Layer Protocols-IEEE 802.11, IEEE 802.15, Wireless HART, ZWave, Bluetooth Low Energy, Zigbee & IoTNetwork Layer Protocols-IPv4, IPv6, 6LoWPAN
IoT Transport & Session Layer Protocols: Transport Layer protocols-TCP, UDP, SCTP, TLS, DTLS, IoT Session Layer protocols- HTTP, CoAP, MQTT
IoT Cloud Platforms, Cloud Computing, Web Services, Sensor-Cloud, Fog Computing, Mist Computing.

List of Tutorials:

1) Sensor selection for IoT Applications
2) Smart sensors
3) Intelligent Sensors
4) Signal Conditioning
5) Network Models
6) IPv4/IPv6
7) Smart Water Irrigation System
8) Traffic Management
9) Garbage Monitoring
10) Street Light Monitoring

11) Bluetooth
12) Cloud Computing

List of Practicals:

1) Setting up the Raspberry Pi
2) LED Interfacing
3) Temperature measurement using DHT11
4) Temperature measurement using LM35
5) Distance measurement using Ultrasonic sensor
6) Traffic Signal Control
7) Intrusion Detection using IR transmitter-receiver
8) Raspberry Pi as a web server
9) Transferring sensor data to web pages
10) Email alert using SMTP protocol
11) Twitter alert using HTTP protocol
12) Text transfer using MQTT protocol

List of Projects:

1. Smart Home
2. Mobility and Transport
3. Energy Usage Monitoring
4. Smart Grid
5. Air Quality Monitoring
6. Anti-Lost Device
7. Smart Clock
8. Smart Parking System
9. Weather Station
10. Motion Capture Security System
11. Home Automation System
12. Health Monitoring System

List of Seminar Topics:

1. IoT Architecture
2. Sensor Characteristics
3. IoT for supply chain management and inventory systems
4. IoT Ethics
5. Security in IoT
6. Cloud Computing Platform
7. IoT Best Practices
8. 5G in IoT
9. Middleware Technology

10. M2M energy efficiency routing protocol
11. IoT based Biometric Implementation
12. Complete IoT solution using AWS

List of Group Discussion Topics:

1. Smart Sensors
2. Intelligent Sensors
3. Signal Conditioning
4. Characteristics of IoT
5. 6 Low PAN
6. Z-Wave
7. Bluetooth
8. Wireless HART
9. Constrained Application Protocol
10. Cloud Platforms
11. Fog Computing
12. Web Services.

List of Home Assignments:

Design:

1. Smart City
2. Smart Transportation
3. Smart Healthcare
4. Smart Industry using IoT
5. Design of IoT framework

Case Study:

1. Open Source in IoT
2. IoT solutions for automobile
3. Cloud Computing
4. AWS
5. Microsoft Azure

Blog:

1. Network Selection for IoT
2. Need of secure protocols
3. Future of IoT
4. IIoT
5. IoT and Industry 4.

Surveys:

1. Autonomous Vehicles
2. List of Indian companies which offer IoT solutions for agriculture and farming. Describe the problem they are addressing and their solution.
3. Make a list of Indian companies which offer IoT solutions for healthcare. Describe the problem they are addressing and their solution.
4. Make an exhaustive list of everything inside, just outside (immediate surroundings) and on the auto body which must be "observed" for safe and comfortable driving using autonomous vehicles.
5. Compare different Cloud Service providers in the market.

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Textbooks:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press)
2. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", (Universities Press)

Reference Books:

1. Ovidiu Vermesan & Peter Friess "Internet of Things Applications - From Research and Innovation to Market Deployment", ISBN:987-87-93102-94-1, River Publishers
2. Joe Biron and Jonathan Follett, "Foundational Elements of an IoT Solution," by Joe Biron

MOOCs Links and additional reading material:

1. www.nptelvideos.in
2. https://nptel.ac.in/courses/108/108/108108123/
3. https://nptel.ac.in/courses/106/105/106105167/

Course Outcomes:

Upon completion of the course, the student will be able to –

1. Demonstrate fundamental concepts of Internet of Things
2. Select sensors for different IoT applications
3. Analyze fundamentals of networking
4. Apply basic protocols in IoT
5. Understand higher layer Protocols in IoT
6. Interface sensor data to cloud platforms

CO PO Map:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	1	1	1	1	1	1	1	1	1	1	1	1
2	2	1	1	1	1	1	1	1	1	1	1	1	1	2
3	2	2	1	1	1	2	1	1	1	1	1	1	2	2
4	2	2	1	1	1	2	1	1	1	1	1	1	2	1
5	3	2	1	1	1	2	1	1	1	1	1	1	3	2
6	3	2	1	1	1	2	1	1	1	1	1	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: level 2
CO2: level 3
CO3: level 3
CO4: level 4
CO5: level 4
CO6: level 5

Future Courses Mapping:

Other courses that can be taken after completion of this course
Ad-Hoc Networks

Job Mapping:

The Internet of Things (IoT) is the most emerging field in today's world. It is revolutionizing every industry, from home appliances to agriculture to space exploration. Since the advent of cloud computing, there has been an exponential growth in the number of sensor-enabled devices connected to the internet and expecting further growth accelerating in the coming years. There are diversified career opportunities in this field. The various career positions available as IoT Research Developer, IoT Design Engineer, IoT Product Manager, IoT Software Developer, IoT Solution Architect, IoT Service Manager and many more.

FF No.: 654

CS2218: OBJECT ORIENTED PROGRAMMING

Course Prerequisites:
Basic course on programming

Course Objectives:

1. Understand Object Oriented programming concepts
2. Demonstrate Object Oriented programming concepts by writing suitable Java programs
3. Model a given computational problem in Object Oriented fashion
4. To develop problem solving ability using Object Oriented programming constructs like multithreading
5. Develop effective solutions using for real world problems using the concepts such as file handling and GUI
6. Implement applications using Java I/O and event-based GUI handling principles

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance:
This is an important course for engineering students. It develops computational problem solving and logic building capability of students. Acquiring programming skills has a high relevance in all branches of Engineering. Once the student gains expertise in coding, this course proves to be beneficial to them to excel in industry demanding coding in specific software.

SECTION-1
Introduction: What is Object Oriented Programming? Why do we need Object Oriented Programming? Characteristics of object-oriented languages, C vs C++. Object Oriented Programming in C++ : Basics, Data Types, Structures, Class, Object, class and data abstraction, class scope and accessing class members, separating interface from implementation, controlling access to members. Functions: Function prototype, Constructors, Destructors, Copy Constructor, Objects and Memory requirements, Static Class members, Data abstraction and information hiding, Inline function, Friend Functions.

Operator Overloading: Concept, Operator overloading, Overloading Unary Operators, Binary Operators.
Inheritance: Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Types of Inheritance, Public and Private Inheritance, Ambiguity in Multiple Inheritance, constructors in derived classes, Aggregation.
Polymorphism: Concept, Types of polymorphism, relationship among objects in inheritance hierarchy, Function overloading, Virtual Functions: Pointers- indirection Operators, Heap Memory Management: new and delete, this pointer, Pointers to Objects, Pointer to derived classes, Function pointers, Pure virtual function, Abstract classes, Templates, Standard template libraries, Best Practices of Class Design.

SECTION-2

Object Oriented Programming in Java:
Java characteristics, Classes and Objects, Methods and Constructors. Information hiding access modifiers, Static keyword: class variables and instance variables, Class methods and instance methods. Arrays, Strings. Basic array processing strategies including passing arrays to functions, Applications illustrating use of arrays to store ordered and unordered sequences, sets
Inheritance: Types of inheritance, Constructors in Derived Classes, Overriding, Hiding Fields & Methods, Interfaces.
Polymorphism: Static and Dynamic. Abstract classes & methods, Final classes & methods. Exceptions: Checked & unchecked exceptions, User-defined exceptions.
Multithreading: Thread life Cycle, Thread Priority, Thread Methods, Inter-thread Communication, Producer-Consumer using Java.
Introduction to Streams: Types of streams, iostreams, Readers and Writers, Print writer, Stream Benefits.
File management: File Processing, Primitive Data Processing, Object Data Processing.
Java GUI: Applet, Applet Vs Application. AWT, Swing, Components. Layout Manager: Flow, Border, Grid and Card. Label, Button, Choice, List, Event Handling (mouse, key), Menus, Tables

List of Course Seminar Topics:

1. Introduction of Arrays and 1D Array programming examples
2. Multidimensional arrays
3. Variants of main() and command line arguments
4. Input and Output stream classes
5. String concepts and various methods of compairing strings
6. Methods in Java
7. Java String Methods
8. Passing array to a function and Jagged array examples
9. Reading input using Scanner and BufferReader Class

10. String, String buffer and String builder
11. Types of Inheritance in Java
12. Implementation of Types using Constructor in Inheritance
13. Using final with Inheritance
14. Base vs derived class reference in Inheritance
15. Using final with Inheritance, Accessing superclass member
16. Parent and Child classes having same data member
17. Overriding, Hiding Fields & Methods
18. Static vs Dynamic Binding & Hiding Methods
19. Private and final methods
20. Passing and Returning Objects in Java
21. Java Memory Management
22. File handling in Java vs C++
23. Data types used in Java vs C++
24. Java Object Serialization and Deserialization
25. Operator precedence
26. Use of Object Class Methods
27. Garbage collection in JAVA
28. Use of Static Blocks in various applications
29. Keywords used in JAVA
30. Types of Variables In JAVA

List of Group Discussion Topics:

1. Checked and unchecked exception, user defined and standard exception
2. Abstraction in Java and different ways to achieve Abstraction
3. Packages in Java – Types, Advantages & Techniques to Access Packages
4. Inner classes, nested interfaces in Java
5. Difference between Interfaces and abstract classes in Java
6. Exception Handling in Java Vs CPP
7. Difference between 1) throw and throws. 2) Final, finally and finalize in Java
8. Discuss Exception propagation and Discuss Exception handling with method overriding in Java
9. Discuss Packages, Access specifiers and Encapsulation in java.
10. Difference between abstraction and encapsulation in Java.
11. Daemon Threads Vs user threads
12. Preemptive scheduling Vs slicing
13. Is it possible to call the run()method directly to start a new thread? pls comment
14. Arraylist Vs Vector
15. Arrays Vs Collections
16. is Iterator a class or an Interface? what is its use?
17. List Vs Set

18. BufferedWriter and BufferedReader classes in java
19. BufferedReader Vs Scanner class in java
20. Buffered Reader Vs FileReader in java
21. Instanceofjava
22. Difference between CPP and JAVA
23. Difference between JDBC and ODBC connectivity
24. file processing in java
25. Difference between premitive data processing and object data processing
26. Creating GUI using swing
27. comparision between Swing, SWT, AWT, SwingX, JGoodies, JavaFX, Apache Pivot
28. Introduction To JFC And GUI Programming In Java
29. Introduction to wrapper classes
30. Why java uses Unicode System?

List of Practicals:

1. Implement Student class using following Concepts
   All types of Constructors
   Static variables and instance variables
   Static blocks and instance blocks
   Static methods and instance methods
2. There is a class Adder which has two data members of type 1D int array and int variable. It has two functions: getdata and numsum. Function getdata accepts non-empty array of distinct integers from user in 1D int array data member and a targetsum in another data member. The function numsum adds any two elements from an input array which is equal to targetsum and return an array of resulting two elements, in any order. If no two numbers sum up to the target sum, the function should return an empty array. Note that the target sum is to be obtained by summing two different integers in the array; you can't add a single integer to itself in order to obtain the target sum. You can assume that there will be at most one pair of numbers summing up to the target sum. Use constructor. Use extra variables if needed

   Input:
   Array=[3,5,-4,8,11,1,-1,7] targetsum=15
   Output: [8,7]
   Input:
   Array=[3,5,-4,8,11,1,-1,6] targetsum=15
   Output: []

3. Write Java program to calculate area of triangle, square & circle using function overloading. Function parameter accept from user (Use function Overloading concepts and Inheritance).
4. Write a program for following exception, develop a suitable scenario in which the following exceptions occur:
   a. divide by zero

b. Array index out of bounds exception
c. Null pointer Exception

5. Write a java program to solve producer-consumer problem where there are two producer threads and one consumer thread.
6. Implement various operations using JDBC Connectivity.
7. Display bank account information (Use interface and inheritance using java)
8. Develop a GUI in java which reads, update the file.

List of Home Assignments:

Blog:

1. Single and Multidimensional arrays in Java
2. Comparison Inheritance & Polymorphism
3. Need of abstract classes and interfaces in Java
4. Multithreading concept in Java
5. Signed & Unsigned arithmetic operations usin JAVA
6. Role of start() and run() methods in multithreading

Survey:

1. Strategies for Migration from C++ to Java
2. Product development using Inheritance and Polymorphism in Industry
3. on Java/OOP features popular amongst developers
4. Which other (non-JVM) languages does your application use?
5. How Java Impacted the Internet
6. How can a ArrayList be synchronised without using vector?

Design:

1. Implementation of Singleton design pattern in Java
2. Notes Repository System for Academic
3. Design for employee management system
4. Design for student management system
5. Inventory Management System
6. Write a program to delete duplicate numbers from the file

Case Study:

1. Java development milestones from 1.0 to 16.0
2. Implementation of Different Methods in Polymorphism
3. Real world systems which use java for its implementation
4. Drawing a flag using java
5. Use of different methods of Class object
6. Drawing a flag using java

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks

Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

Herbert Schildt, "JAVA- The Complete Reference", , 11th Edition, McGraw Hill Education

Reference Books:

1. Bruce Eckel, "Thinking In Java – The Definitive Introduction to Object-Oriented Programming in the Language of the World-Wide Web", Fourth Edition, Pearson Education, Inc.

2. R. Morelli and R. Walde, "Java, java, Java – Object-Oriented Problem Solving", 3rd edition, Pearson Education, Inc.

Moocs Links and additional reading material:

Programming using Java| Java Tutorial | By Infosys Technology
https://infyspringboard.onwingspan.com/en/app/toc/lex_auth_01304972186110361645_shared/overview

An Introduction to Programming through C++ – Prof A.G. Ranade- NPTEL- computer science and engineering – NOC https://nptel.ac.in/courses/106/101/106101208/#

Course Outcomes:

The student will be able to –

1. Understand object-oriented programming features
2. Develop real world applications using class, inheritance and polymorphism
3. Adapt Best Practices of Class Design by using Standard Templates Library
4. Solve computing problems by applying the knowledge of Exception handling and Multithreading
5. Design solutions by choosing suitable data structures such as Array, Vector, Map etc
6. Implement applications using Java I/O and event-based GUI handling principles

CO PO Map:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	3	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	2	0	0	0	0	0	0	0	0	0
4	0	0	0	1	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	2	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	2	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: level 2
CO2: level 3
CO3: level 3
CO4: level 4
CO5: level 4
CO6: level 5

Future Courses Mapping:

Other courses that can be taken after completion of this course is Ad-Hoc Networks

Job Mapping:

The Internet of Things (IoT) is the most emerging field in today's world. It is revolutionizing every industry, from home appliances to agriculture to space exploration. Since the advent of cloud computing, there has been an exponential growth in the number of sensor-enabled devices connected to the internet and expecting further growth accelerating in the coming years. There are diversified career opportunities in this field. The various career positions available as IoT Research Developer, IoT Design Engineer, IoT Product Manager, IoT Software Developer, IoT Solution Architect, IoT Service Manager and many more.

FF No.: 654

CS227: DATABASE MANAGEMENT SYSTEMS

Course Prerequisites:
Basics of computer system and any programming language.

Course Objectives:

1. To study the fundamental concepts of structural Computer system and Computer Arithmetic
2. To understand the basic concepts and functions of Microprocessor
3. To gain knowledge of Computer Memory System
4. To get familiar with GPU and CPU architecture
5. To identify solutions for real world design issues using processors.

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: **2** Hours/Week

Course Relevance:

Modern computer technology requires an understanding of both hardware and software, since the interaction between the two offers a framework for mastering the fundamentals of computing.

The purpose of this course is to cultivate an understanding of modern computing technology through an in-depth study of the interface between hardware and software.

In this course, you will study the history of modern computing technology before learning about modern computer architecture and a number of its essential features, including instruction sets, processor arithmetic and control, the Von Neumann architecture, pipelining, memory management, storage, and other input/output topics.

The course will conclude with a look at the recent switch from sequential processing to parallel processing by looking at the parallel computing models and their programming implications.

Basic concepts of Digital Electronics, Organization and Architecture, Structure & Function, Brief History of computers, Von Neumann Architecture, Integer Representation: Fixed point & Signed numbers. Integer Arithmetic: 2's Complement arithmetic, multiplication, Booth's Algorithm, Division Restoring Algorithm, Non Restoringalgorithm, Floating point representation: IEEE Standards for Floating point representations.

8086 Microprocessor Architecture, Register Organization, Instruction types, Types of operands, Instruction formats, addressing modes and address translation. Near & FAR procedure, Instruction cycles. RISC Processors: RISC- Features, CISC Features, Comparison of RISC & CISC Superscalar Processors. Case study of Processor.

Fundamental Concepts: Single Bus CPU organization, Register transfers, Performing an arithmetic/ logic operations, fetching a word from memory, storing a word in memory, Execution of a complete instruction. Micro-operations, Hardwired Control, Example-Multiplier CU. Micro-programmed Control: Microinstructions, Microinstruction-sequencing: Sequencing techniques, Micro-program sequencing

Need, Hierarchical memory system, Characteristics, Size, Access time, Read Cycle time and address space. Main Memory Organization: ROM, RAM, EPROM, E 2 PROM, DRAM, Design examples on DRAM, SDRAM, DDR3, Cache memory Organization: Address mapping. Basic concepts: role of cache memory, Virtual Memory concept. Pipeline and its performance, Data hazards: operand forwarding, handling data hazards in software, side effects. Instruction hazards: unconditional branches, conditional branches and branch prediction.

Parallelism in Uniprocessor system, Evolution of parallel processors, Architectural Classification, Flynn's, Fengs, Handler's Classification, Multiprocessors architecture basics, Parallel Programming Models : Shared memory, Message passing, Performance considerations : Amdahl's law, performance indications.

Parallel computing architectures (multi-core CPUs, GPUs, traditional multi-processor system, Xeon-Phi, Jetson Kit, Kilocore processor), multiprocessor and multicomputer systems, interconnection networks, Modern GPU architecture (in brief), Performance comparison: Speedup, Gain time and scalability.

List of Practical's: (Any Six)

1. Study of 8086 Architecture and Execution of sample programs.
2. Write 8086 ALP to access marks of 5 subjects stored in array and find overall percentage and display grade according to it.
3. Write 8086 ALP to perform block transfer operation. (Don't use string operations) Data bytes in a block stored in one array transfer to another array. Use debugger to show execution of program.
4. Write 8086 ALP to find and count zeros, positive number and negative number from the array of signed number stored in memory and display magnitude of negative numbers.
5. Write 8086 ALP to convert 4-digit HEX number into equivalent 5-digit BCD number.
6. Write 8086 ALP to convert 5-digit BCD number into equivalent 4-digit HEX number.
7. Write 8086 ALP for following operations on the string entered by the user.
a. String length
b. Reverse of the String
c. Palindrome
8. Write 8086 ALP for following operations on the string entered by the user (Use Extern Far Procedure).
a. Concatenation of two strings
b. Find number of words, lines.
c. Find number of occurrences of substring in the given string.
9. Write 8086 ALP to initialize in graphics mode and display following object on screen.
10. Write 8086 ALP to encrypt and decrypt the given message.
11. Write 8086 ALP to perform following operations on file
a. Open File
b. Write data in the file.
c. Delete data in the file.
d. Close the file.

List of Course Projects:

1. Combinational and Sequential circuits
2. Memory Management
3. Graphics Mode
4. IOT based projects.
5. IoT based atmospheric CO2 administration.
6. IoT based flood risk predictor.
7. Simulate modern traffic control system.
8. Online Parallel Examination.

List of Course Seminar Topics:

1. Computer Architecture VS Computer Organization
2. Evolution of Computing Devices
3. Instructions types , formats and execution
4. Interrupts in Microprocessor
5. Trends in computer architecture
6. RISC Vs CISC architecture : A Case Study
7. ARM processor architecture
8. Latest Technology in Embedded systems
9. Multiplier Control Unit
10. Booth's Encoding Pattern for Fast Scalar Point Multiplication in ECC for Wireless Sensor Networks
11. Internet of Things (IoT) in 5G Wireless Communications
12. State of the art parallel processor design.
13. Memory management in mobile OS.
14. Evolution of processors.
15. Ultra SPARC Processor Architecture.

List of Course Group Discussion Topics:

1. GPU computing: CUDA
2. Memory System
3. Replacement Algorithms
4. Pipelining
5. Cache Coherance
6. Virtural Memory
7. Hazards in pipelining
8. Super Computer

9. Modern computer generations
10. Parallel computing models

List of Home Assignments:

Design:

1. Write the sequence of control steps required for the single bus organization for each of the following instructions:
   1. ADD the (immediate) number NUM to register R1
   2. ADD the contents of memory location NUM to register R1

   Assume that each instruction consists of two words. The first word specifies the operation and addressing mode, and second word contains the number NUM
2. Configure a 32 Mb DRAM chip. Consider cells to be organized in 8K X 4 array. Find out the number of address lines.
3. A set associative cache consists of 64 lines, or slots, divided into four-line sets. Main memory contains 4K blocks of 128 words each. Analyze the format of main memory addresses with proper explanation.
4. A one pipeline system takes 50 ns to process a task. The same task can be processed in 6 segment pipeline with a clock cycle of 10 ns. Determine the speedup ratio of pipeline for 100 tasks. What is maximum speedup ratio?

Case Study:

1. Micro-programmed Control Unit and Hardwired Control Unit.
2. Pipeline Hazards
3. Flynn's architectural classification scheme.
4. Modern Processor units

Survey:

1. New memory technologies and their potential impact on **architecture**
2. Virtual Memory
3. Simulation of a superscalar processor and analyzing impact of design tradeoffs
4. Cache Consistency Models in Modern Microprocessors

Blog:

1. Super Computer
2. Intel Journey
3. New Arm Interconnect technologies
4. Distributed Systems and Parallel Computing

Text Books:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", 7th
Edition, Pearson Prentice Hall Publication, ISBN 81-7758-9 93-8.

2. C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill Publication, ISBN 007-120411-3.
3. Kai Hwang, "Advanced Computer Architecture", Tata McGraw-Hill ISBN 0-07-113342-9
4. Douglas Hall, "Microprocessors and Interfacing", 2nd Edition, Tata McGraw Hill Publications, ISBN 0-07-025742-6.
5. Peter Abel, "Assembly Language Programming," 5th Edition, Pearson Education Publications, ISBN 10:013030655.

Reference Books:

1. *Hwang and Briggs,"Computer Architecture and Parallel Processing", Tata McGraw HillPublication ISBN 13: 9780070315563.*
2. *A. Tanenbaum, "Structured Computer Organization", Prentice Hall Publication, ISBN 81 –203 – 1553 – 7, 4th Edition.*

MOOCs Links and additional reading material:

1. www.nptelvideos.in
2. https://www.udemy.com/
3. https://learn.saylor.org/
4. https://www.coursera.org/
5. https://swayam.gov.in/

Course Outcomes:

Upon completion of the course, post graduates will be able to –

1. Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os. (2)
2. Illustrate the micro operations sequencing. (3)
3. Evaluate various alternatives in processor organization. (3)
4. Understand concepts related to memory & IO organization (2)
5. Adapt the knowledge based on Pipeline and its performance (3)
6. Design real world applications using processors. (4)

Future Courses Mapping:

Advance Computer Architecture, Advance Operating Systems

Job Mapping*:*

Application Developers, System programmer

FF No. : 654

ET2290: Signals & Systems

Course Prerequisites:

Exposure to algebra, complex numbers and calculus

Course Objectives:

1. To develop a thorough understanding of the signal processing systems
2. Use continuous and Discrete time Fourier series and Fourier transform to analyze continuous time systems
3. To analyze systems using Laplace transform
4. To understand Sampling process in time and frequency domain
5. To develop an ability to apply the DSP concepts to a wide range of real-world signal processing applications
6. To strengthen the DSP Fundamentals

Credits: 2

Teaching Scheme: 2 Hours / Week
Theory: 2 Hours / Week

Course Relevance:

Signal processing is the heart of the digital revolution that brought us CDs, DVDs, MP3 players, mobile phones and countless other devices which has enabled unprecedented levels of interpersonal communication and of on-demand entertainment. The inherent flexibility of digital elements permits the utilization of a variety of sophisticated signal processing techniques which had previously been impractical to implement. A thorough understanding of signal processing fundamentals and techniques is essential for anyone whose work is concerned with signal processing applications. Signals and Systems course begins with representation and analysis of continuous and discrete-time signals and systems, convolution, Fourier series, Fourier transform, DFT, FFT, Laplace transform to analyze CT and DT signals and systems.

SECTION-1
Unit 1 : Continuous Time signals and systems Basic elementary signals, Continuous time signals and systems, Representations of signals, types of signals, types of systems, properties of systems **Unit 2: Discrete Time signals and systems** Representation of discrete time signals, continuous and discrete time LTI systems- Convolution

integral, Convolution sum, representation of signals in terms of impulses

Unit 3: Continuous-Time Fourier Series, Continuous-Time Fourier Transform
Basis functions, Complex exponentials, representation of periodic signals- Trignometric and exponential Fourier series, representation of aperiodic signals- Fourier transform, Properties of Transforms

SECTION-2

Unit 4: Sampling Theorem and its Applications
Sampling process, Nyquist criteria, ADC Blocks, Sampling theorem in time and frequency domain, Aliasing effect, Applications of sampling

Unit 5: Discrete-Time Fourier Series, Discrete-Time Fourier Transform
representation of discrete periodic signals-Fourier series, representation of discrete aperiodic signals-Fourier transform, Properties of Transforms

Unit 6: Laplace Transform and its properties
Introduction, need of Laplace Transform, Region of Convergence of Laplace transform, Inverse Laplace Transform, Properties of Laplace transform, Applications of Laplace Transform

Assessment Scheme:

Home Assignment - 20 Marks
End Semester Examination - 60 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

1. Alan V. Oppenheim, Alan S. Wiisky and S. Hamid Nawab, “Signals and systems,” Pearson Education, 2004.

2. Ramesh Babu and Anandnatarajan, “Signals and Systems,” Scitech Publication, Fourth Edition.

Reference Books:

1. Haykin Simon and Veen Barry Van, “Signals and Systems,” New York. John Wiley & Sons

2. Roberts Michael J, “Signals and Systems,” Tata McGraw Hill Publishing Company Limited, 2003.

ET2292: ENGINEERING DESIGN AND INNOVATION - III

Course Prerequisites:

Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Credits: 6 **Teaching Scheme:** Lab 2 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands on experience and self-learning to the students which will help them throughout their career. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. This course is designed to encourage and ensure application of technology for solving real world problems using an interdisciplinary approach.

Students need to plan their work in following steps:

1. Formation of project group comprising of 4-5 students. Multidisciplinary groups are allowed
2. A supervisor/mentor teacher assigned to individual groups.
3. Carrying out literature survey
4. Finalization of problem statement
5. Planning the project execution
6. Execution of project and testing
7. Writing a report
8. Publication in the form of research paper/patent/copyright as found suitable by supervisor/mentor

Teacher's Role in PCL:

1. Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
2. To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
3. To aware the group about time management.
4. Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

1. Students must have ability to initiate the task/idea they should not be mere imitators.
2. They must learn to think.
3. Students working in PCL must be responsible for their own learning.
4. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
5. Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
6. Students in PCL are expected to work in groups.
7. They must develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1. VLSI Design
2. Embedded Systems
3. Signal Processing
4. Communication
5. Machine learning

Assessment Scheme:

Mid Semester Examination - 30 Marks
End Semester Examination - 70 Marks

MOOCs Links and additional reading material:

www.nptelvideos.in
https://worldwide.espacenet.com/

Course Outcomes:

Upon completion of the course, the student will be able to –

1. Review the literature to formulate problem statement to solve real world problems.
2. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
3. Manage project ethically as team member/ lead.
4. Demonstrate effectively technical report/ research paper/ prototype/patent.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	1	0	0	3	1	3	0	2	2	2
2	3	3	3	3	3	3	3	2	1	2	0	2	3	3
3	0	1	1	1	0	2	0	3	3	3	3	2	0	0
4	3	1	1	1	0	0	0	3	1	3	3	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: - Level 3
CO2: - Level 4
CO3: - Level 3
CO4: - Level 4

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus of

Second Year B.Tech.

Electronics & Telecommunication Engineering

"Pattern – B23"

Module - IV

FF No.: 654

ET2270: ADVANCED DATA STRUCTURES

Course Prerequisites:

C and C++ programming.

Course Objectives:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques.
3. To construct and implement various data structures and abstract data types including lists, stacks, queues, trees, and graphs.
4. To make understand about writing algorithms and step by step approach in solving problems with the help of fundamental data structures.
5. To emphasize the importance of data structures in developing and implementing efficient algorithms

Credits:4 **Teaching Scheme** Theory: 2. Hours/Week

Tut: 1. Hours/Week

Lab: 2 Hours/Week

Course Relevance:

This is an advanced Course for Computer Engineering and allied branches. This course has a high relevance in all domains of computer engineering such as in Industries, research etc. as a basic prerequisite course.

SECTION-1

Arrays, Stacks, Queues and Linked Lists.
Sorting Techniques: Bubble sort, Insertion sort Quick Sort, Heap sort with Analysis.
Searching techniques: Linear Search, Binary search with Analysis.
Linked Lists: Dynamic memory allocation, Singly Linked Lists, doubly linked Lists, Circular linked lists and generalized linked lists, Applications of Linked list.
Stack: Stack representation and Implementation using arrays and Linked lists. Applications, Expression conversions and evaluations.
Queues: Representation and implementation using array and Linked lists, Types of queues. Applications of priority Queues: Job Scheduling, Josephus problem and load balancing.

SECTION-2

Trees: - Basic terminology, representation using array and linked lists. Tree Traversals: Recursive and Non recursive, Operations on binary tree. Binary Search trees (BST). Application of tree: Huffman tree with analysis.
Advanced Trees: Introduction to balanced trees, AVL tree, R-B tree, B tree and B+ tree with analysis.
Graphs: Terminology and representation using Adjacency Matrix and Adjacency Lists, Graph Traversals and Application: BFS and DFS, connected graph, Bipartite Graph, Detecting Cycle in graph. Minimum Spanning tree: Prims and Kruskal's Algorithm, Shortest Path Algorithms, Union Find. Applications of graph: traveling salesman problem with analysis.
Hashing: Hashing techniques, Hash table, Hash functions. Collision handling and Collision resolution techniques. Dynamic Hashing, applications of hashing: Password Encryption, Integrity Check

List of Tutorials:

1. Sorting Techniques: Insertion, Merge sort, Bubble, Shell Sort, Radix Sort.
2. Searching Techniques: Ternary Search, Fibonacci Search.
3. Problem solving using stack (Maze problem, Tower of Hanoi).
4. Expression conversion like infix to prefix and postfix and vice versa.
5. Priority Queues and Job Scheduling Algorithm.
6. Generalized Linked Lists.
7. Threaded Binary tree and Stack less Traversals using TBT.
8. B and B+ Tree.
9. Applications of Graph in Network problems.
10. Design of Hashing Functions and Collision Resolution techniques.
11. Cuckoo Hashing**.**

List of Practicals:

1. Assignment based on Sorting and Searching.
2. Assignment based on Stack Application (Expression conversion etc.)
3. Assignment based on Queue Application (Job scheduling, resources allocation etc.)
4. Assignment based on linked list.
5. Assignment based on BST operations (Create, Insert, Delete and Traversals)
6. Assignment based on various operations on Binary Tree (Mirror image, Height, Leaf node display, Level wise display etc.)
7. Assignment based on AVL and R-B tree.
8. Assignment based on DFS and BFS
9. Assignment based on MST using Prim's and Kruskal's Algorithm.
10. Assignment based on Finding shortest path in given Graph.
11. Assignment based on Hashing.

List of Projects:

1. Finding Nearest Neighbors.
2. Calendar Application using File handling.
3. Path finder in Maze
4. Word Completion Using Tire.
5. Bloom Filters.
6. Different Management Systems.
7. Scheduling Applications and Simulation.
8. Shortest Path Applications. (Kirchhoff's Circuit, TSP with Scenario.)
9. Efficient Storage and Data Retrieval Systems.
10. Different Gaming Application.

List of Seminar Topics:

1. Asymptotic Notations in Data structures.
2. Hash Table, Heaps and Their applications.
3. Analysis of Merge Sort, Quick Sort and Bubble Sort for Best, Average and Worst Case.
4. Solving N-queen and Josephus Problem using Backtracking, Stack and Queue respectively.
5. Priority Queue in Job Scheduling.
6. Application of Stack in Backtracking problems.
7. Priority Heap and min-Max Heap.
8. Data Structures for Languages and Libraries.
9. Multidimensional and Special Data Structures.

10. Algorithm Designing using Divide and Conquer

List of Group Discussion Topics:

1. Application based comparison of Sorting Algorithms.
2. Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?
3. Advanced trees: which is the best? (AVL, RB, B, B+) when? how? why?
4. Scenario Based Comparison: Kruskal's vs Prims Algorithm.
5. Hashing application in today's technology. Is it necessary?
6. Application based comparison: Stack vs Queues.
7. B- Tress VS B+ Trees: Which is to be consider? When? Why?
8. Need and Role of Different tree Traversals.
9. Graphs vs Tree Data Structures: Application based comparison? Which is best? Why? How?
10. Linked List application in today's technology. Is it necessary?

List of Home Assignments:

Design:

1. Design Single Source multiple destination Shortest Path Algorithm for Driving Application.
2. Expression Tree and Topological Sorting application in Problem solving.
3. Scheduling Algorithms using Queue.
4. Implementation of B and B+ trees for database management.
5. GLL application to Solve problems on Multivariable Polynomial. Consider suitable example.

Case Study:

1. Consider a Suitable Example for Hashing Application. Study its Merits, Demerits and Design.
2. Consider different real-life examples where different sorting, searching techniques have been used. Why used? How? Comparative study.
3. Why there is a need of different tree traversal algorithms? Consider different real-life examples where they are used. Why? How?
4. Game Base study for data structures.
5. Compare different graph traversal algorithm by considering different real-life examples where they have used.

Blog

1. Comparative Application of Prims vs Kruskal's Algorithm in real life scenarios.
2. AVL Tree vs RB Tree with applications
3. Need of different Sorting techniques.
4. How Hashing is useful in recent technologies? Consider any application related to it.
5. Role of Stacks and Queues in problem Solving.

Surveys

1. How application of Graph Search Algorithms (DFS and BFS) is there in recent technologies? Consider some real-life technologies.
2. How Advanced Trees Data structure plays important role in Database management?
3. Survey of Data Structures for computer Graphics applications.
4. A survey on different hashing Techniques in programming.
5. Graph algorithms in Network Application.

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Textbooks:

1. E. Horwitz, S. Sahani, Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, Universities Press.
2. Y. Langsam, M.J. Augenstein, A.M. Tenenbaum, "Data structures using C and C++", Pearson Education, Second Edition.
3. Narasimha karumanchi, "Data Structures and Algorithm Made Easy", Fifth Edition, CareerMonk publication.

Reference Books:

J. Tremblay, P. soresan, "An Introduction to data Structures with applications", TMHPublication, 2nd Edition.

MOOCs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

Upon completion of the course, the student will be able to –

1. To interpret and diagnose the properties of data structures with their memory representations and time complexity analysis.
2. To use linear data structures like stacks, queues with their applications.
3. To implement operations like searching, insertion, deletion, traversing mechanism etc. on various data structures with the help of dynamic storage representation.
4. To demonstrate the use of binary tree traversals and to perform various operations on Non-linear data structures.
5. To analyze the Graph data structure and to solve the applications of Graph data structures.
6. To design the appropriate data structure by applying various hashing Techniques.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	3	3	0	0	0	0	0	0	0	1	3	0
2	2	3	3	0	0	0	0	0	0	0	0	1	3	1
3	2	2	3	0	0	0	0	0	0	0	0	1	3	1
4	2	1	3	0	0	0	0	0	0	0	0	1	3	1
5	1	2	2	0	0	0	0	0	0	0	0	1	3	1
6	2	2	**3**	0	0	0	0	0	0	0	0	1	3	1

CO attainment levels

CO1 -level 1
CO2 –level 2
CO3- level 3
CO4- level 5
CO5 -level 4
CO6- level 3

Future Courses Mapping:

Following courses can be learned after successful completion of this course: Advanced Data Structures, Design and Analysis of Algorithms, Operating Systems, Compiler Design, Embedded system, Systems Programming, Data Science, Artificial Intelligence, and similar courses.

Job Mapping:

Data Structures and Algorithm is must necessary part of any programming job. Without Data structures it is not possible to be good in Competitive coding. All Industries always looks for a strong knowledge in Data structures. Without learning this course, one can't imagine a job in computer/IT related industries and research.

FF No.: 654

ET2271: DIGITAL SYSTEMS

Course Prerequisites: Boolean Algebra and Basic Electronics.

Course Objectives:

The student will be able to

1. Use a K-map to simplify truth table functions.
2. Implement simple logical operations using combinational logic circuits.
3. Understand the data conversion.
4. Implement sequential logic to improve digital circuit design.
5. Impart the concepts of sequential circuits to analyze sequential systems in terms of state machines.
6. Describe how basic TTL and CMOS gate operate at the component level.

Credits: 04

Teaching Scheme: 5 Hours / Week
Theory: 2 Hours / Week
Lab: 2 Hours / Week
Tutorial: 1 Hours / Week

Course Relevance:

Digital technology pervades almost everything in our daily lives. For examples, cell phones and other types of wireless applications, television, radio, process controls, automotive electronics, consumer electronics, aircraft navigation – to name a few applications – depends heavily on digital electronics.

A strong grounding in the fundamentals of digital technology will prepare you for the highly skilled jobs of the future. The single most important thing you can do is to understand the core fundamentals. From there you can go anywhere.

SECTION-1

Binary Codes & Logic Simplification: Classification of Binary codes, 8421 Binary Coded Decimal code, Excess-3 Code, Gray code, Standard logic gates, Universal logic gates, De Morgan's Theorem, Sum-of- Products and Product-of-Sums forms of Boolean function, Minters and Maxterms, Karnaugh map up to 4 variables.

Combinational Circuit Design: D**es**ign procedure, Code converters, Half and Full Adder, Half and Full Subtractor, Ripple Carry Adder, Carry Look Ahead adder, BCD Adder, Digital Comparator, Digital Comparator with multiple inputs, Multiplexer and Demultiplexer, Encoder and Decoder, Parity generator and checker.

Data Converters: Performance Parameters – Resolution, Speed, DNL, INL, Quantization noise/error**,** types - Weighted-Resistor, R-2R ladder type DAC. ADC: Characteristics, types – Single Slope, Dual-Slope, Successive Approximation.

SECTION-2

Sequential Circuit Design: Flip-flops**,** Shift registers, Barrel shifter, Asynchronous and synchronous circuits, counters, up/down counters, modulo-N counters, Shift register counters, Pulse train generators.

Finite State Machines: Finite state model, Basic Design steps for sequential circuits, State diagram, State Table, State reduction and state assignment, Mealy machine and Moore machine representation and implementation.

Logic Families: Characteristics of Digital ICs: Speed of Operation, Power Dissipation, Figure of Merit, Fan in, Fan out, Current and Voltage Parameters, Noise Immunity, Classification of Logic Families: TTL, CMOS, TTL NAND Gate

List of Tutorials:

1. Number Conversion
2. Karnaugh Map
3. Code converters
4. Look ahead Carry Adder
5. D to A Converter
6. A to D Converter
7. Flip-flops
8. Shift Registers
9. Moore Model

10. Mealy Model
11. TTL family
12. CMOS family

List of Practicals:

1. Design & implement code converters
2. Design & implement Half adder, Full adder
3. Design & implement BCD Adder
4. Design & implement combinational logic circuit using multiplexer & de-multiplexer
5. A to D Conversion
6. D to A Conversion
7. Design & implement 3-bit bidirectional shift register using D flip-flop
8. Decade counter
9. Design & implement pulse train generator
10. Design & implement 3 bit up-down ripple counter using flip-flop
11. Verification of mod-n counters
12. Design & implement sequence generator.

List of Projects (Any 1)

1. Tank with level sensor and control
2. Hexadecimal to 7 segment decoders for letters A to F
3. Traffic signal control
4. Security system
5. Digital score board
6. Seven segment display dice circuit
7. Programmed display logic
8. Tank with temperature sensor and control
9. Digital clock
10. Vending machine
11. Object Counter/ Digital Bank Token Number Display
12. Digital voltmeter
13. Random number generators
14. Non-volatile low-power crossbar memory
15. Power efficient synchronous counter design
16. Fast Multiplier Generator for FPGAs with LUT
17. Sigma-Delta modulator
18. Digital comparator with multiple inputs
19. The Design of Various Digital Blocks Based on ALM
20. Design of Viterbi Decoder
21. High Speed Floating-point Multipliers
22. Implementation of Stream Cipher using Block RAM and pipelining
23. Design of High-Speed Carry Select Adder

24. Design and Implementation of Double Precision Floating Point Comparator

List of Seminar Topics

1. Number Systems
2. Binary Codes
3. Boolean Algebra
4. Logic Simplification Techniques
5. Arithmetic Logic Unit
6. Code Converters
7. Parity Generators/Checkers
8. Flip-flop Conversion
9. Gates using CMOS
10. Flip-flop Applications
11. A to D Types
12. D to A Types

List of Group Discussion Topics

1. Characteristics of Digital ICs
2. Comparison of logic families
3. TTL Vs CMOS logic family
4. Shift registers & its applications
5. Asynchronous Vs Synchronous Counters
6. Mealy Vs Moore models
7. Comparison of flip-flops
8. Programmable Logic Devices
9. Memory Types
10. Specifications of Data Converters
11. Combinational Vs Sequential Circuits
12. Applications of Digital Electronics

List of Home Assignments

Design:

1. Design of Combinational Circuits
2. Design of Sequential Circuits
3. Design of FSM
4. Design of A to D Conversion
5. Design of D to A Conversion

Case Study:

1. Simulation Software Tool for Digital Design
2. Logic used in Calculators

3. Display Devices
4. Optical Encoders
5. ADC/DAC Interfacing

Blog:

1. Importance of CMOS
2. Digital and Analog Systems
3. Functions of Digital Logic
4. Interfacing of logic families
5. Role of memory in a computer system

Survey:

1. Digital IC Specifications
2. Digital Integrated Circuits
3. Error detection and correction techniques
4. TTL Subfamilies
5. Algorithmic State Machines

Assessment Scheme:

1. Seminar (PPT) – 15 marks
2. Group Discussion – 15 marks
3. Home Assignment – 10 marks
1. Course Viva – 20 marks
2. Lab – 10 marks
3. Course Project- 10 marks
4. MSE – 10 marks
5. ESE – 10 marks

Textbooks:

1. R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 3rd Edition
2. A. Anand Kumar, "Fundamentals of Digital Circuits'', PHI, 2nd edition
3. Melvino & Leach, 'Digital Principles & Applications'', Tata McGH, 7th edition

Reference Books:

1. Thomas L Floyd, "Digital Fundamentals", Pearson Education, 11th Edition
2. M. Morris Mano, "Digital Design", Pearson Education, Third Edition

MOOC Links and additional reading material:

1. https://nptel.ac.in/courses/117/106/117106086/
2. https://www.classcentral.com/course/swayam-digital-electronic-circuits-12953

Course Outcomes:

The student will be able to

1. Interpret Binary coding/ logic simplification
2. Design combinational logic circuits
3. Compare Data Converters
4. Design sequential logic circuits
5. Design finite state machine
6. Compare different parameters of logic families

CO PO MAP:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	0	0	0	0	0	1	1	0	1	1	1
2	2	1	3	0	1	1	0	0	1	1	0	1	3	1
3	2	1	1	0	1	1	0	0	1	1	0	1	1	1
4	2	1	3	0	1	1	0	0	1	1	0	1	3	1
5	2	1	3	0	1	1	0	0	1	1	0	1	3	1
6	2	1	1	0	0	0	0	0	1	1	0	1	1	1

CO Attainment Level

CO1: - Level 1

CO2: - Level 3

CO3: - Level 3

CO4: - Level 3

CO5: - Level 4

CO6: - Level 3

Future Courses Mapping:

Upon completion of this course, student can take following courses –

1. Embedded Systems
2. Digital Design
3. CMOS IC Design

Job Mapping:

Upon completion of this course, student will be able to –

1. Join an industry which is into Automation, Robotics, Control Panel Designs, Embedded Control of Power with state-of-art technology.
2. Join Govt sectors/ Services.

FF No. : 654

ET2204 COMMUNICATION ENGINEERING

Teaching Scheme

Credits:.4..... **Theory:** 2 Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Section 1: Topics/Contents

1.1 Introduction To Communication System : Analog & Digital Communication System Overview, Types of Electronic Communication, Communication Channels, The Electromagnetic & Optical Spectrum and its usage, Classification of noise, Noise in Cascaded Stages.

1.2 Analog Modulation Techniques: Need of modulation, Mathematical treatment for an AMand FM signal, Spectral Analysis, Modulation Index, Efficiency, Power calculations, DSB- SC and SSB-SC ,FM generators, pre-emphasis and de-emphasis in FM signal.

Analog Receivers: TRF Receiver, Super Heterodyne Receiver (AM & FM), IntermediateFrequency and Image Frequency, Performance characteristics of radio receiver.

Section2: Topics/Contents

2.1 Sampling and Waveform Coding: Sampling, ideal sampling, Flat top & Natural Sampling, Aliasing, Pulse amplitude modulation, Quantization, Pulse code modulation & reconstruction, Delta modulation, Time division multiplexing, Line Coding, ISI and eye diagram.

2.2 Digital Modulation Techniques: Digital modulation techniques - Amplitude Shift Keying, Binary Phase Shift Keying, Quadrature Phase Shift Keying, M-ary PSK, Binary Frequency Shift Keying, Quadrature amplitude modulation.

2.3 Detection and Performance analysis of digital signal: Baseband signal receiver.

List of Practicals: (Any Six)

1. Spectral analysis of time-domain signal using Digital Storage Oscilloscope (DSO).

2. Double side band full carrier (DSBFC) modulation and demodulation

3. Double sideband suppressed carrier (DSBSC) modulation and demodulation

4. Single sideband suppressed carrier (SSBSC) modulation and demodulation
5. Frequency modulator (FM).
6. Pulse Amplitude modulation (PAM).
7. Pulse Code modulation (PCM).
8. Delta modulation (DM).
9. Binary phase shift keying (BPSK).
10. Quadrature phase shift keying (QPSK)
11. Frequency shift keying (FSK).

List of Project areas:

1. Simple AM Transmitter
2. Double SideBand –Suppressed Carrier modulator and demodulator
3. Pre-emphasis and De-emphasis for FM
4. Anti Aliasing filter
5. Transistor/IC based Amplitude modulator
6. PLL IC 565 based FM demodulation
6. Discrete PAM signal
7. Analog to Digital Conversion
9. BPSK modulator
10. Digital to Analog Conversion
11. FM generator using IC 8038
12. AM generator using IC 2206

Text Books: ***(As per IEEE format)***

1. *Louis E Frenzel; Principles of Electronic Communication Systems; Third Edition., McGraw Hill Publications.*
2. *Kennedy & Davis; Electronic Communication; Tata McGraw Hill Publications.*
3. *Taub Schilling; Principles of Communication Systems; Fourth Edition., Tata McGraw Hill Publications.*

Reference Books: ***(As per IEEE format)***

1. *Dennis Roddy & Coolen; Electronic Communication; Tata McGraw Hill Publications.*

2. *Wayne Tomasi; Electronic Communication Systems; Fourth Edition.*

3. *Simon Haykin; Digital Communications; Fourth Edition, Wiley Publications*

4. *Carlson; Communication Systems;Fourth Edition, McGrawHill.*

5. *Simon Haykin; Analog & Digital Communications; Wiley Publications.*

6. *B.Sklar; Digital Communication; Second Edition, Pearson*.

Course Outcomes:

The student will be able to –

1. Differentiate communication channels and noise sources.
2. Analyze amplitude and frequency modulated signal and their spectrum.
3. Illustrate the working of analog receivers.
4. Discuss sampling and waveform coding techniques.
5. Evaluate modulation techniques with respect to bandwidth, Euclidean distance.
6. Evaluate performance of digital receiver.

FF No. : 654

ET2293: Semiconductor Devices and Circuits

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: **2**Hours/Week

SECTION-1

Topics and Contents

Semiconductor devices- Semiconductor theory, Drift and diffusion, Conductivity in semiconductors, pn junction, temperature dependence, BJT, MOSFET, Characteristics, modes of operation, Configurations, Biasing types, Operating point calculation, Device modelling, Application as switch

SECTION-1I

Device applications- Amplifier analysis (AC analysis), Amplifier parameters calculation, Power Amplifiers- types and efficiency calculations, Oscillators – fundamentals and types- Hartley and Colpitts, Voltage regulators – series and parallel

1. **List of Practicals: (Any Six) (NA)**
2. BJT Biasing
3. BJT CE Characteristics
4. BJT as a switch
5. BJT CE Amplifier
6. BJT CC Amplifier
7. BJT CB Amplifier
8. MOSFET characteristics
9. MOSFET as a switch
10. Clipper circuits
11. Clamper Circuits
12. Multi stage amplifiers
13. Class AB Power amplifier

14. Oscillator circuit

List of Projects:

1. CC amplifier analysis and implementation
2. CB amplifier analysis and implementation
3. CD amplifier analysis and implementation
4. Waveform generator
5. Voltage regulator
6. Oscillator Design
7. Precision rectifier
8. Signal Conditioning for sensor
9. Single phase Power Control (e.g. Fan speed regulator)
10. Switching/triggering circuit for a power device (SCR / power BJT / power MOSFET / IGBT)
11. PWM generation for device switching
12. Audio amplifier
13. Filter circuits
14. Power Supply/Battery charger
15. Intensity control of lighting
16. DC motor speed control
17. IC 555 application
18. Automatic battery charger
19. Frequency synthesiser
20. Level Controller
21. Design of Multistage amplifier
22. Design of Power amplifier

List of Group Discussion Topics:

1. MOSFET applications
2. MOSFET based sensors for measuring systems
3. MOSFET based chopper
4. Fabrication of MOSFET
5. Power amplifiers
6. SMPS Design
7. IGBT Vs MOSFET
8. UPS
9. Photovoltaic cells
10. Industrial applications of Power circuits
11. Regions of Operation of MOSFET
12. SCR firing circuit
13. Power Electronics In Defence
14. Witricity
15. Uncontrolled vs controlled rectifiers
16. Solar PV System
17. Renewable Energy
18. CB Vs CE Vs CC configuration
19. CS Vs CD Vs CG Configuration
20. Audio amplifiers Vs Power amplifiers
21. Non idealities in opamps
22. Inverting Vs Non inverting operation in Opamp
23. BJT Vs MOSFET
24. Applications of IC555
25. Do power systems need transformers?
26. Thyristor family vs Transistor family
27. Firing pulses generation schemes: Need, Working, Features
28. SMPS, UPS OR Regulated power supply?

Suggest an assessment Scheme:

1. Lab assessment – 10 Marks
2. Group Discussion – 20 Marks
3. Course Viva – 20 Marks

4. 6. ESE – 30 Marks
5. Course project -20 Marks

Text Books: ***(As per IEEE format)***

1. Thomas L. Floyd, "Electronic Devices", Pearson Education
2. **Donald Neaman, Semiconductor Physics and Devices, McGraw Hill.**
3. **Boylsted and Nashelsky, Electronic Devices and Circuit Theory,Prentice Hall**
4. Jacob Millman and Christos Halkies, Integrated Circuits, McGraw Hill

Reference Books:

1. **Ben Streetman and Sanjay Banerjee, Solid State Electronic Devices, PHI.**
2. Jacob Millman and Arvin Grabel, Microelectronics, McGraw Hill.3. Thomas L. Floyd, "Electronic Devices", Pearson Education
5. Mahesh B. Patil, Basic Electronic Devices and Circuits, PHI, 2013 edition.

Moocs Links and additional reading material:

https://onlinecourses.nptel.ac.in/noc20_ee77/preview

Course Outcomes: Students will be able to

1. Understand semiconductor theory
2. Understand operation and characteristics of semiconductor devices
3. Identify biasing types and find operating point
4. Analyse amplifier circuit to find amplifier parameters
5. Understand applications of Semiconductor Devices like oscillators/ Power amplifiers
6. Understand the concept of voltage regulation

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	1	-	1	1	1	-	2	2	2

2	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**1**	**-**	**2**	**2**	**2**
3	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**1**	**-**	**2**	**2**	**2**
4	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**1**	**-**	**2**	**2**	**2**
5	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**1**	**-**	**2**	**2**	**2**
6	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**1**	**1**	**-**	**2**	**2**	**2**

Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

Co1 -Level 3

Co2 - Level 4

Co3 - Level 4

Co4 - Level 4

Co5 - Level 4

Co6 - Level 4

Future Courses Mapping:

Digital Design

Job Mapping:

Engineers in Manufacturing / Automation and VLSI industries

FF:654

ET2291:Network Theory

Credits: 2

Teaching Scheme: 2 Hours / Week
Theory: 2 Hours / Week
Lab/ Project:

Section 1

Network Theorems: Superposition, Thevenin's Norton's and Maximum Power transfer Theorems. Concept of Network Topology, Terms used in Topology, Relation between Twigs and Links Properties of a Tree in a Graph, Formation of Incidence Matrix [Ai], number of tree in Graph. Cut –Set Matrix, Network Equilibrium Equation.

Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity & Symmetry conditions, Interrelation of Parameters, interconnection of parameters. Network functions for one port and two port networks.

Section 2

Classifications: Symmetrical and Asymmetrical networks. Properties of two port Network: Symmetrical Networks (T and Π only). Z0 and γ in terms of circuit components, open and short circuit parameters,

Filter fundamentals, Constant K -LPF, HPF, BPF and BSF, m derived LPF and HPF, introduction to Neper and Decibel, Relation between Neper and Decibel introduction to Neperand Decibel, Relation between Neper and Decibel.

Significance of Quality factor, Series Resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity Resonant frequency and admittance variation with frequency, Bandwidth and selectivity. Magnification factor, Parallel resonance: General case: Resistance present in both branches

List of Presentation Topics

1. Applications of Network Theorems
2. Use of Network Topology
3. Analysis of electrical network using graph theory
4. Network Equilibrium Equation
5. Two-port networks, two port network parameters for network analysis
6. Classification and properties of two port networks
7. Filter circuits
8. Attenuator circuits
9. Transient response of RL, RC circuits
10. Transient response of RLC circuit
11. Series resonant circuit
12. Parallel resonant circuit

Text Books:

1. "Circuit Theory (Analysis and Synthesis)",Chakrabarti, DhanpatRai and Co.
2. "Electrical Networks", Ravish R Singh, Tata Mc-Graw Hill

Reference Books:

1. "Network Analysis", Van Valkenberg, PHI
2. "Kuo F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India.
3. "Engineering Circuit Analysis, Hayt W. H., Kemmerly J. E. and Durbin S. M., 6th Ed.,Tata McGraw-Hill Publishing Company Ltd

Reference URLs:

https://lecturenotes.in/subject/25/network-theory-nt

Course Outcomes:

CO_1: Simplify networks and circuits using network theorems.

CO_2: Simplify networks and circuits using graph theory.

CO_3:Find network parameters and network function

CO_4: Design Attenuators and filters

CO_5: Analyze RL, RC and RLC Circuits using steady state and transient response

CO_6: Analyze Resonance Circuits

CO- PO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2
CO1	3	2	1	-	-	-	-	2	0	1	0	1	3	3
CO2	3	2	1	-	-	-	-	2	0	1	0	1	3	3
CO3	3	2	3	-	-	-	-	2	0	2	0	2	3	3
CO4	3	2	1	-	-	-	-	2	0	2	0	2	3	3
CO5	3	2	2	-	-	-	-	2	0	2	0	2	3	3
CO6	3	2	1	-	-	-	-	2	0	1	0	1	3	3

CO1:

This CO is maps with PO1 Substantially. Here students have to apply the knowledge of mathematicsand engineering fundamentals to simplify networks by using Ohm's Law, KVL, KCL, source transformation. This CO moderately maps with PO2 because students have to analyze networks by using networks theorem and demonstrate their skill in mathematics to solve a problem in graph theory.

This CO slightly meets to PO3. Here students must design small circuit for the public health and safety.

This CO is maps with PO8 moderately because students must follow the ethical practices at the time examination, solving home assignment and have to commit their responsibilities in terms engineering education.

FF No.: 654

ET2292: ENGINEERING DESIGN AND INNOVATIONS-III

Course Prerequisites:

Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Credits: 6 **Teaching Scheme:** Lab 2 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands on experience and self-learning to the students which will help them throughout their career. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. This course is designed to encourage and ensure application of technology for solving real world problems using an interdisciplinary approach.

Students need to plan their work in following steps:

1. Formation of project group comprising of 4-5 students. Multidisciplinary groups are allowed
2. A supervisor/mentor teacher assigned to individual groups.
3. Carrying out literature survey
4. Finalization of problem statement
5. Planning the project execution
6. Execution of project and testing
7. Writing a report
8. Publication in the form of research paper/patent/copyright as found suitable by supervisor/mentor

Teacher's Role in PCL:

1. Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
2. To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
3. To aware the group about time management.
4. Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

1. Students must have ability to initiate the task/idea they should not be mere imitators.
2. They must learn to think.
3. Students working in PCL must be responsible for their own learning.
4. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
5. Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
6. Students in PCL are expected to work in groups.
7. They must develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1. VLSI Design
2. Embedded Systems
3. Signal Processing
4. Communication
5. Machine learning

Assessment Scheme:

Mid Semester Examination - 30 Marks
End Semester Examination - 70 Marks

MOOCs Links and additional reading material:

www.nptelvideos.in
https://worldwide.espacenet.com/

Course Outcomes:

1. Review the literature to formulate problem statement to solve real world problems.
2. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
3. Manage project ethically as team member/ lead.
4. Demonstrate effectively technical report/ research paper/ prototype/patent.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	1	0	0	3	1	3	0	2	2	2
2	3	3	3	3	3	3	3	2	1	2	0	2	3	3
3	0	1	1	1	0	2	0	3	3	3	3	2	0	0
4	3	1	1	1	0	0	0	3	1	3	3	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: - Level 3
CO2: - Level 4
CO3: - Level 3
CO4: - Level 4

FF 654

ET2245: DESIGN THINKING-3

Credits: 1 **Teaching Scheme Tut:** 1 Hour/Week

Course Objectives:

To provide ecosystem for students and faculty for paper publication and patent filing

Contents:

Structure of The paper
Journal List (Top 50 Journals)
Selection of the journal
Use of various online journal selection tools
Plagiarism checking
Improving contents of the paper
Patent drafting
Patent search
Filing of patent
Writing answers to reviewer questions
Modification in manuscript
Checking of publication draft

Suggest an assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the importance of doing Research
CO2: Interpret and distinguish different fundamental terms related to Research
CO3: Apply the methodology of doing research and mode of its publication
CO4: Write a Research Paper based on project work
CO5: Understand Intellectual property rights
CO6: Use the concepts of Ethics in Research
CO7: Understand the Entrepreneurship and Business Planning

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus of

Third Year B.Tech.

Electronics & Telecommunication Engineering

"Pattern – C23

"Module – V&VI

FF No. : 654

ET3270: Digital Signal Processing

Course Prerequisites:

Exposure to algebra, complex numbers and calculus

Course Objectives:

7. To develop a thorough understanding of the signal processing systems
8. Use Discrete time Fourier series and Fourier transform to analyze Discrete time systems
9. Use z-transform and discrete Fourier transform to analyze digital systems
10. Apply DFT-FFT algorithm to perform spectral analysis of discrete time signals
11. Provide an understanding of different methods to design digital filters
12. To develop an ability to apply the DSP concepts to a wide range of real-world signal processing applications

Credits: 5

Teaching Scheme: 5 Hours / Week
Theory: 2 Hours / Week
Lab/ Project: 2 Hours / Week
Tutorial : 1 Hours / Week

Course Relevance:

Signal processing is the heart of the digital revolution that brought us CDs, DVDs, MP3 players, mobile phones and countless other devices which has enabled unprecedented levels of interpersonal communication and of on-demand entertainment. The inherent flexibility of digital elements permits the utilization of a variety of sophisticated signal processing techniques which had previously been impractical to implement. A thorough understanding of signal processing fundamentals and techniques is essential for anyone whose work is concerned with signal processing applications. Signal Processing begins with a discussion of representation and analysis of discrete-time signals and systems, convolution, Fourier series , Fourier transform , DFT, FFT , Z-transform to analyze CT and DT signals and systems. Signal Processing concludes with digital filter design techniques and their efficient realizations. An integral part of the course is MATLAB based computer assignments and course projects, which are designed to reinforce theoretical concepts.

SECTION-1

Unit 1 : Discrete-time signals and systems , Discrete-time systems properties : Linearity, Time variance and causality , analysis of discrete-time LTI systems: impulse response , convolution

Unit 2: Representation of periodic signals-Discrete-Time Fourier Series, Representation of aperiodic signals Discrete-Time Fourier Transform, Propertits of DTFT, Applications of Fourier series Transforms

Unit 3: Discrete Fourier Transform and it's properties , Fast Fourier Transform – Decimation in Time DIT FFT, Decimation in Frequency- DIF FFT algorithms, Signal flow Graphs

SECTION-2

Unit 4: Sampling theorem , Z transform , Rational Z-transform, System function ,Inverse Z-transform , causality and stability considerations for LTI systems

Unit 5: Design and implementation of FIR filter, Linear phase FIR filter, FIR filter design using Windows method, Realization of FIR filter – Transverse structure, Linear phase structure, Hardware implementation of FIR Filters

Unit 6: Design and implementation of IIR filter Analog lowpass Butterworth filter, Design of IIR filters from analog filters –Bilinear transformation , Realization of digital filters – Direct form I, Direct form II, cascade form, Hardware implementation of IIR Filters

List of Tutorials:

1. Discrete time convolution of signals
2. Verification of sampling theorem, conversion of continuous time (CT) signals into discrete time (DT) signals and recovery of CT signals.
3. Discrete time Fourier series computation
4. Compute Z transform and inverse Z transform of DT signals
5. Analysis of LTI systems using pole-zero plot
6. Compute DFT and IDFT using direct computation and matrix method
7. Compute DFT and IDFT using FFT algorithm
8. Find, visualize, and analyze spectrum of a DT signal
9. Design IIR filters using Impulse invariance method
10. Design IIR filters using BLT method
11. Design of FIR filters using windowing method Realization of digital filters

List of Practicals:

1. To perform convolution of two discrete-time sequences in time domain.
2. To reconstruct the given periodic signal using fourier series .
3. Implement algorithm to perform linear convolution of two sequence using DFT.
4. To determine z-transform from the given transfer function and its ROC
5. Implement different window functions and observe the effect of different windows on FIR filter response
6. Design Butterworth filter (IIR) using bilinear transformation method and plot its frequency response.
7. Design and apply moving average and difference filters on the audio signals
8. Design and apply a suitable digital filter to clean noisy ECG signal

List of Projects:

1. ECG Signal Analysis Perform discrete time signal analysis using FFT.
2. Speech Enhancement using Spectral Subtraction Method.
3. Musical Instrument Identification.
4. Audio Equalizer.
5. Speech Recognition.
6. DTMF Encoder and Decoder.
7. Correcting the geometrical orientation of text in an image using discrete Fourier transform.
8. Real time filtering using overlap-save or overlap-add method.
9. Audio Effects Generation.
10. Voice Activity Detector.
11. Vibration signal analysis using signal processing techniques.
12. Design of 2D filters suitable for the given vision application.

List of Seminar Topics:

1. Use of DSP in Telephony applications
2. DSP in motor control
3. DSP in Biomedical applications – ECG,EEG MRI etc
4. DSP in Seismology
5. DSP in speech processing
6. DSP In video signal processing
7. DSP in audio signal processing
8. Multirate signal processing
9. Transforms used in DSP for various purposes.
10. DSP in processing signals coming from outer space (Pulsars, Quasars etc)
11. Issues in using DSP in Real Time applications

13.DSP in automobiles, aircrafts , marine applications etc

List of Group Discussion Topics:

1. Analog filters Vs Digital filters --- Design (typical cases) and analysis
2. Analog filters Vs Digital filters --- Implementation
3. IIR filters Vs. FIR filters -- Design (typical cases) and analysis
4. IIR filters Vs. FIR filters -- Implementation
5. Hardware Vs. Software implementation of Digital filters
6. Implementation of Digital filters on Microcontrollers, dedicated DSP Processors and FPGAs
7. uses of different transforms in DSP
8. sampling rates
9. comparison of different windows in design of FIR filter

List of Home Assignments:

Design:

1. Design and develop a high-quality surround sound system and implement in MATLAB Simulink
2. Real Time Filtering of audio signals in MATLAB
3. Design of Adaptive noise cancellation system
4. of digital Dolby system
5. Design and implement LPC vocoder

Case Study: Design

1. FFT spectrum analyzer
2. ECG/EEG monitoring system
3. Audio compression (mp3)
4. Adaptive echo cancellation systems
5. Speech coding and decoding

Blog

1. Audio codec
2. Comb Filter implementation
3. Power spectral density estimation
4. Text-to speech synthesizer
5. Radar signal processing

Surveys

1. Selection of digital signal processor based on the application
2. Signal processing in military applications
3. Underwater signal processing
4. Hearing aids and background noise
5. Voice assistant systems (e.g. Alexa, Siri)

Assessment Scheme:

Course Project - 20 Marks
Home Assignment - 20 Marks
Presentation /Group Discussion - 20 Marks
End Semester Examination - 20 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

1. Oppenheim, Wilsky,Nawab , "Signal and systems " , PHI; 2nd edition ,1996
2. John G. Proakis, Dimitris G. Manolakis," Digital Signal Processing-Principles algoritms and applications ", PHI 1997
3. E.C. Ifeachor and B.W. jervice, " Digital signal processing – A practical approach,"Pearson Edu, 2nd edition, 2002
4. Oppenheim and Schafer , "Discrete-Tine Signal Processing " , Pearson Education India; 3rd edition , 2014

Reference Books:

1. Ramesh babu ,R.Anandrajan "Signal and systems "Scitech publications,2011
2. Ramesh babu ,"Digital Signal processing,"Scitech publications,2001
3. Shalivahan, Vallavraj, Gnyanapriya C. ," Digital Signal processing,"TMH 2001
4. Li Tan, Jean Jiang,"Diogital Signal Processing: Fundamentals and applications,"Academic press.
5. S.K.Mitra," Digital Signal Processing- A Computer Based approach," Tata McGraw Hill, 1998.

Moocs Links and additional reading material:

www.nptelvideos.in
https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/
https://swayam.gov.in/nd1_noc19_ee50/preview
http://www.ws.binghamton.edu/fowler/fowler%20personal%20page/EE521.htm
http://vlabs.iitkgp.ernet.in/dsp/
https://ocw.tudelft.nl/courses/digital-signal-processing/subjects/3-ofdm/

Course Outcomes:

The student will be able to –

1. Analyse LTI systems in time domain
2. Analyse signals using fourier series and fourier transform
3. Apply DFT to analyse discrete time systems
4. Analyse LTI systems using Z-Transform
5. Design linear phase FIR filter of given specifications
6. Design IIR filter of given specifications from Analog filter.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	2	2	0	0	0	1	0	0	1	2	1
2	3	3	2	2	3	0	0	0	1	0	0	1	2	2
3	3	3	2	2	3	0	0	0	1	0	0	1	2	2
4	3	3	2	2	3	0	0	0	1	0	0	1	2	2
5	3	3	2	2	3	0	0	0	1	0	0	1	2	3
6	3	3	2	2	3	0	0	0	1	0	0	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Future Courses Mapping:

Courses that can be taken after completion of this course:

1. Advanced Digital Signal Processing
2. Adaptive Signal Processing
3. Speech Processing
4. Digital Image Processing
5. Audio and video data compression
6. Pattern recognition
7. Digital communication systems

Job Mapping:

Job opportunities that one can get after learning this course

Unlike in most fields of study, in digital signal processing, future jobs are not defined by or restricted to a single professional area. Signal processing – the enabling technology for the generation, transformation, extraction and interpretation of information via electronic signals – is essential for our smartphones and wearable devices, as well as the latest health care technologies, digital cameras and our digital assistants like Amazon Echo and Google Home.

FF No. : 654

ET3221: COMPUTER VISION

Course Prerequisites:

1. Linear Algebra
2. Python / C Programming
3. Basics of Digital Electronics

Course Objectives:

1. Learn Fundamentals of Digital Image Processing
2. Understand Features, their Selection and Extraction
3. Implement Object Detection
4. Implement Object Recognition
5. Implement Object Classification

Credits:4 **Teaching Scheme** Theory: 2 Hours/Week
Tut: 1 Hour/Week
Lab: 2 Hours/Week

Course Relevance:
Computer vision is an interdisciplinary scientific field that deals with how computers can gain high-level understanding from digital images or videos. From the perspective of engineering, it seeks to understand and automate tasks that the human visual system can do.

SECTION-1
Fundamentals of Image Formation, Human Vision System, Computer Vision System, Geometric Transformation, Fourier Transform, Discrete Fourier Transform, Convolution and Filtering, Image Enhancement, Histogram Processing, Image Registration, Image Restoration. Image Segmentation: Edge Based approaches to segmentation, Gradient using Masks, Laplacian of Gaussian, Canny, Edge Linking, Line detectors (Hough Transform), Corners – Harris, Region Growing, Region Splitting.

SECTION-2

Feature Detectors and Descriptors: Features from Accelerated Segment Test, Oriented Fast and Rotated Brief, Scale Invariant Feature Transform, Haar-Cascade, Local Binary Pattern, Local Directional Pattern, Feature Matching and Feature Tracking. Supervised and Unsupervised Machine Learning for Image Classification: Support Vector Machine, K-Nearest Neighbours, Principal Component Analysis, K-Means. Camera Geometry Fundamentals, Camera Calibration, Epipolar Geometry, Stereo Vision: Distortion, Rectification, Point-Correspondence, Triangulation.

List of Tutorials:

1. Introduction to OpenCV and Setting up Python Programming Environment for Computer Vision
2. Essentials of Linear Algebra Part-I (Matrix Theory) for Computer Vision
3. Essentials of Linear Algebra Part-II (Vector Spaces) for Computer Vision
4. Configuration of Raspberry Pi-4B for Computer Vision
5. Essentials of Raspbian Operating System
6. Configuration of Jetson Nano for Computer Vision
7. Essentials of Ubuntu Operating System
8. Camera Calibration
9. Mathematics of Support Vector Machine
10. Mathematics of K-Means Classification.

List of Practicals:

1. Image Manipulations and Geometrical Transformations
2. Image Filtering and Enhancement
3. Detection of Lines, Edges and Corners
4. Camera Calibration
5. Image Registration
6. Feature Detection and Description by using FAST, ORB
7. Feature Detection and Description by using SIFT, SURF
8. Feature Detection and Description by using LBP, LDP
9. Implementation of Object Tracking
10. Object Classification by using SVM and K-Means

List of Projects:

1. Counting of Objects
2. Object Locator.
3. Barcode Detection
4. Traffic Sign Recognition
5. Motion Detection and Tracking
6. Detection of Potholes
7. Face Recognition
8. Detection of Dents on a Car
9. Detection of Type of Roads (Tar, Cement, and Mud)
10. Detection of Roadside Vegetation, Trees, etc.
11. Detection of Littering / Garbage on the Road
12. Detection of Stray Animals on the Road
13. Detection of Road Intersection (Crossings)
14. Vehicle License Plate Recognition at Security Checkpoints

List of Course Seminar Topics:

1. Bioinspired Stereo Vision Calibration for Dynamic Vision Sensors
2. Low-Power Computer Vision: Status, Challenges, and Opportunities
3. Subpixel Computer Vision Detection based on Wavelet Transform
4. Automatic Counting and Individual Size and Mass Estimation of Olive-Fruits Through Computer Vision Techniques
5. Person Recognition in Personal Photo Collection
6. Measuring Gait Variables Using Computer Vision to Access Mobility and Fall Risk in Older Adults with Dementia
7. Wearable Vision Assistance System based on Binocular Sensors for Visually Impaired Users
8. Edge Detection Algorithm for Musca-Domestica Inspired Vision System
9. Automated Vision Based High Intraocular Pressure Detection using Frontal Eye Images
10. Detection of Possible Illicit Messages using Natural Language Processing and Computer
11. Vision on Twitter and LinkedIn Websites

List of Course Group Discussion Topics:

1. Human Visual System and Computer Vision System
2. Spatial Domain Filtering and Frequency Domain Filtering
3. Features from Accelerated Segment Test Features from Accelerated Segment Test and
4. Oriented Fast and Rotated Brief
5. Local Binary Pattern and Local Directional Pattern
6. K-Nearest Neighbors and K-Means

7. Monocular Vision and Stereo Vision
8. Image Enhancement and Image Restoration
9. Raspberry Pi-4B and Jetson Nano
10. Essential Matrix and Fundamental Matrix
11. Camera Calibration.

List of Home Assignments:

Design:

1. Depth Calculation based on Monocular Vision
2. Depth Calculation based on Stereo Vision
3. Automatic Attendance monitoring system
4. Detection of Traffic Signals
5. Pose Estimation

Case Study:

1 Detection of Roadside Infrastructure (Lampposts, Pavement Blocks, Seating Arrangements, Roadside Line Markers, Manholes, Barricades, etc.
2. Vehicle License Plate Recognition at Security Checkpoints
3. Detection of Dents on a Car
4. Detection of Type of Roads (Tar, Cement, and Mud)
5. Hand-Gesture Recognition

Blog

Computer Vision for:

1. Mobility of Visually Impaired People
2. Avoiding Accidents
3. Obstacle Detection and Avoidance
4. Patient Monitoring
5. Fall detection

Survey:

Computer Vision for

1. Differently Abled People
2. Computer Vision for Kids Care
3. Computer Vision Electric Vehicles
4. Computer Vision for Women Safety
5. Computer Vision for Teaching-Learning Process at Academic Institutes

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

1. Gonzalez, Woods, "Digital Image Processing", Prentice Hall India, 2nd edition.
2. Pratt W.K., "Image Processing", John Wiley, 2001
3. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Publication.
4. Forsyth and Ponce, "Computer Vision-A Modern Approach", 2nd Edition, Pearson Education.
5. R. O. Duda, P.E.Hart, and D.G.Stork,", Pattern Classification", 2nd edition, Springer, 2007.
6. Theodoridis and Koutrombas," Pattern Recognition", 4th edition, Academic Press, 2009

Reference Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", Thomson Learning.
2. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I, II, Addison-Wesley, 1993.
3. Ludmila I.Kuncheva,"Combining pattern classifiers", John Wiley and sons Publication.
4. Ethem Alpaydin," Introduction to Machine Learning", The MIT press.

MOOC's Links and additional reading material:

https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs58/

Course Outcomes:

1. Perform Image Enhancement Operations
2. Apply Segmentation Techniques to Divide Image into Parts
3. Develop Feature Vectors for Object Detection Purpose
4. Select Algorithm for Object Recognition
5. Classify Image / Signal / Data/ by using Supervised / Unsupervised Classifier
6. Discuss Epipolar Geometry and Stereo Vision for Depth Calculation.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	1	1	1	3	1	0	3	3	3	2	2	1	1
2	3	3	3	1	3	1	0	3	3	3	2	2	1	1
3	3	3	3	3	3	2	0	3	3	3	2	2	3	3
4	3	1	3	1	3	3	0	3	3	3	2	2	3	3
5	3	3	3	3	3	2	1	3	3	3	2	2	3	3
6	3	2	1	3	2	1	1	3	3	3	2	2	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1 : Level 3
CO2 : Level 4
CO3 : Level 4
CO4 : Level 5
CO5 : Level 5
CO6 : Level 4

Future Courses Mapping:

1. Pattern Recognition, Deep Learning

Job Mapping:

1. Embedded Engineer
2. Computer Vision Specialist
3. Data Engineer
4. Machine Learning Engineer
5. Data Scientist
6. Engineer-Autonomous Vehicle
7. Research Engineer

FF No.: 654

ET3206: DIGITAL DESIGN

Course Prerequisites:

Semiconductor devices: FET, MOS operation, biasing techniques. MOS as inverter.
Digital Electronics: Logic Gates, Boolean Algebra, Truth table, K-maps, Combinational Circuits, Sequential Circuits, State Diagrams.

Course Objectives:

Student will be able to

1. Understand the effect of power and frequency of operation of MOS on overall performance.
2. Compare performance of digital logic families
3. Optimizing pipelines for speed, area, power and resources
4. Understanding parallelism of hardware and advantage over sequential processors
5. Design optimized digital circuits in HDL Verilog
6. Generate self-checking test bench for given functionality

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance:

This course emphasizes on the deep understanding of the operation of a transistor. The understanding of the transistor is necessary to model and innovate future process technologies. The basic circuit understanding is essential for achieving the best PPA (Power, performance and area) metrics. A transistor level understanding of the circuits is regularly used for circuit analysis, design and debug in standard cell, methodology development, process technology, memory design, analog design, digital design, physical design teams in the industry. Often, high performance designs need hand instantiation of logic gates to meet the timing at the high clock speeds. For example: CPU, Memory controller cores, PHY designs are high performance cores being clocked at greater than 2-4GHz. The second section of the course emphasizes on the language constructs and a method of implementation of complex logic and functionalities in the SoCs. The language is a powerful tool for keeping the designs technology independent and hence increasing reusability across technology nodes and across designs.

SECTION-1

MOS Inverter: Digital vs Analog vs Discrete vs Continuous, MOS as Switch, Concept of Gate Threshold voltage, MOS structure and working, Types of MOS : Enhancement , Depletion, NMOS , PMOS, Capacitors in MOS, IV Characteristics, Equations, Channel length modulation, its effect on current.

Importance of scaling, dimensions for scaling, types of scaling. Effect on threshold, current, power, delay due to - Constant voltage scaling. Effect on threshold, current, power, delay due to - Constant Field scaling. Comparison of constant voltage and constant field scaling. Short channel and narrow channel effects, DIBL, supporting Equations. Drain punch through, Hot carrier effect, Surface states and interface trapped charge.

CMOS Combinational Circuits: Ratioed logic, Need of of PUN and PDN for digital circuits, Design issues of RL in ratioed logic, TPLH vs Power dissipation, CMOS Logic, PUN PDN for CMOS. Inverter and basic logic gates using CMOS, Weak 1 and Strong 0 using NMOS, Weak 0 and Strong 1 using PMOS in CMOS inverter, DCVSL Working, Pass Transistor logic, Level restorer, Transmission Gate logic, Dynamic Logic Design , Speed and power dissipation in dynamic logic, Signal Integrity issues in Dynamic Design, Domino Logic & Optimization of Domino

CMOS Sequential Circuits - Overview of working, Multiplexer based latch, Mux based FF, NMOS only pass transistor logic - FF circuit, Clock overlap issues. C2MOS Logic Working and immunity to clock overlap. TSPC Working. Pipelining - Approach to optimize sequential circuits, Latch vs Register pipeline, NORA CMOS.

SECTION-2

Configurable Hardware: Design options for digital systems, Standard Chips, PLDs, FPGAs and ASICs. VLSI design flow. Role of hardware description languages, motivation. Concurrency in hardware.

Introduction to Verilog HDL: Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, Module, System Tasks, Simulation and Synthesis. Verilog Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators. Gate level modelling and Data flow modelling.

Behavioral modeling : Procedural constructs- initial & always block, procedural assignments – blocking and nonblocking statements, difference in blocking and nonblocking statements, active region, inactive region, event scheduling under stratified event queue, event scheduling

in Verilog, delay timing control, selection statements- if-else, case, iterative statements- while, for, repeat, forever loop. Task, function, system tasks and functions, file I/O system task

List of Tutorials:

1. Moores Law, Technology nodes in VLSI Fabrication
2. VLSI Fabrication process
3. FINFET technology
4. Power Delay optimization
5. Simulation of combinational and sequential circuits in SPICE
6. Simulation Verification & Synthesis
7. Protocol implementation using Verilog
8. High Level Synthesis
9. Filter implementation in HDL
10. Self checking test bench.

List of Practicals:

1. Operation point analysis, DC Analysis and AC analysis of RC network using SPICE.
2. DC analysis of nMOS, pMOS and CMOS Inverter for varying threshold voltage and W/L ratio using SPICE.
3. Transient analysis and Voltage Transfer Characteristics of CMOS inverter using SPICE.
4. CMOS Inverter Layout, Pulse and dc sweep characteristics using Layout editor.
5. CMOS Logic Gate, Pulse and dc sweep characteristics using SPICE
6. CMOS ratioed logic analysis for varying loads using SPICE.
7. Transient analysis of CMOS based 2:4 Decoder
8. Transient analysis of CMOS based 3:2 priority encoder
9. Simulation of Combinational Circuit using Verilog
10. Simulation of Sequential Circuits using Verilog.

List of Projects:

1. To simulate I2C protocol in Verilog HDL
2. To simulate SPI protocol in Verilog HDL
3. To simulate RAM in Verilog HDL
4. To simulate FIFO in Verilog HDL
5. To simulate encryption standard in Verilog HDL
6. To simulate UART in Verilog HDL
7. To simulate CPU in Verilog HDL
8. To simulate electronic voting machine in Verilog HDL
9. To simulate traffic light controller in Verilog HDL
10. To implement filter in Verilog HDL

List of Course Seminar Topics:

1. Moores Law, Technology nodes in VLSI Fabrication
2. VLSI Fabrication process
3. FINFET technology
4. Power Delay optimization
5. Simulation of combinational and sequential circuits in SPICE
6. Simulation Verification & Synthesis
7. Protocol implementation using Verilog
8. High Level Synthesis
9. Filter implementation in HDL
10. Self checking test bench.

List of Course Group Discussion Topics:

1. Emerging Technology for CMOS replacement
2. Comparison of VLSI Fabrication techniques & representation schemes
3. High Level Synthesis vs Verilog which one describes hardware better
4. Bicmos Technology, Combining BJT & MOS, comparison with CMOS, Fabrication flow, Companies using that technology.
5. Different Types of Fabrication Techniques, SOI/ CMOS/ FINFET technologies, Stick diagram representation, Lambda rules, area calculation
6. Semiconductor memories - RAMBUS, SDRAM, DDR RAM etc., DDR Standards, DDR IC manufacturers,
7. Synchronizer techniques for multiblock domain SOCs, Clock domain crossing, MUX synchronizer, FIFO, Handshake
8. Timing issues in datapath design, Clock Skew positive vs negative skew, Metastability
9. Instruction Pipelining, MIPS pipelined data path, Basic 5 stage pipeline, Multicycle pipeline, performance improvement and hazards etc.
10. Fermi energy band diagrams, Band diagram representing NMOS and PMOS accumulation, depletion, inversion stages.

List of Home Assignments:

Design:

1. Design & Verify packet processor
2. Design AMBA Bus protocol
3. Design of AXB Bus
4. CPU Design
5. Microprocessor design

Case Study:

1. Design & Verify packet processor
2. Design AMBA Bus protocol

Blog : Blog based on course project based reading

1. Memory Technologies
2. Owning a Fab vs Staying Fabless
3. Security Risks in SoCs and Systems
4. Open Source in Semiconductor Industry
5. Moore's Law; Thermal Challenges

Surveys

1. VLSI supply chain security risks and mitigation techniques
2. VLSI Architectures for Image Interpolation
3. Optimal solution for VLSI circuit partitioning in physical design
4. Verilog HDL simulator technology
5. Parallel Multi-core Verilog HDL Simulation
6. Historical Survey of Functional Hardware Languages
7. Survey of High-Level Synthesis Systems
8. Defect tolerance in VLSI circuits: techniques and yield analysis
9. Synchronizer techniques for multi-clock domain SoCs
10. Impact of FSM Design for High-Performance Architecture Evaluation.

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Textbooks:

1. Kang, Sung-Mo, and Yusuf Leblebici. CMOS digital integrated circuits. Tata McGraw -Hill Education, 2003.
2. Rabaey, Jan M., Anantha P. Chandrakasan, and Borivoje Nikolić. Digital integrated circuits: a design perspective. Vol. 7. Upper Saddle River, NJ: Pearson Education, 2003.
3. Palnitkar, Samir. Verilog HDL: a guide to digital design and synthesis. Vol. 1. Prentice

Hall Professional, 2003.

4. Link to e-books http://www.stem-edu.com/wp-content/uploads/2017/02/Rabaey-Digital-Integrated-Circuits-Asign-Perspective-2Nd-Edition.pdf

Reference Books:

1.Weste, Neil HE, and David Harris. CMOS VLSI design: a circuits and systems perspective. Pearson Education India, 2015.
2. Ciletti, Michael D. Advanced digital design with the Verilog HDL. Vol. 1. Upper Saddle River: Prentice Hall, 2003.

Moocs Links and additional reading material:

www.nptelvideos.in
https://nptel.ac.in/courses/108/106/108106158/ IIT Madras
https://nptel.ac.in/courses/106/105/106105165/ Dr. Indranil Sengupta

Course Outcomes:

Student will be able to

1. Determine MOSFET behavior under dimension scaling
2. Compare performance of CMOS based logic circuit
3. Analyze combinational and sequential circuit for pipelining
4. Describe VLSI design flow and basic Verilog constructs
5. Describe functionality of digital Circuits using Verilog HDL
6. Select Verilog HDL statement for coding and synthesis optimization

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	3	2	3	3	3	3	3	3	3	3
2	2	3	3	2	3	2	3	3	3	2	2	3	2	3
3	2	3	3	3	2	2	3	3	2	2	1	3	2	3
4	3	3	3	2	3	2	3	3	3	3	3	3	3	3
5	3	2	3	3	3	2	3	3	3	3	3	3	3	2
6	2	2	3	3	3	2	3	3	2	3	1	3	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1 : Level 3
CO2 : Level 4
CO3 : Level 4
CO4 : Level 5
CO5 : Level 5

CO6 : Level 5
Future Courses Mapping: CMOS Analog Design, System Verilog.

FF No.: 654

ET3271: EMBEDDED SYSTEM DESIGN

Course Prerequisites:

Microprocessor & Microcontroller concepts and applications, Assembly language concepts, C programming, Computer architecture and operating system

Course Objectives:

1. Learn designing and programming Embedded Systems for real time applications.
2. Set up and operate Raspberry Pi with different interfaces
3. Develop embedded software using RTOS and implement small programs to solve well-defined problems on an embedded platform.

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

SECTION-1
Introduction to embedded system: Introduction to embedded system, hardware and software architecture, RISC and CISC architecture, Processor and memory selection criteria,I/O , **ARM Processor** ARM family, nomenclature, data flow model of ARM7 , registers model of ARM 7, Architecture of ARM7 , operating modes, Exception Handling, **LPC2148 Microcontroller** : Features, Block diagram , GPIO, Interrupts, Timers, PLL, ADC/DAC, PWM
SECTION-2
Communication Protocols: UART, RS232, CAN, I2C & SPI Implementation **Raspberry PI** : Introduction to Raspberry Pi, setting up Raspberry Pi, Interfacing & Programming Raspberry Pi using Python **RTOS** :Characteristics, RTOS kernel services, task management(task states, API,), Task scheduling algorithms , Resource management (synchronization , Mutual Exclusion,

Semaphores) Critical section of code, race condition , Intertask Communication, Priority Inversion, Deadlock, memory management, ISR, Timer.

List of Tutorials:

1. ARM nomenclature and Comparative study of different versions of ARM
2. LPC2148 GPIO
3. LPC2148 Timers and ADC
4. LPC 2148 Interrupts
5. LPC 2148 DAC
6. LPC2148 UART
7. LPC 2148 I2C /SPI protocols
8. Study of various embedded hardware development platforms
9. STudy of different Embedded OS
10. uCOS III RTOS task scheduling /multitasking.

List of Practicals:

1. LPC2148 interface with LED and & 7 segment Display
2. LPC2148 interface with 16 X 2 LCD
3. LPC2148 interface with Matrix Keyboard.
4. LPC2148 interface with temperature sensor and relay.
5. LPC2148 interface with DC Motor
6. Setting up Raspberry Pi
7. GPIO programming with Raspberry pi
8. Task Scheduling for Input and Output Devices using µCOS- II Semaphore
9. Implementation of Message Queue for 3 Tasks on µCOS- II.
10. Implementation of Message Mailbox for 3 Tasks on µCOS- II.

List of Projects:

1. Rolling Display
2. Automatic sanitizer dispenser and water tap
3. Automatic door opener and closure along with display of total count of people gone into the shop/bank.
4. Queue regulation in shop/bank at safe social distance.
5. Image operated bill generating machines at Govt. Ration shops.
6. Mobile app for grocery/vegetable shopkeeper and customer.
7. Home automation.
8. Non touching Electric switches for home/offices/shops
9. Greenhouse farming
10. AC /stepper motor speed control.

List of Course Seminar Topics:

1. Speeding up power estimation of embedded software
2. Battery model for embedded system
3. Integrating security policies with embedded real time systems
4. Real time dynamic voltage scaling for embedded systems
5. Scratchpad memory: A design alternative for cache on chip memory in embedded systems
6. AUTOSAR architecture in Automobiles
7. Performance issues of embedded systems
8. Lin protocol in automobile
9. GPU
10. Reconfigurable processor.

List of Course Group Discussion Topics:

1. Serial interface vs parallel interface
2. Various types of semiconductor memories used in microcontrollers.
3. Wired Vs. wireless interface
4. .Industrial communication protocols
5. Microcontroller Vs. FPGA/ASIC
6. OS scheduling algorithms
7. RTLinux Vs uCOS III RTOS
8. uCOS III Vs FreeRTOS
9. CAN Vs MODBUS Protocol
10. Microcontroller based system's Real time testing vs Simulation based testing.

List of Home Assignments:

Design:

1. Incremetal Phase shifter design
2. Prevention system from Locust attack
3. Battery management system in electric vehicle
4. Implementation of CAN protocol
5. Health monitoring system

Case Study:

1. Software development life cycle models
2. ECU in automobiles
3. Aerospace / Aircraft monitor and control

4. Electric vehicles and microcontroller application
5. Assessment of Malware for embedded Architectures

Blog:

1. Protection and Security of RTOS
2. Modern embedded system programming: Beyond RTOS
3. Role of RTOS in autonomous cars
4. Embedded system: A carrier option

Surveys:

1. Securing wireless data: design challenges
2. Multicore processors architecture
3. RTOS and GPOS
4. Flexray protocol

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

1. Sloss Andrew , "ARM system Developer's Guide", Elsevier Publication
2. Dr. K.V.K.K. PrasSad , " Embedded / Real Time Systems Programming" Black Book, Dreamtech Press,
3. Jean J. Labrosse, "MicroC OS II, The Real-Time Kernel", 2nd edition, CMP Books.

Reference Books:

1. Embedded System Design, CMP Books, Arnold S. Berger
2. Software introduction" 3rd edition, Wiley, Frank Vahid and Tony Givargis.
3. LPC 2148 Datasheet
4. LPC 2148 reference manual

MOOC's Links and additional reading material:

https://swayam.gov.in/nd1_noc20_cs15
https://nptel.ac.in/courses/106/105/106105193/
https://nptel.ac.in/courses/106/105/106105166/

Course Outcomes:

The student will be able to

1. Elaborate Classic ARM processor architecture
2. Design and analyse various peripheral device interfaces with LPC2148 Microcontroller.
3. Compare various communication protocols used in embedded systems
4. Describe Raspberry Pi system.
5. Design and analyse various peripheral device interface with Raspberry Pi
6. Apply uCOS II RTOS in real time application.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	0	0	1	0	0	1	1	2	2	3	2	0	0
2	2	3	3	1	3	3	2	2	3	3	3	3	0	3
3	1	0	3	1	3	0	1	2	3	3	3	3	3	0
4	1	0	3	1	3	3	1	2	3	2	3	2	3	0
5	2	3	0	1	3	3	2	2	3	3	3	3	0	3
6	2	3	0	1	3	3	2	2	3	3	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1: Level 1
CO2: Level 3
CO3: Level 2
CO4: Level 2
CO5: Level 4
CO6: Level 4

Future Courses Mapping:

Automotive Electronics, Embedded networking

Job Mapping:

System software engineer, Embedded software engineer, System expert, Chip design engineer. Application software engineer in various sectors like automotive, consumer electronics, medical, aviation etc.

FF No.: 654

ET3283: ENGINEERING DESIGN AND INNOVATIONS-3

Course Prerequisites:

Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group to develop team skills and learn professionalism.

Credits: 6 **Teaching Scheme:** Lab 2 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands on experience and self-learning to the students which will help them throughout their career. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. This course is designed to encourage and ensure application of technology for solving real world problems using an interdisciplinary approach.

Students need to plan their work in following steps:

1. Formation of project group comprising of 4-5 students. Multidisciplinary groups are allowed
2. A supervisor/mentor teacher assigned to individual groups.
3. Carrying out literature survey
4. Finalization of problem statement
5. Planning the project execution
6. Execution of project and testing
7. Writing a report
8. Publication in the form of research paper/patent/copyright as found suitable by supervisor/mentor

Teacher's Role in PCL:

1. Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
2. To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
3. To aware the group about time management.
4. Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

1. Students must have ability to initiate the task/idea they should not be mere imitators.
2. They must learn to think.
3. Students working in PCL must be responsible for their own learning.
4. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
5. Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
6. Students in PCL are expected to work in groups.
7. They must develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1) VLSI Design
2) Embedded Systems
3) Signal Processing
4) Communication
5) Machine learning

Assessment Scheme:

Mid Semester Examination - 30 Marks
End Semester Examination - 70 Marks

MOOCs Links and additional reading material:

www.nptelvideos.in
https://worldwide.espacenet.com/

Course Outcomes:

1. Review the literature to formulate problem statement to solve real world problems.
2. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
3. Manage project ethically as team member/ lead.
4. Demonstrate effectively technical report/ research paper/ prototype/patent.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	1	0	0	3	1	3	0	2	2	2
2	3	3	3	3	3	3	3	2	1	2	0	2	3	3
3	0	1	1	1	0	2	0	3	3	3	3	2	0	0
4	3	1	1	1	0	0	0	3	1	3	3	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: - Level 3
CO2: - Level 4
CO3: - Level 3
CO4: - Level 4

FF No.: 654

ET3272: DESIGN AND ANALYSIS OF ALGORITHMS

Course Prerequisites: Basic courses on programming, data structures, Discrete structures, theory of computing.

Course Objectives:

1. Students will gain understanding of asymptotic notations and will be able to apply suitable mathematical techniques to find asymptotic time and space complexities of algorithms.
2. Students will develop ability to formulate computational problems in abstract and mathematically precise manner.
3. Student will gain understanding of different algorithm design paradigms such as divide and conquer, dynamic programming, greedy, backtracking and will apply suitable paradigm for designing algorithms for computational problems
4. Students will develop understanding of notions of NP-hardness and NP-completeness and their relationship with the intractability of decision problems.
5. Students will design randomized, approximation algorithms for some computational problems.

Credits: 4 **Teaching Scheme Theory: 2** Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance:

This is a foundational course for Computer science and Engineering. This course develops algorithmic thinking capability of students. Designing algorithms using suitable paradigm and analysing the algorithms for computational problems has a high relevance in all domains where computer science plays a crucial role (equally in Industry as well as research). This course is also an essential pre-requisite for advanced domain specific algorithmic courses such as Algorithmic Graph Theory, Algorithmic Number Theory, Computational Geometry, Motion planning and Robotics, etc, to give a few examples. Once the student gains expertise in Algorithm design and in general gains ability of Algorithmic thinking, it facilitates in systematic study of any other domain (in computer science or otherwise) which demands logical thinking. This course is also relevant for students who want to pursue research career in theory of computing, computational complexity theory, advanced algorithmic research.

SECTION-1

Basic introduction and time and space complexity analysis:
Asymptotic notations (Big Oh, small oh, Big Omega, Theta notations). Best case, average case, and worst-case time and space complexity of algorithms. Overview of searching, sorting algorithms. Adversary lower bounds (for the comparison-based sorting algorithms, for finding second minima). Using Recurrence relations and Mathematical Induction to get asymptotic bounds on time complexity. Master's theorem and applications. Proving correctness of algorithms. (4 hr)

Divide and Conquer: General strategy**,** Binary search and applications, Analyzing Quick sort, Merge sort, Counting Inversions, Finding a majority element, Order statistics (randomized and deterministic algorithms), Josephus problem using recurrence, Efficient algorithms for Integer arithmetic (Euclid's algorithm, Karatsuba's algorithm for integer multiplication, fast exponentiation). (4 hr)

Dynamic Programming: General strategy, simple dynamic programming based algorithms to compute Fibonacci numbers, binomial coefficients, Matrix Chain multiplication, Optimal binary search tree (OBST) construction, 0-1 Knapsack, Traveling Salesperson Problem. (7 hr)

SECTION-2

Greedy and Backtracking strategy:
Greedy: General strategy, Analysis and correctness proof of minimum spanning tree and shortest path algorithms, fractional knapsack problem, Huffman coding, conflict free scheduling.
Backtracking: General strategy, n-queen problem, backtracking strategy for some NP-complete problems (e.g. graph colouring, subset sum problem) (7 hr)

Introduction to complexity classes and NP-completeness:
Complexity classes P, NP, coNP, and their interrelation, Notion of polynomial time many one reductions reduction, Notion of NP-hardness and NP-completeness, Cook-Levin theorem. NP-Complete problems (some selected examples from - Satisfiability problem, Circuit-SAT, 3-CNF SAT, vertex cover problem, independent set problem, clique problem, Hamiltonian-circuit problem.
(4hr)

Introduction to Randomized and Approximation algorithms:
Introduction to randomness in computation, Las-Vegas and Monte-Carlo algorithms,Abundance of witnesses/solutions and application of randomization, randomized quick sort, Las-Vegas and Monte-Carlo algorithms for majority search
Introduction to Approximation algorithms for NP-optimization problems, Approximation algorithm for metricTraveling-Sales-Person Problem (metric-TSP). (4 hr)

List of Tutorials:

1. Problem solving based on asymptotic notations, solution of recurrences
2. Problem solving based on Divide and Conquer strategy
3. Advanced problem solving based on Divide and Conquer strategy
4. Problem solving based on Dynamic Programming strategy
5. Advanced problem solving based on Dynamic Programming strategy
6. Problem solving based on Greedy strategy
7. Problem solving based on Backtracking strategy
8. Proving correctness of algorithms: some techniques
9. Adversary lower bound technique
10. Problem solving based on complexity classes, NP-completeness.
11. Randomized Algorithms
12. Approximation Algorithms

List of Practicals:

1. Assignment based on some simple coding problems on numbers, graphs, matrices
2. Assignment based on analysis of quick sort (deterministic and randomized variant)
3. Assignment based on Divide and Conquer strategy (e.g. majority element search, finding kth rank element in an array)
4. Assignment based on Divide and Conquer strategy (e.g. efficient algorithm for Josephus problem using recurrence relations, fast modular exponentiation)
5. Assignment based on Dynamic Programming strategy (e.g. Matrix chain multiplication, Longest increasing subsequence)
6. Assignment based on Dynamic Programming strategy (e,g, All pair shortest path, Traveling Sales Person problem)
7. Assignment based on Greedy strategy (e.g. Huffman encoding)
8. Assignment based on Backtracking (e.g. graph coloring, n-queen problem)
9. Assignment based on Las-Vegas and Monte-Carlo algorithm for majority element search
10. Assignment based on factor-2 approximation algorithm for metric-TSP

List of projects:

1. Applications of A* algorithm in gaming
2. Pac-Man game
3. File compression techniques
4. Solution of Maze (comparing the backtracking based solution and Dijkstra's algorithm)
5. Different exact and approximation algorithms for Travelling-Sales-Person Problem
6. Creation of Maze using backtracking
7. Knight tour algorithms
8. Network flow optimization and maximum matching
9. AI for different games such as minesweeper, shooting games, Hex, connect-4, sokoban, etc
10. SUDOKU solver
11. Graph theoretic algorithms
12. Computational Geometry Algorithms
13. AKS primality testing
14. Algorithms for factoring large integers
15. Randomized algorithms for primality testing (Miller-Rabin, Solovay-Strassen)
16. Slider puzzle game

List of Course Seminar Topics:

1. Divide and Conquer Vs Dynamic Programming
2. Greedy strategy
3. NP-hardness
4. Backtracking strategy
5. Dynamic Programming Vs Greedy
6. Computational Complexity
7. Philosophical relevance of P Vs NP question
8. Complexity classes
9. Space complexity
10. Compression Techniques
11. Real world applications of Graph theoretic algorithms
12. Approximation algorithms
13. Hardness of approximation
14. Pseudorandom number generators

List of Group Discussion Topics:

1. Greedy Algorithms
2. Dynamic Programming strategy
3. Dynamic Programming Vs Greedy
4. NP-completeness
5. P Vs NP question

6. Algorithm design paradigms
7. Different Searching techniques
8. Backtracking strategy
9. Relevance of Cook-Levin theorem
10. Randomness in computation
11. Approximation Algorithms
12. Application of Recursion

List of Home Assignments:

Design:

1. Problem solving based on Divide and Conquer strategy
2. Problem solving based on Dynamic Programming strategy
3. Problem solving based on Greedy strategy
4. Problem solving based on Backtracking strategy
5. Problems on Randomized Algorithms
6. Problems on Approximation Algorithms
7. Problems on NP completeness

Case Study:

1. AKS primality test
2. Quadratic sieve factoring algorithm
3. Huffman Encoding, LZW encoding
4. Network flow optimization algorithms
5. Approximation algorithms for TSP
6. Cook-Levin theorem and its relationship with intractability of computational problems
7. Sorting techniques

Blog:

1. Approximation Algorithms
2. Randomized Algorithms
3. Computational Geometry Algorithms
4. Number Theoretic Algorithms
5. Graph Theoretic Algorithms
6. P Vs NP Problem
7. Complexity classes
8. Greedy Algorithms
9. Divide and Conquer Vs Dynamic Programming

Surveys:

1. Primality Testing Algorithms
2. Integer Factoring Algorithms
3. NP-complete problems
4. Compression Techniques
5. Shortest Path Algorithms

6. Algorithms for finding Minimum Weight Spanning Tree
7. SAT solvers

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Textbooks:

1. Cormen, Leiserson, Rivest and Stein "Introduction to Algorithms" ,PHI 3nd edition, 2009. ISBN 81-203-2141-3
2. Jon Kleinberg, Eva Tardos "Algorithm Design", Pearson, 1st edition, 2005. ISBN 978-81-317-0310-6
3. Dasgupta, Papadimitriu, Vazirani "Algorithms" McGraw-Hill Education; 1 edition (September 13, 2006), ISBN-10: 9780073523408, ISBN-13: 978-0073523408

Reference Books:

1. Motwani, Raghavan "Randomized Algorithms", Cambridge University Press; 1 edition (August 25, 1995), ISBN-10: 0521474655, ISBN-13: 978-0521474658
2. Vazirani, "Approximation Algorithms", Springer (December 8, 2010), ISBN-10: 3642084699, ISBN-13: 978-3642084690

MOOCs Links and additional reading material: www.nptelvideos.in,

Course Outcomes:

The student will be able –

1. To formulate computational problems in abstract and mathematically precise manner
2. To design efficient algorithms for computational problems using appropriate algorithmic paradigm
3. To analyze asymptotic complexity of the algorithm for a complex computational problem using suitable mathematical techniques.
4. To establish NP-completeness of some decision problems, grasp the significance of the notion of NP-completeness and its relationship with intractability of the decision problems.

5. To understand significance of randomness, approximability in computation and design randomized algorithms for simple computational problems and design efficient approximation algorithms for standard NP-optimization problems.
6. To incorporate appropriate data structures, algorithmic paradigms to craft innovative scientific solutions for complex computing problems.

CO PO Map:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	2	0	0	0	0	0	1	1	1	1	2	1	0
2	1	2	3	0	0	0	0	1	1	1	1	2	1	0
3	1	3	1	3	0	0	0	1	1	1	1	2	1	0
4	1	2	3	3	0	0	0	0	1	1	0	2	1	0
5	1	1	3	2	0	0	0	0	1	1	0	2	1	0
6	1	2	2	0	0	0	0	1	1	1	1	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: Level 2
CO2: Level 3
CO3: Level 3
CO4: Level 5
CO5: Level 5
CO6: Level 2

Future Courses Mapping:

Following courses can be learned after successful completion of this course:
Advanced Algorithms, Computational Complexity, Computational Geometry, Algorithmic Number Theory, Algorithmic Graph Theory.

FF:654

ET3207: INFORMATION THEORY & CODING TECHNIQUES

Course Prerequisites:

Probability Theory, Basic Maths.

Course Objectives:

- To study various Lossless and Lossy Compression methods
- To compress effectively Text, Signal, and Image
- To generate Linear block codes
- To Encode and decode data effectively

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hour/Week
Lab: 2 Hours/Week

Course Relevance: This course introduces the concept of information theory, Entropy, Compression techniques, coding techniques and models.

SECTION-1
Introduction to Information theory, Discrete memory less channel , Entropy and its properties, Differential entropy and mutual Information, Information Capacity theorem. Kraft's McMillan Inequality, Source coding theorem, Huffman coding, Shannon-Fano coding, Arithmetic Coding , Dictionary Techniques for lossless compression, Linear Block Codes-Syndrome and error detection, Error detection and correction capacity, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes

SECTION-2

Cyclic Codes, generator polynomial, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes, Convolutional Codes, State diagram, Polynomial description of convolution code, Generator matrix of convolution code, Tree diagram, Trellis diagram, Viterbi decoding, Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes.

List of Practicals:

1. To determine Entropy and information rate for the given source.
2. To implement Huffman code.
3. To implement arithmetic code.
4. To implement LZ77 algorithm.
5. To implement LZ77 algorithm.
6. To implement LZW algorithm
7. To implement linear block codes.
8. To implement cyclic code.
9. To implement convolution code.
10. To implement Viterbi decoder

List of Course Projects:

1. Signal compression with lossless/lossy compression techniques.
2. Image compression with lossless/lossy compression techniques.
3. Text files compression with dictionary techniques.
4. Comparison of various channel coding Techniques.

List of Course Seminar Topics:

1. Data Compression
2. Lossless Compression Techniques
3. Lossy Compression Techniques
4. JPEG Compression Standard
5. Lempel Ziv Dictionary Techniques
6. DCT based Compression
7. Wavelet based Compression
8. Linear block codes
9. Cyclic Codes

List of Course Group Discussion Topics:

1. Need of data Compression
2. Comparison of Lossless and Lossy Compression methods
3. DCT versus DFT Transform
4. Wavelet Transform based Compression
5. Study of File formats
6. Linear Block codes with Applications
7. Convolution versus Cyclic codes
8. Applications of Vitterbi coding Technique
9. JPEG versus MPEG Compression

List of Home Assignments:

Case Study

Compress one Speech/ECG Signal/Image using different compression methods and make a comparative study in terms of compression ratio, efficiency, computational complexity and execution time.

Surveys

Survey of existing lossless and Lossy compression algorithms for ECG Signal Processing.

Design

Design an efficient encoding and decoding algorithm for one Low frequency and one High frequency Text/Signal/Image.

Blog

Suitability of different Compression algorithms for various types of Multimedia Data.

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Textbooks:

1. "Information Theory coding and Cryptography" , RanjanBose , 2ndEdition ,McGraw-Hill Publication.
2. " Analog and digital communications ", Hwei Hsu, second edition , Schaum's outlines.

Reference Books:

1. "Digital Communication Fundamentals & applications"; Bernad Sklar, Second Edition, Pearson Education.
2. "Communication Systems", Simon Haykin; Fourth Edition, John Wiley & Sons.
3. "Introduction to Data compression", Khalid Sayood, Morgan Kaufmann Publisher.

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

The students will be able to

1. Evaluate the performance of source coding theorem based on entropy.
2. Analyze & implement lossless and Lossy compression techniques.
3. Analyze linear block codes for error detection.
4. Decode cyclic code for error detection.
5. Generate Convolutional code & decode using Viterbi decoding.
6. Analyze RS code

CO PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	0	2	2	0	0	0	0	0	0	0	3	3
2	2	2	0	2	3	1	0	0	0	1	1	0	3	3
3	3	2	0	0	3	1	0	0	0	1	1	0	3	3
4	3	3	0	0	2	1	0	0	0	1	1	0	3	3
5	2	2	0	2	3	1	0	0	0	1	0	0	3	3
6	2	2	0	2	3	1	0	0	0	0	0	0	3	3

Future Courses Mapping:

1. Coding and Data Compression
2. Multimedia Signal processing

Job Mapping:

Job opportunities that one can get after learning this course

- Multimedia Signal Processing Industries
- Software Developer
- Telemedicine based Biomedical Industries
- Entrepreneur

FF No. : 654

ET3273 WEB TECHNOLOGY

Teaching Scheme

Credits:.4..... **Theory:** 2 Hours/Week

Tut: 1 Hours/Week

Lab: 1 Hours/Week

Section 1: Topics/Contents

- **Front End Technology:** Introduction to web technology, internet and www, Web site planning and design issues. HTML elements: headings, paragraphs, line break, styles, colors, fonts, links, frames, lists, tables, images and forms, Difference between HTML and HTML5,CSS.(5)

- **Client-Side Technologies:** JavaScript: Overview of JavaScript, Data types, Control Structures, Arrays, Functions and Scopes, Forms Validation, Objects in JS, DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM. (5)

- **Server-Side Technologies:** PHP: Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, File Handling, Exception Handling, E-mail validations .(5)

Section2: Topics/Contents

- **MySQL with PHP:** Introduction, built-in database functions, connecting to a MySQL, selecting a database, building and sending query to database engine, retrieving, updating and inserting data. (2)

- **React :**Introduction to React, React component, JSX, Render function, Component API, Component lifecycle, State, Props, Mixins, Component composition, Pass data from parent to child, Pass data from child to parent, Component styling, Forms, Events, Refs, Keys, Router, Flux.(6)

- **Node JS :** Introduction to Node JS, Installation of Node JS, Node JS Modules, Node Package Manager (npm), Creating Web server, File System, Express JS, Serving Static Resources, Database connectivity.(5)

List of Practicals: (Any Six)

12. Develop a basic web page using HTML tags.
13. Create an admission Template form for VIT admission Process? Perform the validation for email and phone no fields (Develop a responsive web site for your CV having video background for first page

and perform the validation using email or mobile number as username and a password of min length 11 consisting at least one uppercase letter one digit and one special character.)

14. Write a JavaScript program to reverse the elements of a given array.
15. Installation and configuration and testing working of XAMPP server for local host.
16. Write a PHP program to create a simple calculator that can accept two numbers and perform operations like add, subtract, multiplication and divide.
17. Design a dynamic web application using PHP and MYSQL as back-end for student data with insert, delete, view and update operation.
18. Design and implement a website using REACT, Spring Boot and MySQL/Oracle.
19. Design and implement a website using REACT, Node Js and MySQL/Oracle.

List of Project areas:

1. Develop a Website with NLP as a backend
2. Student Grievance System
3. Workflow Management System for MNC
4. Browser-based Game Website using HTML, CSS, JavaScript, Bootstrap
5. Develop an web application that help to farmers to solve their farming problems
6. GST Billing Software for Small Business
7. Online Crime Reporting System using PHP
8. Develop an Online College Voting System
9. Develop an Online Loan Processing System for Farmers.

Text Books: ***(As per IEEE format)***

1. *Kumar, A., Web technologies, CRC press, 2019*
2. *Gupta, R., Internet & Web Technologies, Engineering Handbook, 2019*
3. *Martin, M.G., Programming for Beginners: 6 Books in 1 – Swift+PHP+Java+Javascript+Html+CSS: Basic Fundamental Guide for Beginners, independently published, 2018*
4. *Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5, O'Reilly Media; 5th edition, 2018*
5. *Kohli, S., Web Technologies, PPB Publications, 2015*
6. *Adam Bretz & Colin J Ihrig, "Full Stack Javascript Development with MEAN", SPD, First Edition 2015, Indian Reprint September 2015*
7. *Giulio Zambon, "Beginning JSP, JSF and Tomcat", Apress Publication, Second Edition, 2013*
8. *Jeremy McPeak& Paul Wilton," Beginning JavaScript", Wrox Publication, Fifth Edition, 2015*
9. *Jeffrey C.Jackson, "Web Technologies: A Computer Science Perspective", Second Edition, Pearson Education, 2007, ISBN 978-0131856035.*

10. *Robert W. Sebesta: Programming the World Wide Web, 4th Edition, Pearson education, 2008.*

Reference Books: ***(As per IEEE format)***

1. *Marty Hall, Larry Brown,"Core Web Programming", Second Edition, Pearson Education, 2001, ISBN 978-0130897930.*

2. *H.M. Deitel, P.J. Deitel and A.B. Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006, ISBN 978-0131752429.*

3. *Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.*

4. *Xue Bai et al: The web Warrior Guide to Web Programming, Thomson, 2003*

Course Outcomes:

The student will be able to –

On the completion of course, student will able to

1. Create front end web pages using HTML and CSS tags and attributes
2. Provide validation mechanism and event handling in a website using javascript as a front end technology
3. Differentiate between client-side and server-side validation.
4. Integrate front end with serverside and backend technologies for commercial websites using PHP and Mysql
5. Build single page applications using REACT as a reusable UI component technology as client side technology and Node Js as server side technologies
6. Design and develop three tier enterprise application using client side, server side and back end

FF No. : 654

ET3265 : CONTROL SYSTEMS

Course Prerequisites:

Linear algebra Calculus

Credits:4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hour/Week
Lab: 2 Hours/Week

SECTION-1
Components of control system, Mathematical Modeling of physical systems, Block Diagram Algebra, Signal flow graph, Time Domain Analysis: Standard test signals, Time response and specifications of first order and second order systems, Routh Stability Criteria, Root Locus Technique, Frequency domain specification.
SECTION-2
Frequency Domain Analysis: Frequency response, Bode plot, Polar plot, Nyquist plot and stability criterion. PID Controllers, Introduction to Lead and Lag compensation circuits, State Variable analysis.
List of Practicals: 1. Step, ramp and impulse response of transfer function. 2. Time response of first order system 3. Time response of second order system 4. Mathematical modeling of physical system. 5. Frequency response analysis using Bode plot 6. Frequency response analysis using Nyquist Plot. 7. Study of PID Controller. 8. Designing of Lead, Lag and Lead-Lag Networks 9. DC Position control system. 10. Simulation of state space model.

List of Course Projects:

1. Simulation of given electrical/mechanical system.
2. Linear System Analysis (Time-Domain Analysis, Error –Analysis) using MATLAB
3. Speed control of DC motor.
4. Implementation of op amp based PID controller.
5. Designing of Lead-Lag Compensators for Systems
6. Designing with State Feedback System
7. Simulation of fuzzy control application
8. Design and implementation of filter.
9. Automated Steering control system
10. Automotive suspension system

List of Course Seminar Topics:

1. Electromagnetic levitation: concepts, control and applications
2. Fuzzy logic control
3. Smart control loops in automobile
4. Application of Laplace Analysis to Control
5. A day without control system
6. Frequency domain analysis and stability
7. Time domain analysis and stability
8. Actuators in control system
9. Development of control engineering methods
10. Feedback components in control system

List of Course Group Discussion Topics:

1. Instability in Control System: facts, causes, effects and solution
2. Solving mechanical modelling of system: Force-voltage analogy or Force-current analogy
3. Who serves the stability analysis most: Time domain or frequency domain?
4. Implementing PID controller: problems, challenges and solution
5. Feedback: Impact on system performance
6. Do alone poles curb on system performance?
7. Should Nyquist analysis be made compulsory to describe frequency response of the systems?
8. Steady state error: causes and analysis
9. Effectiveness of Open loop control system and closed loop control system
10. Bode plot or Root locus-a right choice?

List of Home Assignments:

Case Study:

1. Flight control systems
2. Applications of control loops in chemical processes
3. PID controllers tuning methods with example
4. Multivariable control system
5. Intelligent control system

Surveys:

1. Software toolkits for control algorithm simulation
2. Pneumatic and hydraulic actuators
3. Feed forward control systems
4. Servomechanism
5. Networked control systems

Design:

1. Mathematical modeling of thermal system
2. Mathematical modeling of hydraulic system
3. Cascade lead – lag compensator design
4. Controller design using Bode plot
5. Printwheel system with belt and pulleys

Blog:

1. Electromagnetic levitation: concepts, control and applications
2. Fuzzy logic control
3. Smart control loops in automobile
4. Application of Laplace Analysis to Control
5. A day without control system

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

1. K. Ogata, “Modern Control Engineering”, Fourth edition, Pearson education India.
2. I. J. Nagarth and M. Gopal, “Control Systems Engineering”, Third Edition, New age International Publishers, India.

Reference Books:

1. B. C. Kuo, "Automatic control systems", Seventh Edition, Prentice, Hall of India.
2. Norman S. Nise, "Control systems engineering", Third Edition, John Wiley and sons, Inc, Singapore.

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

CO 1: Model a given system using transfer function approach
CO 2: find steady state and transient response of control systems
CO 3: Analyze given system for stability using root locus.
CO 4: Demonstrate various techniques of frequency domain analysis
CO 5: Analyze given system for stability in frequency domain.
CO 6: Model a given system in state space.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	0	0	1	0	0	0	0	0	0	2	0	0
2	2	2	0	0	0	0	0	0	2	0	0	0	2	0
3	2	2	0	0	1	0	0	0	0	0	1	2	0	0
4	3	2	2	0	2	0	0	0	2	1	1	0	2	2
5	3	2	2	0	2	0	0	0	2	1	1	0	2	2
6	3	0	2	0	2	0	0	0	2	1	1	2	2	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

FF:654

ET3274: OPERATING SYSTEMS

Course Prerequisites: Basics of computer system, data structures and any programming language.

Course Objectives:

1. To understand the basic concepts and functions of Operating System.
2. To gain knowledge of process synchronization and its mechanism.
3. To get familiar with CPU scheduling algorithms.
4. To discuss different deadlock handling mechanisms.
5. To learn memory management techniques and virtual memory.
6. To discuss I/O management and file management.

Credits: 4

Teaching Scheme Theory: 2 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance:

This course focuses on functions of operating system. Operating system is system software that manages resources of the computer system and simplifies applications programming. The Operating System acts as a platform of information exchange between your computer's hardware and the applications running on it.

SECTION-1
Introduction: Interaction of OS and Hardware, Functions of OS, OS Services, Types of OS: Batch, Multiprogramming, Time Sharing, Parallel, Distributed & Real-time OS. OS Commands, System Calls, Types of System Calls. **Process management:** Concept of Process, Process States: 2, 5, 7 State Models, Process Structure: Process Control Block, Threads, Thread implementations – User Level and Kernel Level Threads, Concurrency: Issues with Concurrency, Principles of Concurrency, Critical Section Problem, Semaphores and Mutex, Classical Process Synchronization Problems **CPU Scheduling**: Uniprocessor Scheduling, Scheduling Algorithms: First Come First Serve (FCFS), Shortest Job First (SJF), Round Robin and Priority.

SECTION-II

Deadlock: Principles of Deadlock, Necessary Conditions for a Deadlock: Mutual Exclusion, Hold and Wait, No Pre-emption, Circular Wait, Handling Deadlocks: Prevention, Avoidance, Bankers Algorithm.

Memory Management: Logical vs Physical Address Space, Memory Partitioning, Fragmentation, Segmentation, Address Translation, Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit, Paging and Virtual Memory: Page Table Structure, Page Size, Page Replacement Policies: First In First Out (FIFO), Least Recently Used (LRU) and Optimal.

I/O Management:I/O Devices Types andCharacteristics, Secondary Storage: Disk Structure, Disk SchedulingAlgorithms: First Come First Serve (FCFS), Shortest Seek TimeFirst (SSTF),SCAN, C-SCAN, LOOK and C-LOOK.

List of Tutorials:

1. Comparison of different Operating Systems
2. Linux file hierarchy structure/ File system hierarchy Standard
3. Linux commands
4. Operating system structures
5. File system in Windows and Linux
6. CPU scheduling algorithms
7. Deadlock avoidance algorithm
8. Memory management techniques
9. Page replacement algorithms
10. Disk scheduling algorithms

List of Practicals:

1. Execution of Basic Linux commands.
2. Execution of Advanced Linux commands.
3. Shell scripting program.
4. Program for demonstrating use of different system calls.
5. Implementation of multithreading for Matrix Operations using pthreads.
6. Implementation of Classical problems using Threads and Mutex
7. Implementation of Classical problems using Threads and Semaphore.
8. Program to compute finish time, turnaround time and waiting time for the following algorithms:
    a. First come First serve b) Shortest Job First (Preemptive and Non Preemptive)
    b. Priority (Preemptive and Non Preemptive) d) Round Robin
9. Program to check whether given system is in safe state or not using Banker's Deadlock Avoidance algorithm.

10. Program for following placement algorithm check whether memory can be allocated to given process or not by using following methods
    a. First fit b) Best fit c) Worst fit d) Next fit
11. Program to calculate the number of page faults for a reference string for the following page replacement algorithms:
    a) FIFO b) LRU c) Optimal
2) Program to implement the following disk scheduling algorithms:
    a) FCFS b) SCAN c) C-SCAN d) SSTF

List of Projects:

1. Design and implementation of a Multiprogramming Operating System: Stage I
   i.CPU/ Machine Simulation
   ii.Supervisor Call through interrupt
2. Design and implementation of a Multiprogramming Operating System: Stage II
   i. Paging
   ii. Error Handling
   iii. Interrupt Generation and Servicing
   iv. Process Data Structure
3. Design and implementation of a Multiprogramming Operating System: Stage III
   i. Multiprogramming
   ii. Virtual Memory
   iii. Process Scheduling and Synchronization
   iv. Inter-Process Communication
   v. I/O Handling, Spooling and Buffering

List of Course Seminar Topics:

1. Different File Systems in Windows and Linux OS
2. Operating System generations
3. OS Structures
4. System call Vs API
4. Classical process synchronization problems
5. Process Vs Threads
6. Virtual Machines
7. Real Time Scheduling
8. Booting Process of different Operating Systems.
9. Protection and Security in Operating System
10. Flynn's taxonomy

List of Course Group Discussion Topics:

1. Interprocess Communication (IPC)
2. Role of Operating system
3. 32 bit Vs 64 bit OS
4. Storage structures and their tradeoffs
5. Disk Scheduling
6. Desktop OS Vs Mobile OS
7. Security Vs Protection in OS
8. I/O processors
9. Linux Vs Windows OS
10. Best OS for smartphones

List of Home Assignments:

Design:

1. Report Generation using Shell Script an AWK
2. Library Management System using shell
3. Inter Process Communication in Linux
4. Design any real time application using job scheduling
5. Design any application using Android

Case Study:

1. Distributed Operating System
2. Microsoft Windows 10
3. VMware
4. Linux
5. Android

Blog

1. Operating System Forensics
2. Open Source OS Vs Commercial OS
3. Protection and Security of OS
4. Comparative study of different mobile OS
5. Operating Systems for IoT Devices

Surveys

1. A survey of Desktop OS
2. Analysis and Comparison of CPU Scheduling Algorithms
3. A Survey of mobile OS
4. Parallel Computing
5. Malware Analysis, Tools and Techniques

Assessment Scheme:

1. Home Assignment: Design, Case Study, Blog and Survey
2. MCQ
3. CVV
4. Seminar
5. Group Discussion
6. LAB-Course Assignment and Project Evaluation

Text Books:

1. Stalling William;"Operating Systems"; 6th Edition,Pearson Education;
2. Silberschatz A., Galvin P., Gagne G.;"Operating System Concepts" ; 9th Edition; John Wiley and Sons;
3. Yashavant Kanetkar; "Unix Shell Programming"; 2nd Edition, BPB Publications
4. Sumitabha Das; "Unix Concepts and Applications"; 4th Edition, TMH.

Reference Books:

1. Silberschatz A., Galvin P., Gagne G; "Operating System Principles"; 7th Edition, John Wiley andSons.
2. Forouzan B. A., Gilberg R. F.; "Unix And Shell Programming"; 1st Edition, Australia Thomson Brooks Cole.
3. Achyut S. Godbole , Atul Kahate; "Operating Systems"; 3rd Edition, McGraw Hill.

Moocs Links and additional reading material:

1. www.nptelvideos.in
2. https://www.udemy.com/
3. https://learn.saylor.org/
4. https://www.coursera.org/
5. https://swayam.gov.in/

Course Outcomes:

The student will be able to

1. Examine the functions of a contemporary Operating system with respect to convenience, efficiency and the ability to evolve.
2. Demonstrate knowledge in applying system software and tools available in modern operating system
3. Apply various CPU scheduling algorithms and process synchronization mechanisms to construct solutions to real world problems.
4. Identify the mechanisms to deal with Deadlock.
5. Illustrate the organization of memory and memory management techniques
6. Analyze I/O and file management techniques for better utilization of secondary memory

CO PO Map:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	0	0	0	0	0	1	1	0	1	1	1
2	2	2	3	0	1	1	0	0	1	1	1	1	3	1
3	2	1	0	0	3	2	0	1	1	1	0	1	1	1
4	1	0	0	0	1	2	0	0	1	1	0	1	3	1
5	2	1	3	0	1	2	0	1	1	1	0	1	3	1
6	2	1	1	0	1	1	0	1	1	1	0	1	1	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1- Level 2
CO2- Level 2
CO3- Level 3
CO4- Level 4
CO5- Level 4
CO6- Level 3

Future Courses Mapping:
High Performances Computing, System Programming

Job Mapping*:*
Linux Administration, Kernel Developers, Application Developers, System Programmer, System Architect

FF No.: 654

ET3277: DIGITAL COMMUNICATION

Course Prerequisites:

Fourier series, Fourier transform, probability theory, Analog communication.

Course Objectives:

1. Understand digital communication systems.
2. The basics of Sampling Theorem & Aliasing Effect.
3. Brief about digital modulators and receivers.
4. Build an understanding of Spread Spectrum Techniques
5. UnderstandDigital Communication Techniques

Credits:4

Teaching Scheme Theory**: 2** Hours/Week
Tut**: 1** Hours/Week
Lab: 2 Hours/Week

Course Relevance:

Communication engineering concerned with the sending and receiving of signals especially by means of electrical or electroacoustic devices and electromagnetic waves. Today, communications is the largest sector of the electronics field with the most employees and the largest equipment sales annually. In addition, wireless, networking, or other communication technologies are now contained in almost every electronic product. This makes a knowledge and understanding of communication a must rather an option for every student. Rapid development in electronic communication systems is changing the face of human civilization, especially due to the convergence of wireless voice/data communications and Internet technologies. Analog and digital communication is a core subject of Electronics and Communication Engineering.

SECTION-1

Introduction to digital communication, Sampling, reconstruction, ideal sampling, Flat top & Natural Sampling Aliasing, Aperture effect. Pulse code modulation & reconstruction, Quantization noise, Companded PCM, Delta modulation, Adaptive delta modulation, Differential PCM, ISI and eye diagram.

Digital modulation techniques such as Binary Phase Shift Keying, Quadrature Phase Shift Keying, M-Ary PSK, Quadrature Amplitude Shift Keying, Binary Frequency Shift Keying, M-Ary Frequency Shift Keying, Minimum Shift Keying

Base Band signal receiver ,Derivation for Error prob of int. & dump Filter, Optimum Filter, white noise matched filter, probability error of match filter, correlation, FSK, PSK, non-coherent detection of FSK, DPSK, QPSK, Calculation of error probability for BPSK & BFSK , Signal Space to calculate Probability of error.

SECTION-2

Pseudo-random Sequence, Direct Sequence Spread Spectrum Phase Shift Keying block details & mathematical treatment, Power Spectrum Density curves, Jamming margin and processing gain, Probability of error, Frequency Hop Spread Spectrum

CDMA, TDMA,FDMA, Kepler's Laws, Satellite orbits, Satellite system link models, Satellite system parameters and link budget.

Forward error correcting codes, block codes, cyclic codes, convolutional codes, turbo codes, trellis codes.

List of Tutorials:

1. PAM- TDM
2. Code Modulation.
3. Pulse Code Modulation Companding.
4. Differential PCM
5. Adaptive Delta Modulation
6. Study of data formats.
8. To Study QAM.
9. PN Sequence Generator
10. Study of FHSS
11. Study of Satellite Receiver.

List of Practicals:

1. Verification of Sampling Theorem (PAM).
2. To Study PCM (Tr & Rx)
3. To Study DM (Tr & Rx)
4. To Study QPSK
5.. To Study BFSK.
6. To Study DS-SS PSK.
7. To study PN Sequence Generation
8. Simulation of GMSK
9. Simulation of QAM

List of Course Projects:

1. Simulation of Digital Communication System
2. Double SideBand –Suppressed Carrier Amplitude Modulator
3. Analog to Digital Conversion
4. BASK modulator & Demodulator
5. Simulation of QPSK modulator and Demodulator
6. GSM based home Security
7. Precision agriculture using GSM
8. Digital comm system using BPSK for a Industry for 50 mtr distance

List of Course Seminar Topics:

1. Pulse-Code Modulation - An Overview
2. Introduction to Dolby Digital Plus, an Enhancement to the Dolby Digital Coding System
3. Simulation of Bit Error Performance of FSK, BPSK, and pi/4 DQPSK in Flat Fading Indoor Radio Channels Using a Measurement-Based Channel Model
4. Frequency-hop spread Spectrum with QAM and Error-Control Coding.
5. An Overview of Sustainable Green 5G Networks
6. An automatic digital modulation classifier for measurement on telecommunication networks
7. An overview of feature-based methods for digital modulation classification
8. A new bandwidth efficient transmit antenna modulation diversity scheme for linear digital modulation
9. Analog & Digital Modulation Techniques: An overview
10. Bandwidth-efficient digital modulation with application to deep space communications

List of Course Group Discussion Topics:

1. Impact of new media on Radio broadcast
2. Time domain versus Frequency domain analysis for signals and Modulation Techniques.
3. Digital Satellite Communication
4. Digital Modulation Techniques for 5G
5. 5G Vision
6. Jamming against digital communication
7. Error Control Techniques
8. Equalization in Digital Communication
9. Wireless Digital Communication
10. Digital Communication and Smart Building Solutions

List of Home Assignments:

Case Study:

1. HAM Radio ("The Utilization Of Amateur Radios In Disaster Management")
2. LEO digital satellite communication for DTH services.
3. Software Defined Radio
4. WiTricity technology for industrial applications
5. RFCs for wireless TCP based reliable communication

Surveys:

1. 5G
2. Modulation techniques in Industrial Communication
3. AM Radio Transmitter
4. IEEE Wireless Communication standards
5. Digital Communication in Software Defined Networks

Design:

1. 16-ary QAM
2. PN Sequence Generator & demodulator
3. Line Encoder Generator
4. Integrator and Dump Filter for Baseband reception
5. Design a Digital communication framework for irrigation system

Blog:

1. Receiver performance characteristics
2. Antennas for 5G network at Home & Office
3. OFDM
4. MIMO
5. Forward error correction

Assessment Scheme:

Seminar – 15 Marks

Group Discussion – 15 Marks

Home Assignment – 10 Marks

Course Viva – 20 Marks

MSE – 10 Marks

ESE – 10 Marks

Lab work –10 Marks

Course project -10 Marks

Text Books:

1. Taub Schilling, 'Principles of communication system', Tata McGraw Hill, 2nd Edition
2. B.Sklar , 'Digital Communication', Pearson, 2nd edition

Reference Books:

1. Simon Haykin , 'Digital Communications', Wiley Publications, 4th edition
2. Carlson , 'Communication System', McGraw Hill, 4th edition

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

1. Analyze analog modulated signal and their spectrum
2. Illustrate sampling theorem along with line coding techniques.
3. Evaluate modulation techniques with respect to bandwidth, Euclidean distance.
4. Discuss basic terminologies used in spread Spectrum
5. Analyze baseband reception.
6. Design forward error correcting codes

Future Courses Mapping:

Courses that can be taken after completion of this course:

1. Advances in Digital Communication
2. Wireless Communication
3. Mobile Communication
4. Antenna and Microwave Techniques
5. Audio and video processing
6. Advanced High Speed Networking
7. Network and Cyber Security

CO Attainment Levels:

CO1:- Level 2
CO2:- Level 3
CO3:- Level 4
CO4:- Level 2
CO5:- Level 3
CO6:- Level 3

Job Mapping:

Job opportunities that one can get after learning this course

The two major tupes of technical positions available in the communication field are Engineer and Technicians. Engineers design communication equipment and system engineers work from specifications and create new equipment or systems which are then manufactured. Some engineers specialize in design other work in manufacturing, testing, quality control and management. Engineer may serve as field service personnel, installing and maintaining complex equipment and systems. There are many outstanding jobs in technical sales, technical writer and as a trainer. Four major segments of industry are manufacturing, resellers, service organization and end users. The major categories in communication field are Telephone companies, Radio users (Mobile, Marine, Aircraft etc), Radio and TV broadcast stations and Cable TV companies, Business and industries of satellite, netwoks etc, Transportation companies(Airline, Shipping, Railroads), Government and Military.

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ET3285: Computer Network Security

Credits: 04 **Teaching Scheme: Theory 02 Hours / Week**
Lab 02 Hours / Week
Tutorial 01 Hours / Week

Section 1: Topics/Contents

Section 1

I. Computer Networking
- ISO OSI
- TCP/IP
- Wired /Wireless Communication
- LAN/MAN /WAN/IOT/CLOUD etc.

II. Introduction to security
- Need for Security
- The OSI Security Architecture
- Security Attacks
- Security Services
- Security Mechanisms
- A Model for Network Security

III. Network Security Fundamentals
- Security Through Network Devices
- Security Through Network Technology
- Security Through Network Design Elements

Section2: Topics/Contents

I. Symmetric Ciphers
- Substitution &Transposition Techniques
- Block Cipher
- DES
- Stream Ciphers
- RC4

II. Public Key Cryptography
- Need and Principles of Public Key Cryptosystems
- RSA Algorithm
- Key Distribution and Management
- Diffie-Hellman Key Exchange
- Digital Signatures

III. Internet Security

- Firewalls
- IP Security
- VPN
- Intrusion Detection
- Web Security
- SSL
- TLS

List of Practicals:

- Study the use of network tools like WHOIS, dig, traceroute, nslookup
- Setting up a computer network.
- Implement HTTP, SMTP, DNS, etc.
- Implement Basic Encryption Algorithm
- Breaking the Shift Cipher
- Implement the RSA algorithm.
- Implement the Diffil-Hellmankey exchange algorithm.
- To Capture the network traffic and understand the network protocol using Wireshark/packet capturing tool.
- Firewall Implementation and Testing
- Demonstration of Security Protocols
- Use the Nessus tool to scan the network for vulnerabilities.
- Develop a program for port scanning.
- Develop a program for penetrating testing.

List of Project areas:

- Design a System to develop a analyzer which will differentiate between different vulnerability and packets entered using it.
- Securing Video Conferencing App for online meetings
- Steganography for Image/Video/Files
- Secure Image display on online social media.
- Secure transfer of government subsidies to farmers/BPL people/ students etc
- Authentication of users for various applications for integrity, availability, confidentiality.
- Implementing a system for detecting the modification of videos/images on social media
- Secure App for online exams detecting Keystroke and camera movements.
- A system to detect the difference between the voice edited in the audio/video
- A System to check the vulnerabilities in the websites.

List of Course Group Discussion Topics:

- Security Issues in Android and IOS devices
- Industry 4.0 and security
- Blockchain and E-voting system
- Security of Aadhar Card and other digital cards
- Automated Home Appliances and Security
- Programming Bugs and Malicious code in information security
- Indian Cyber laws and Deficiencies

- Social Media and Cyber Security
- Need of cyber crime and security in school education.

Text Books: ***(As per IEEE format)***

- Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
- Cryptography and Network Security: Principles and Practices by W. Stallings, Prentice Hall, 5th Edition, ISBN-10: 0136097049
- CompTIA Security+ Guide to Network Security Fundamentals, Mark Ciampa, 5th Edition, ISBN-10: 1305093917
- Principles of Computer Security: CompTIA Security+ and Beyond by Wm. A. Conklin et al., McGraw Hill, 3rd Edition, ISBN-10: 0071786198

Reference Books: ***(As per IEEE format)***

- James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017 .
- Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson.
- "Cryptography & Network Security", PHI 4, Forouzan.
- "Cryptography & Network Security", Mc Graw Hill, Atul Kahate
- https://nptel.ac.in/courses/106105031/
  "Cryptography and Network Security by Debdeep Mukhopadhyay, IIT Kharagpur"
- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-858-computer-systems-security-fall-2014/index.htm
  "Computer Systems Security by Nickolai Zeldovich & James Mickens, MIT"
- Vlabs, "Cryptography Lab": http://cse29-iiith.vlabs.ac.in/

Course Outcomes:

The student will be able to –

After successful completion of the course, the learners would be able to

- Present an overview of the main concepts wired and Wireless networking and Protocols.
- Develop the concept of Security needed in Communication of data through computers and networks along with Various Possible Attacks.
- Design and protect any network from the threats.
- Understand Various Encryption mechanisms for secure transmission of data.
- Do research in the emerging areas of cryptography and network security.
- Implement various networking and Web security protocols**.**

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ET3203: POWER ELECTRONICS AND DRIVES

Course Prerequisites:

Semiconductor Devices, Electronics Circuits, Fourier Series Representation, Basics of Electrical Circuits and Machines

Course Objectives:

The student will be able to –

1. Understand uses of power devices in power converters.
2. Examine the performance of controlled converter fed DC Drives.
3. Observe the performance of AC voltage controllers.
4. Examine the performance of inverter fed AC Drives.
5. Use DC to DC converters for relevant applications .
6. Apply the knowledge of power converters for real life applications.

Credits: 4

Teaching Scheme:2 Hours / Week
Theory: 3 Hours / Week
Lab/ Project: -2 Hours / Week

Course Relevance:

There is an encouraging growth in power electronics technology creating an impact over electrical energy sectors. To meet the growing demand of power uses, converters are used as suitable to the applications. The research on power devices is improving the performance of these power converters. Also, as most of the real world applications use machines with it's optimum performance, schemes can be implemented through an integration of power electronics and electrical machines which will serve as electrical drives.

In view of this technologically advancing area, course on power electronics introduces the learner (student), power devices and different power converter topologies with the judgement of it's performance when used for control of power utilization and drives.

SECTION-1

Power Devices**: -** Power Diode and BJT, SCR, Triac, MOSFET, IGBT- Structure, Characteristics, LDMOS-Structure and I-V, Selection criterion, Driver Circuits, Protection of power Devices: Snubber circuit.
DC Drives: Controlled bridge rectifiers and its analysis, DC Motors starting, characteristic and speed control, DC drive requirements.
AC Voltage Controllers: Configurations and operation.

SECTION-2

Switched mode DC/DC Converters: Linear power supplies, switching power supplies, step down converters, step up converter, buck boost converter - continuous and discontinuous conduction, fly back converters, forward converters, push pull converters.

AC Drives: Single phase inverters – Working of push pull inverters, full bridge inverter with R and L load, Importance of PWM technique for voltage control.
Induction motor- Starting, Characteristic and speed control, AC drive requirements.
Applications: HF induction heating, , ON- line and OFF line UPS, Power Management Unit (PMU), Solar Photovoltaic (SPV) system.

List of Practicals:

1. DC I-V of Power MOSFET.
2. Performance of IGBT.
3. Single phase Half Controlled (Semi) converter
4. Single phase Fully Controlled (Full) converter
5. AC to AC Converter.
6. Single phase Bridge-inverter
7. MOSFET based PWM step down Chopper
8. Step up Chopper
9. Power electronic conversion system (AC-DC/ DC-DC), with suitable load.
10. Power electronic conversion system (DC-AC/AC-AC), with suitable load.
11. Study of SMPS
12. Study of UPS

List of Course Projects:

1. Single phase Power Control (e.g. Fan speed regulator)
2. Switching/triggering circuit for a power device (SCR / power BJT / power MOSFET / IGBT)
3. PWM generation for device switching
4. Power Supply/Battery charger
5. Intensity control of lighting
6. Inverter
7. SMPS
8. DC motor speed control
9. Induction motor speed control
10. Emergency lighting system
11. Power Management Unit (PMU)

List of Course Seminar Topics:

1. GaN Power Devices
2. Gate Drivers for Power Devices
3. Heat Sink Design
4. SiC Power Devices
5. IGBT based Rectifiers
6. Power Factor of Converter Systems
7. Converter Suitability for Applications
8. Sensing of Power Parameters
9. Simulation Softwares in power system design Harmonic Control in Inverters

List of Course Group Discussion Topics:

1. GaN versus SiC Power Devices
2. SCR Rectifiers versus IGBT Rectifiers
3. Protection for AC/DC Drives
4. Power Electronics Systems and Control in Electric vehicle
5. Power Quality
6. Power Management Unit
7. Solar PV System
8. Renewable Energy
9. Power Electronics in eMobilty Modern Control Tehniques for Converters

List of Home Assignments:

Case Study:

6. Simulation Software Tool for Power System Design
7. Motor Control in Robotics
8. BLDC Motors
9. Battery Management Systems
10. Buck-Boost Converters

Surveys:

6. Power electronics in Space Aplications
7. Power Electronics in Telecommunication
8. Generations of Power Devices
9. Filters in Power Circuits
10. Magnetics in Power Systems

Design:

6. Design of Controlled Converter System
7. Design of Inverter System
8. Design of UPS
9. Design of Converter driven DC Drive
10. Design of Inverter driven AC Drive

Blog:

6. Growth in Power demand
7. Latest Control technology of Power Systems
8. Power Regeneration Electric Tractions
9. Power Systems in Self-driving Vehicles
10. Power Applications in Domestic Uses

Assessment Scheme:

Mid Semester Examination - 10 Marks
Presentation - 15 Marks
Laboratory - 10 Marks
Course Project - 10 Marks
Home Assignment - 10 Marks
Group Discussion - 15 Marks
End Semester Examination - 10 Marks
Comprehensive Viva Voce - 20 Marks

Text Books:

1. M D Singh & K B Khanchandani, "Power Electronics", 2nd Edition, Tata McGraw Hill.
2. M. H. Rashid, "Power Electronics: Circuits, Devices, and Application", 2nd Edition, Prentice Hall (I).
3. B L Theraja & A K Theraja, "A Text Book of Electrical Technology - AC & DC Machines", Volume II, S. Chand.

Reference Books:

1.Ned Mohan, Tore Undeland, Williams Robbins, "Power Electronics: Converters, Applications, and Design", 2nd Edition, John Wiley & Sons.
2. P. C. Sen,."MODERN POWER ELECTRONICS", S Chand & Co., New Delhi.

Moocs Links and additional reading material:

https://nptel.ac.in/courses
https://www.coursera.org/specializations/power-electronics

Course Outcomes:

Upon completion of the course, the student will be able to –

1. Identify power device from the structure.
2. List the differences between uncontrolled and controlled DC converters.
3. Draw output voltage waveform of AC converters.
4. Differentiate between linear and switched mode power supplies.
5. Calculate duty cycle of PWM waveform.
6. Select power converters for real life applications.

Future Courses Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	0	0	0	0	1	0	1	0	2	2	2
2	3	3	2	0	2	0	0	1	1	1	0	2	1	3
3	3	3	2	0	0	0	0	1	1	1	0	2	1	3
4	3	3	2	0	2	0	0	1	1	1	0	2	1	3
5	3	3	2	0	0	0	0	1	1	1	0	2	1	3
6	3	2	2	0	0	0	0	1	0	1	0	2	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO Attainment Levels:

CO1:- Level 3
CO2:- Level 2
CO3:- Level 5
CO4:- Level 4
CO5:- Level 3
CO6:- Level 2

Future Courses Mapping:

Upon completion of this course, student can take following courses –

1. Advanced Power Electronics
2. Power Systems
3. Renewable Energy
4. High Power Devices
5. Electric Vehicles/ Hybrid Vehicles
6. Electrical Machines and Drives
7. Power Control Systems

Job Mapping:

Job opportunities that one can get after learning this course

Upon completion of this course, student will be able to –

1. Join an industry which is into Automation, Robotics, Control Panel Designs, eMobility, EV Sector, Embedded Control of Power with state-of-art technology, Energy Management Services, Design of Power Converters in Space Applications etc.
2. Join Govt sectors/ Services in the areas of Power Generation, Utilization, Renewable Energy Development, Space applications
3. Become an antrepreneur in the area of Solar Systems, Energy Management Services, Power Control Units, Drives and Drives Control etc.

ET3283: ENGINEERING DESIGN AND INNOVATIONS-III

Course Prerequisites:

Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

6. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
7. To Evaluate alternative approaches, and justify the use of selected tools and methods,
8. To emphasize learning activities those are long-term, inter-disciplinary and student centric.
9. To engage students in rich and authentic learning experiences.
10. To provide every student the opportunity to get involved either individually or as a group to develop team skills and learn professionalism.

Credits: 6 **Teaching Scheme:** Lab 2 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands on experience and self-learning to the students which will help them throughout their career. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Preamble - The content and process mentioned below is the guideline document for the faculties and students to start with. It is not to limit the flexibility of faculty and students; rather they are free to explore their creativity beyond the guideline mentioned herewith. This course is designed to encourage and ensure application of technology for solving real world problems using an interdisciplinary approach.

Students need to plan their work in following steps:

9. Formation of project group comprising of 4-5 students. Multidisciplinary groups are allowed
10. A supervisor/mentor teacher assigned to individual groups.
11. Carrying out literature survey
12. Finalization of problem statement
13. Planning the project execution
14. Execution of project and testing
15. Writing a report
16. Publication in the form of research paper/patent/copyright as found suitable by supervisor/mentor

Teacher's Role in PCL:

5. Teacher is not the source of solutions rather he will they act as the facilitator and mentor.
6. To utilize the principles of problems solving, critical thinking and metacognitive skills of the students.
7. To aware the group about time management.
8. Commitment to devote the time to solve student's technical problems and interested in helping students to empower them better.

Student's Role in PCL:

8. Students must have ability to initiate the task/idea they should not be mere imitators.
9. They must learn to think.
10. Students working in PCL must be responsible for their own learning.
11. Students must quickly learn how to manage their own learning, Instead of passively receiving instruction.
12. Students in PCL are actively constructing their knowledge and understanding of the situation in groups.
13. Students in PCL are expected to work in groups.
14. They must develop interpersonal and group process skills, such as effective listening or coping creatively with conflicts.

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

6) VLSI Design
7) Embedded Systems
8) Signal Processing
9) Communication
10) Machine learning

Assessment Scheme:

Mid Semester Examination - 30 Marks
End Semester Examination - 70 Marks

MOOCs Links and additional reading material:

www.nptelvideos.in
https://worldwide.espacenet.com/

Course Outcomes:

5. Review the literature to formulate problem statement to solve real world problems.
6. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
7. Manage project ethically as team member/ lead.
8. Demonstrate effectively technical report/ research paper/ prototype/patent.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	1	0	0	3	1	3	0	2	2	2
2	3	3	3	3	3	3	3	2	1	2	0	2	3	3
3	0	1	1	1	0	2	0	3	3	3	3	2	0	0
4	3	1	1	1	0	0	0	3	1	3	3	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1: - Level 3
CO2: - Level 4
CO3: - Level 3
CO4: - Level 4

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ET3282: DESIGN THINKING-5

Credits: 1 **Teaching Scheme Tut:** 1 Hour/Week

Course Objectives:

To provide ecosystem for students and faculty for paper publication and patent filing

Contents:

Structure of The paper
Journal List (Top 50 Journals)
Selection of the journal
Use of various online journal selection tools
Plagiarism checking
Improving contents of the paper
Patent drafting
Patent search
Filing of patent
Writing answers to reviewer questions
Modification in manuscript
Checking of publication draft

Suggest an assessment Scheme:

Publication of paper or patent

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Understand the importance of doing Research
CO2: Interpret and distinguish different fundamental terms related to Research
CO3: Apply the methodology of doing research and mode of its publication
CO4: Write a Research Paper based on project work
CO5: Understand Intellectual property rights
CO6: Use the concepts of Ethics in Research
CO7: Understand the Entrepreneurship and Business Planning

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MD4206: FINANCIAL MANAGEMENT AND COSTING

Course Prerequisites:
Basic concepts of cost, profit, loss, debit and credit.

Course Objectives:

Students will be able to:
1. Understand, analyze and interpret financial statements
2. Understand and concept of financial accounting for analysis of financial statements of a business.
3. Develop an ability of decision making about investments.

Credits: 2 **Teaching Scheme Theory: 2** Hours/Week

Course Relevance: Basic knowledge of Finance for working in a industry

SECTION-1

1. Financial Statement Analysis- Nature and Scope of Finance Function; Financial goal profit vs. wealth, Maximization; Scope and Functions of Financial Management, Financial Planning and Forecasting. Budgets & Budgetary Control: Types of Budget, Preparation of Budgets: Operational & Financial Budgets, Financing and Dividend decisions. Types of accounts, bookkeeping, Profit and Loss Account and Balance Sheet, Cash Flow Statement

2. Capital Budgeting and ratio Analysis -Ratio Analysis Classification, Ratio Analysis and its limitations. Types of Ratios, Activity Turnover, Profitability, Liquidity, etc., B: Common Size Statement, Index Statement, Capital Budgeting - Nature of Investment decisions; Investment evaluation criteria - Non-DCF & DCF Techniques, PBP, Discounted PBP, PI, ARR, Annual Worth

3. Working Capital Management - Meaning, significance and types of working capital; calculating operating cycle period and estimation of working capital requirements; sources of working capital, NPV and IRR comparison; Capital rationing. Various committee reports on bank finance; Dimensions of working capital management.

SECTION-1I

4. Introduction to concept of Cost and Overheads - Cost, Cost Centre, Cost Unit, Elements of Cost: Material Cost. Different methods of pricing of issue of materials Labour Cost: Direct & Indirect cost, Different methods, Direct Expenses: Constituents and Significance, Prime Cost, Classification: Production, Office & Administration, Selling & Distribution. Treatment of Overheads: Collection ,Primary and Secondary Distribution and Absorption of Overheads Machine, Labour hour rate, Under/Over Absorption of Overheads, Preparation of Cost Sheet

5. Costing Methods - Job Costing, Unit Costing, Contract Costing, Process Costing, Activity Based Costing Simple numerical on various methods of costing to enable ascertains cost of product. Standard costing: Concept, Standard Cost, Standard costing. Calculation of Variance Numerical on calculation of variances, Variance – Variance Analysis

6. Marginal Costing and Break Even Analysis - Fixed & Variable (Marginal) Cost, Marginal Cost. Applications of Marginal Costing in Decision-making: Product Mix, Profit Planning, Make or Buy Decisions. Limiting Factor, Cost Volume Profit Analysis, Concept of Break-Even, P/V Ratio and Margin of Safety

List of Tutorials: (Any Three)

1.Capital financing
2.Working capital finance
3.Preparation of Journal entries, Ledgers 4.Profit
and Loss Account and Balance Sheet 5.Ratio
Analysis
6.Investment decisions
7.Product Costing
9.Service Costing.
10.Process Costing

List of Practicals: (Any Six)

1. Case study on sources of capital and working capital
2. Case study on assessment of working capital
3. Studying and understanding Financial Statements - Profit and Loss
4. Studying and understanding Financial Statements - Balance sheet
5. Studying and understanding various financial ratios used in practice
6. Studying and understanding various financial ratios for decision making
7. Case study on Analysis of published results of an organisation – Manufacturing
8. Case study on Analysis of published results of an organisation – Service industry
9. Prepare a cost sheet to estimate the cost of any product10. Prepare a cost sheet any process
11. Case study on use Marginal Costing to determine Break Even Point and profitability
12. Case study on use Marginal Costing to determine profitability

List of Projects:

1.Budgeting including sources of capital financing
2.Budgeting including sources of working capital finance
3.Preparation of Journal entries, Ledgers
4.Preparation Profit and Loss Account and Balance Sheet
5.Preparation of Balance Sheet
6.Ratio Analysis based on real life data from project on Profit and loss and Balance sheet
7.Compare Analysis of published results of organisations to enable investment decision
8.Apply Product Costing to estimate cost of any process used in practice
9.Apply Service Costing to estimate cost of any process used in practice
10.Apply Process Costing to estimate cost of any process used in practice
11.Apply Standard Costing to estimate cost of any process used in practice
12.Apply Marginal Costing to determine Break Even Point and profitability

List of Course Seminar Topics:

1.Sources of Capital Financing
2.Working Capital Management
3.Profit and Loss Account
4.Balance Sheet
5.Turnover and Ratios
6.Taxation
7.Product Costing
8.Service Costing
9.Process Costing
10.Investment Decisions

List of Course Group Discussion Topics:

1. Sources of Capital Financing - Bank or Investors.
2. Working Capital Management - Which is better - Less or More?
3. Profit and Loss Account
4. Balance Sheet - Effect on share prices.
5. Turnover and Ratios - which should be focused on?
6. Taxation - Fair or Unfair in India
7. Product Costing - does it drive Profits or Markets?
8. Service Costing - Quality or Cost?
9. Process Costing - Automation or Manual Labour?
10. Investment Decisions - Guts or Statistics?

Text Books:

1. Prasanna Chandra, Financial Management – Theory and Practi ce, Edition 8, 2011, Tata McGraw Hill Education,
2. B. K. Bhar, Cost Accounting– Methods and Problems, Academi c Publishers,1980
3. M.Y. Khan and P K Jain, Financial Management: Text, Proble ms and Cases, Tata McGraw Hill Education

Amitabha Mukherjee and Mohammed Hani, Modern Accountancy, Edition 2, 2002, Tata McGraw Hill Education

Reference Books:

1. Paresh P. Shah, Financial Management, Reprint No. 2 2011, Biztantra, New Delhi,
2. S. N. Maheshwari, Introduction to Accountancy, Edition 11, 2013, Vikas Publishing House

M. Y. Khan, P. K. Jain, Management Accounting –Text, Problems, Cases, Edition No. Tata McGraw Hill Publishers, 2013

Course Outcomes:

1.Understand and analyze financial statements and budgeting, interpret accounting ratios
2.Understand the concepts of Capital Budgeting and Working Capital management
3.Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business
4.Classify, apply different types of costs and overheads to ascertain costs of a product/ process
5.Apply costing methods as per the suitability for various production processes and services.
6.Develop decision making of optimum product mix, profit planning, make or buy decisions

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MD4203: BUSINESS PROPOSAL WRITING

Credits: 2 **Teaching Scheme** Theory: 2 Hours/Week

SECTION-1
Introduction The world of B2B Businesses, Pre-Scale Roles and Responsibilities, End to end bid management Process including costing. **Focus on Customer** Compliance, Responsiveness, Client Analysis and Competitive Intelligence, Strategies and win themes, Features, Benefits and Discriminators, Teaming/sub-contracting
SECTION-2
Manage Processes Proposal development cycle, Business approvals, and reviews, lessons learned **Elements of persuasive writing** Assertive writing, Headings, graphics and action captions, Page and document design, and style guides.
Textbooks: 1. Tom Sant, Persuasive Business Proposal, AMACOM; 3rd edition 2. John Care and Aron Bohlig, Mastering Technical Sale- The Sales Engineer's Handbook, Artech House; 3rd ed. Edition. 3. Neil Cobb and Charlie Divine, Writing Business Bids and Proposal for Dummies, For Dummies; 1st edition, 2016. 4. Larry Newman, The Shipley Proposal Guide 4.0, Shipley Associates; 4th Edition, 2011.
Course Outcomes 1. To understand basic bid and proposal management terminologies. 2. They will be able to conceptualize the entire process of bid and proposal management. 3. Know the techniques and tools for customer analysis and competitive intelligence.

4. Create business proposals with basic building blocks.
5. Can create customer-centric theme statements.
6. Present a business proposal and defend it.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2	0	0	0	0	0	0	0	0	0	0	2	0	0	0
3	0	0	2	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	2	0	0	0	0	3	0	0	0	0	0
5	0	0	0	0	0	0	0	0	3	0	0	0	0	0
6	0	0	0	0	0	0	0	0	3	0	0	0	0	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO Attainment Level:

CO1: Level 3
CO2: Level 3
CO3: Level 3
CO4: Level 3
CO5: Level 3
CO6: Level 3

MD4202:Project Management

Credits: 2 Teaching Scheme Theory: 2 Hours/Week

Course Prerequisites:

Production Systems, Basics of Industrial Engineering

Course Objectives:

1. Understand the Project Management Basics
2. Learn & Apply Project Management principles in Manufacturing and Service Sector
3. Learn Modern Tools like MS-Project for managing projects
4. Understand Project Management principles usage in the entrepreneurship

Section 1: Topics / Contents Introduction:

Definition & Characteristics of Project, Performance Parameters: Time, Cost & Quality. Difference with respect to Standard Routine Production. Classification of Projects: Sector based, Investment based, Technology based, Causation based, Need based (BMERD) - Balancing, Modernization, Replacement, Expansion & Diversification Project Life Cycle Phases – Concept/Initiation Phase: Parameters Involved in Project Identification. Sources of New Project Ideas. Governmental Framework for Identification of Opportunities, Incentives from state & central govt.; Import-substitution projects

Project Conceptualization & Feasibility Analysis

Project Definition Phase: Project Formulation & Feasibility. Types of Feasibility Studies – Pre-feasibility, Support/Functional, Feasibility Study. Preparation of Project Feasibility Report

Project Planning, Implementation & Control

Planning & Organization Phase: Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications, Work Breakdown Structure, Network Analysis & Duration Estimating Network Diagrams – PERT/CPM, Estimate Activity Times, Milestone Scheduling. Project Crashing.

Section 2: Topics / Contents Topics and Contents

Project Human Resource

Project Organization & Management. Project Organization Structure, Role of Project Manager, Resource Levelling, Resource Smoothening,

Project Cost Management

Project Cost Estimation: Need, Causes of Cost & Time Overruns. Nature of Cost Estimates, Types of Project Cost Estimates

Project Implementation & Control

Implementation Phase: Activities Involved: Erection & Commissioning, Installation, Trial Runs & Commencement of Commercial Production. Cleanup / Shutdown Phase

List of Home Assignments:

On following topics any type of (**Design, Case Study, Blog, Survey**) Home Assignment can be done in a group.

1. HA Based on Project Planning by using MS- Project
2. HA Based on CPM with or without using MS- Project (On actual projects)
3. HA Based on PERT with or without using MS- Project (On actual projects)
4. HA Based on Project Crashing (Cost Optimization)
5. HA Based on Resource Optimization - Resource Levelling and Smoothening
6. Survey based on PM Softwares and its applicability
7. Study based on Project Cost Management
8. Analysis based on Earned Value Management of any project
9. Blog based on Best practices in Project Management
10. Blog based on Project Management Softwares and its usage
11. Use of MS Project in Construction / IT/ Techonology/ NPD Projects
12. Use of Project Management in Instrumentation & Control Engg fields
13. Use of PM in Education (From student's perspective)
14. Feasibility study of any project or Business plan
15. Blog on Scope of Project Management domain in India
16. Blog on Challenges in Project Management for IT / Construction / Govt sector
17. Survey based on Project Manager's experience about Challenges/ Benefits in the PM domain
18. Study of Project Life Cycle Management
19. Study of Cost or Time or Quality aspects of Project Management
20. Study of Industry 4.O feasibility in Project Management

Assessment Scheme: Ensures 360 degree assessment and covers all aspects of Bloom's Taxonomy.

MCQ Exam – Section I - Mid Semester 30 Marks converted to 30 equivalent Marks

Home Assignment - End of Semester 100 Marks converted to 10 equivalent Marks

MCQ Exam – Section II - End of Semester 30 Marks converted to 30 equivalent Marks

Comprehensive Viva Voce -End of Semester 100Marks converted to 30 equivalents Marks

Text Books: ***(As per IEEE format)***

1. Project Management- Harrold Kerzner, Wiley Publisher, 13th Edition, 2022
2. Project Management by Dennis Lock, 10th Edition, Gower Publishing Company, 2013
3. Project Management by Nagarajan, 2nd Edition, K, New Age International (P) Ltd Publishers, 2004

Reference Books: ***(As per IEEE format)***

1. Project Management - Body of Knowledge (BOK) Guide by PMI – Sixth Edition, 2021

Moocs Links and additional reading material: www.nptelvideos.in

Course Outcomes:

1. Learn the basic concepts of project and project management.
2. Ascertain the feasibility of small and medium projects with respect to managerial,marketing,operational, financial and socio-economic perspectives
3. Plan and schedule small and medium projects to achieve the triple constraint of time, costandquality using software package
4. Understand the concept of earned value management system and critical chain inmanagingprojects
5. Understand the concepts of project risk management and critical chain project management
6. Monitor the progress of projects to determine variances and recommend corrective actions

CO PO Map

	Program Outcomes (PO)												PSO			
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1									1	1	3	1				3
CO2									1	1	3	1				3
CO3	2				3				2	1	3	1		2		3
CO4		1									3	1				3
CO5		2									3	1				3
CO6						1	1				3	1				3
Average	2.0	1.5			3.0	1.0	1.0		1.33	1.0	3.0	1.0		2.0		3.0

CO Attainment Levels
CO-1 : 3
CO-2 : 3
CO-3 : 3
CO-4 : 3
CO-5 : 3
CO-6 : 3
Future Courses Mapping:
Industry Internship or Capstone Project
Job Mapping:
Project Manager, Project Executive, CFT member, Program Manager, Entrepreneurship

FF No.: 654

MD4205: MARKETING MANAGEMENT

Credits: 2 **Teaching Scheme** Theory: 2 Hours/Week

SECTION-1
Concepts of Marketing: Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, Characteristics affecting Consumer behavior, Types of buying decisions, buying decision process, Classification of consumer products, Market Segmentation Marketing Information Systems And Research Components of marketing information system–benefits & uses marketing research system, marketing research procedure, Demand Estimation research, Test marketing, Segmentation Research - Cluster analysis, Discriminate analysis. Sales forecasting: objective and subjective methods Marketing Of Industrial Goods: Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behavior, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users.
SECTION-2
Product Management: The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of "New – product, major stages in new – product development product life cycle. Branding Reasons for branding, functions of branding features of types of brands, kinds of brand name. Pricing Policies, Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions, Advertising and Sales Promotion Objectives of advertisement function of advertising, classification of advertisement copy, advertisement media – kinds of media, advantages of advertising. Objectives of sales promotion, advantages sales promotion, Packaging: Meaning, growth of packaging, function of packaging, kinds of packaging.

List of Practical: -

Student will do exercises or case studies based on following topic

1. Analysis of Factors affecting Consumer behavior
2. Identification of variables for market segmentation
3. Components of marketing information system
4. Cluster analysis for Market Research
5. Questionnaire design for collecting primary data for Market Research
6. Case study on Marketing of Industrial Goods
7. Case study on Product Line Management
8. Product life cycle analysis
9. Case study on Product Promotion strategies
10. Case study on Pricing policies
11. Case study on Labeling & Packaging
12. Case study on Branding

List of Projects

Students will perform following projects

1. Consumer Behavior Analysis
2. Market Segmentation Analysis
3. Exploratory Research for Market Competition Analysis
4. STP (Segmentation, Target, Positioning) Analysis
5. Analysis of B2B Marketing
6. Forecasting for Market Analysis
7. Designing Marketing Information System
8. Designing Product Promotion Mix
9. Pricing Policy Impact Analysis
10. Data collection & analysis for Market Research
11. Cluster Analysis for Market Segmentation
12. Market Analysis for New product development

List of GD Topics

1. Advertisements- helpful to customers or just eye wash
2. Advertising is all glitter and no substance.
3. Consumer is never satisfied.
4. Consumer is the king in today's market.
5. Commitment is more important than other skills in marketing
6. Digital marketing via Blogs versus Video - Which is more effective?
7. Should a start-up invest heavily in Marketing
8. Quality is the key to successful Marketing
9. A career in marketing - Worth it or not?
10. Lying for sale of products should be avoided in Marketing.

Textbooks:

1. Philip Kotler, Principles of Marketing, Prentice – Hall
2. Philip Kotler, Marketing Management, Prentice – Hall

Reference Books:

1. William J Stanton, Fundamental of Marketing, McGraw Hill
2. R. S. N. Pillai and Mrs. Bagawathi, Marketing, S. Chand & Co. Ltd.

Course Outcomes:

Students will be able to:

1. Understand basic marketing management concepts and their relevance to business development
2. Prepare a questionnaire for market research
3. Understand consumer & industrial buying decision process & motives.
4. Understand the concept of product management and branding in context of consumer and industrial products
5. Design marketing research plan for business organizations.
6. Optimize marketing mix to get competitive advantage.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2	0	0	0	0	0	0	0	0	0	0	2	0	0	0
3	0	0	2	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	2	0	0	0	0	3	0	0	0	0	0
5	0	0	0	0	0	0	0	0	3	0	0	0	0	0
6	0	0	0	0	0	0	0	0	3	0	0	0	0	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO Attainment Level:

CO1: Level 3
CO2: Level 3
CO3: Level 3
CO4: Level 3
CO5: Level 3
CO6: Level 3

FF 654

LL4001: GENERATIVE AI AND ITS APPLICATION

Credits: 2 **Teaching Scheme Theory: 2 Hours/Week**

Course Prerequisites:

Statistical Mathematics, Artificial Intelligence

LinkedIn Course: For this course, each student will have to complete following six modular courses mentioned in six units. **Other guidelines related to examination and assessment will be given by course coordinator.**

Unit-I: Processing Text with Python Essential Training

In the world of big data, more and more information is consumed and analyzed in text form. Websites, social media, emails, and chats have become the key sources for data and insights. If you work with data, then understanding how to deal with unstructured text data is essential. In this course, instructor Kumaran Ponnambalam helps you build your text mining skill set, covering key techniques for extracting, cleansing, and processing text in Python. Kumaran reviews key textprocessing concepts like tokenization and stemming. He also looks at techniques for converting text into analytics-ready form, including n-grams and TF-IDF. Along the way, he provides examples of these techniques using Python and the NLTK library.

Unit-II: Hands-On Natural Language Processing

Dexterity at deriving insight from text data is a competitive edge for businesses and individual contributors. This course with instructor Wuraola Oyewusi is designed to help developers make sense of text data and increase their relevance. This is a hands-on course teaching practical application of major natural language processing tasks. Learn how to replicate the knowledge gained into the data that you work with. This course includes a background of each task's process flow, use cases, and a coding demo. Some of the topics covered are named entity recognition, text summarization, topic modeling, and sentiment analysis.

Unit-III: Advanced NLP with Python for Machine Learning

An incredible amount of unstructured text data is generated every day by social media, web pages, and a variety of other sources. But without the ability to tame and harness that data, you'll be unable to glean any value from it. In this course, learn how to translate messy text data into powerful insights using Python. Instructor Derek Jedamski begins with a quick review of foundational NLP concepts, including how to clean text data and build a model on top of vectorized text. He then jumps into more complex topics such as word2vec, doc2vec, and recurrent neural networks. To wrap up the

course, he lends these concepts a real-world context by applying them to a machine learning problem.

Unit-IV Deep Learning Foundations: Natural Language Processing with Tensor Flow

There is a growing demand to harness the power of natural language processing (NLP) and deep learning models to be able to make sense of textual data and reduce the emotional intervention of humans in order to make better decisions. In this course, instructor Harshit Tyagi provides a complete guide to understanding NLP using recurrent neural networks (RNNs). Harshit begins by introducing you to word encodings and using TensorFlow for tokenization. He describes the important concept of word embeddings and shows you how to use TensorFlow to classify movie reviews and project vectors. Harshit discusses RNNs and long short-term memory (LSTM), then shows you how to improve the movie review classifier from earlier in the course. He concludes witha discussion of how you can train RNNs to predict the next word in a sentence, which in turn allows you to generate some original text.

Unit-V Recurrent Neural Networks

Get started with recurrent neural network (RNN) concepts in a simplified way and build simple applications with RNNs and Keras. RNN is a fast-growing domain within the AI world. Popular groundbreaking applications like language translation, speech synthesis, question answering, and textgeneration use RNNs as their base technology. Studying this technology, however, has several challenges. Most learning resources are math heavy and are difficult to navigate without good math skills. IT professionals from varying backgrounds need a simplified resource to learn the concepts and build models quickly. In this course, Kumaran Ponnambalam provides a simplified path to studying the basics of recurrent neural networks, allowing you to become productive quickly. Kumaran starts with a simplified introduction of RNN before walking through the process of building a model. He then covers the popular building blocks of RNN with GRUs, LSTMs, word embeddings, and transformers.

Unit VI Generative AI: Working with Large Language Models

Transformers have quickly become the go-to architecture for natural language processing (NLP). Asa result, knowing how to use them is now a business-critical skill in your AI toolbox. In this course, instructor Jonathan Fernandes walks you through many of the key large language models developed since GPT-3. He presents a high-level overview of GLaM, Megatron-Turing NLG, Gopher, Chinchilla, PaLM, OPT, and BLOOM, relaying some of the most important insights from each model.Get a high-level overview of large language models, where and how they are used in production, and why they are so important to NLP. Additionally, discover the basics of transfer learning and transformer training to optimize your AI models as you go. By the end of this course, you'll be up to speed with what's happened since OpenAI first released GPT-3 as well as the key contributions of each of these large language models.

FF No.: 654

ET4230: NATURAL LANGUAGE PROCESSING

Course Prerequisites:

1. Probability and statistics.
2. Linear Algebra
3. Python programming language

Course Objectives:

1. Learn fundamentals of Text processing
2. Understand the different Language Models
3. Implement POS tagging
4. Implement Text classification
5. Implement sentiment analysis
6. Implement Machine translation

Credits: 2 **Teaching Scheme** Theory: 2 Hours/Week

Course Relevance:

Natural Language Processing is a branch of artificial intelligence that deals with the interaction between computers and humans using the natural language. The common applications of NLP involves, Google translator, Word Processors such as Microsoft, Interactive Voice Response, Personal assistant applications.

SECTION-1
Text Processing: Basics, Empirical Laws, Spelling Correction: Edit Distance, N-Gram Language Models, Basic Smoothing, POS Tagging, Hidden Markov Models for POS Tagging, Viterbi Decoding for HMM and Parameter Learning, Maximum Entropy Models.
SECTION-2
Maximum Entropy Models, Name entity recognition, Syntax, Dependency Grammars and Parsing, Semantic, text classification, sentiment analysis, Machine Translation, Question Answering.

List of Course Seminar Topics:

1. SemEval-2016 task 4: Sentiment analysis in Twitter
2. Modelling user attitudes using hierarchical sentiment-topic model
3. Multilingual dynamic topic model
4. Document-Level Text -classification Using Single-Layer Multisize Filters Convolutional Neural Network
5. Twitter Storytelling Generator Using Latent Dirichlet Allocation and Hidden Markov Model POS-TAG (Part-of-Speech Tagging)
7. Part-of-speech Tagging and Named Entity Recognition Using Improved Hidden Markov Model and Bloom Filter
8. Part of speech tagging for Twitter conversations using Conditional Random Fields model
9. A system for named entity recognition based on local grammars
10. A Maximum-Entropy Segmentation Model for Statistical Machine Translation
11. Mobile embodied conversational agent for task specific applications.

List of Course Group Discussion Topics:

1. Smoothing Technique
2. N-gram models
3. POS tagging
4. Ambiguities in NLP
5. Challenges in NLP
6. Challenges in designing Language Translators
7. Challenges in designing text classification
8. Challenges in designing sentiment analysis
9. Challenges in designing Question and Answering system
10. Challenges in designing text summarization

List of Home Assignments:

Design:

1. POS tagging using HMM
2. Build Chatbot
3. Summarization of customers reviews
4. Social media Information extraction
5. SMS spam classification

Case Study:

1. Hiring and recruitment
2. Advertising
3. Healthcare

4. Market intelligence
5. Sentiment analysis

Blog:

1. Social media Information extraction
2. Name Prediction in Multiple Languages using Recurrent Neural Networks
3. Text Classification using Sentiment Analysis
4. Image Caption Generator
5. gender identification in Marathi names

Surveys

1. POS tagging techniques
2. SMS and email spam classification
3. Categorization of sport articles
4. Machine translation Techniques
5. Name entity recognition methods

Assessment Scheme:

Mid Semester Examination - 30 Marks
Home Assignment - 10 Marks
End Semester Examination - 30 Marks
Comprehensive Viva Voce - 30 Marks

Textbooks:

1. Jurafsky & Martin "Speech and Language Processing" Prentice Hall, 2000
2. Akshar Bharati, Rajeev Sangal and Vineet Chaitanya: "Natural Language Processing: Paninian Perspective", Prentice-Hall of India, New Delhi, 1995.

Reference Books:

1. Steven Bird, Ewan Klein, and Edward Loper “Natural Language Processing”

MOOCS Links and additional reading material:

1. https://nptel.ac.in/courses/106/105/106105158/
2. https://nptel.ac.in/courses/106/106/106106211/

Course Outcomes: The student will be able to –

1. Have broad understanding of the field of natural language processing.
2. Get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics.
3. Apply mathematical models and algorithms in applications of NLP.
4. Design and implementation issues in various NLP applications such as information retrieval and information extraction.

5. Demonstrate crucial ideas in linguistics (e.g., syntax, semantics, pragmatics), artificial intelligence (e.g., knowledge representation), and machine learning (e.g., deep learning) to natural language processing.
6. Identify one of the contemporary (sub) problems of natural language processing and implement, in the form of a complete computer program as a possible solution to it.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	2	2	2	1	0	2	2	2	0	2	2	2
2	3	2	2	2	2	1	0	2	2	2	0	2	2	2
3	3	3	3	3	2	1	0	2	2	3	1	2	3	2
4	3	3	3	3	3	2	0	2	3	3	2	2	3	2
5	3	3	3	3	3	2	0	2	3	2	2	2	3	2
6	3	3	3	3	3	2	0	2	3	3	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

1. CO1- Level 3
2. CO2- Level 3
3. CO3- Level 4
4. CO4- Level 4
5. CO5- Level 4
6. CO6- Level 5

Job Mapping:

Natural Language engineers, Data Scientist and Algorithm Architect with industries in domains Media & Entertainment, Healthcare and Finance.

FF No. : 654

CS4217: HUMAN-COMPUTER INTERACTION

Course Prerequisites: Mathematics

Course Objectives:

1. To differentiate IT applications into categories based on measurable human factors
2. To study ethnographic observations in user community
3. To generate the awareness about usability standards and accessibility guidelines
4. To design user-friendly user interface with due consideration of interface theory and principles
5. To apply usability evaluation methods to identify the usability issues with IT applications
6. To integrate web, CSCW and mobile app design approaches as per user requirement

Credits: 2 **Teaching Scheme** Theory: 2 Hours/Week

Course Relevance:

Human-Computer Interaction (HCI) is a socio-technical course, with a goal of bringing the power of computers and communication systems to users, customers or people. It aims to make all computing and communications systems more accessible, maintainable and useful in working, learning and recreational lives of users or people. It helps every computing, web or mobile application to become really user-centric, increasing its users as well as related sales.

SECTION-1
Fundamentals of Human Computer Interaction (HCI): Definition of HCI, Interdisciplinary Nature, Related Disciplines, Goals of System Engineering, Usability, Types of Usability, User Interface (UI), Measurable Human Factors, Accessibility, Differently abled Users, Accessibility Guidelines. **Interaction Concepts and Models:** User Persona, User Categorization, Golden Rules of Interface Design, Miller's Principle, Norman's Action Model, Task Analysis - GOMS, Contextual Inquiry, Work Models, Interaction Styles, Empathy Maps. **Design Process:** Design Concept, Three Pillars of Design, Process of Design, Ethnographic Observations, Participatory Design, Internationalization, Interaction Design Patterns.

SECTION-2

Usability Evaluation: Expert-based Evaluation, User-based Evaluation, Formative Evaluation, Summative Evaluation, Heuristic Evaluation, Cognitive Walkthrough, Semiotic Analysis, Icon Categorization, User Surveys, Interviews, Usability Testing, Data Analysis, Statistical Methods.
Documentation and Groupware: Classification of Documents, Reading from Displays, Online Help, Tutorials, Error / Warning Messages, Groupware, Computer Supported Cooperative Work (CSCW), Dimensions of Cooperation, Asynchronous Interactions, Synchronous Interactions, Online Communities, Challenges with Online Communications.
Website and Mobile App Design: Content Design, Interaction and Navigation Design, Presentation Design, Differences in design approaches, Design and Evaluation Tools.

List of Course Seminar Topics:

1. Accessibility guidelines
2. Empathy maps
3. Internationalization
4. SIGCHI
5. Ethnography with IT applications
6. Design thinking
7. Participatory design
8. Color schemes in user interfaces
9. Design of home screens
10. Human errors

List of Course Group Discussion Topics:

1. Which is better - human skills or computer abilities?
2. What adds more value - aesthetics or gamification?
3. Are accessibility guidelines affordable?
4. Is multilingual support essential in mobile apps?
5. Should users be involved in the UI design process?
6. Is user-based evaluation better than expert-based evaluation?
7. Is heuristic evaluation more valuable than cognitive walkthrough?
8. Is internationalization essential in IT applications?
9. Are websites easier to design than mobile apps?
10. Are documents designed?

List of Home Assignments:

Design:

1. Social Network for Spiritual Users
2. App for Alzheimer's disease
3. Health Tracking App
4. Ration Card Management App
5. Innovative e-Commerce Platform

Case Study:

1. Chatbot in healthcare domain
2. Best food ordering app in India
3. Online teaching-learning process
4. Use of Twitter with Indian Users
5. User experience with car booking in India

Blog:

1. Noise of Notifications
2. Challenges in Food Delivery Service
3. Need for Accessibility Guidelines
4. Usability of Autonomous Vehicles
5. Failure of Usability Testing

Surveys:

1. User experience with video-conferencing apps
2. User errors on Social Networking Sites (SNS)
3. Challenges for hearing impaired users with IT applications
4. Most popular Indian mobile apps (Made in/by India)
5. Impact of ban on Chinese apps in India

Assessment Scheme:

Mid Semester Examination - 30 Marks
Home Assignment - 10 Marks
End Semester Examination - 30 Marks
Comprehensive Viva Voce - 30 Marks

Textbooks:

1. Ben Shneiderman, "Designing the User Interface", Third Edition, Pearson Education, ISBN 81-7808-262-4.
2. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, "Human-Computer Interaction",Third Edition, Pearson Education, ISBN 81- 297-0409-9.

Reference Books:

1. Donald Norman, "The Design of Everyday Things", 2002 Edition, Basic Books, ISBN 100-465-06710-7.
2. Wilbert Galitz, "The Essential Guide to User Interface Design", Second Edition, Wiley-Dreamtech India (P) Ltd., ISBN 81-265-0280-0.
3. John Carroll, "Human-Computer Interaction in the New Millennium", Pearson Education, ISBN 81-7808-549-6.

MOOCS Links and additional reading material:

https://nptel.ac.in/courses/106/103/106103115/
https://www.coursera.org/learn/human-computer-interaction
https://classroom.udacity.com/courses/ud400

Course Outcomes:

1. Students will be able to appreciate the differences among IT applications and their categories based on measurable human factors.
2. Students will be able to capture the ethnographic observations in user community
3. Students will be able to follow usability standards and accessibility guidelines
4. Students will be able to design user interfaces as per interface theory and user requirements
5. Students will be able to apply a suitable usability evaluation method to identify the usability issues
6. Students will be able to enhance UI designs as per desired web, CSCW or mobile app design approach.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	0	0	3	0	0	0	0	2	0	0	0	0	0
2	0	0	0	0	0	0	0	0	2	0	0	0	0	3
3	0	0	3	0	0	0	0	0	2	1	0	0	0	0
4	0	0	0	0	0	0	0	0	2	0	0	0	0	0
5	0	0	0	0	0	0	0	0	2	2	0	0	0	0
6	0	0	0	0	0	0	0	0	2	0	1	0	0	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1 - Level 3
CO2 - Level 3
CO3 - Level 2
CO4 - Level 2
CO5 - Level 1
CO6 - Level 3

Future Courses Mapping:

User Interface Design
Usable Security
Intelligent User Interfaces

Job Mapping:

UI Designer, Product Designer, Software Engineer, Mobile App Developer

FF No. : 654

CS4222: IMAGE PROCESSING

Course Prerequisites: Digital Signal Processing

Course Objectives:

1. Describe different color models and the need for those
2. Analyze image condition and deduce enhancement algorithms
3. Recognize geometric distortions in image and correct those
4. Learn different compression techniques
5. Understand different mathematical transforms and their properties

Credits: 2 **Teaching Scheme** Theory: 2 Hours/Week

Course Relevance:

Vision sense is the most powerful human sense organ. In the world where intelligent automation is taking place, image processing is a vital domain for research and development. In Industry 4.0, image processing systems built around industrial cameras are an essential component in automated production. Throughout all steps of production, from the inspection of raw materials and production monitoring (i.e. flaw detection) to final inspections and quality assurance, they are an indispensable part of achieving high efficiency and quality standards. In the Entertainment Industry, latest trends such as 4K video streaming requires high quality compression that can provide limited/no loss image quality with high fps. In social networking, sharing images has been a vital part. Creating innovative effects and overall manipulating the images will be explored.

SECTION-1
Introduction: Elements of image processing system, Scenes and Images, Vector Algebra, Human Visual System, color vision color model: RGB, HVS, YUV, CMYK, YCbCr and some basic relationships between pixels, linear and nonlinear operations. Image types (optical and microwave), Image file formats (BMP, tiff, jpeg,PIN, GIF,png, raster image format). Image sampling and quantization. **Image Enhancements:** Memory-less operations, Convolution, Spatial domain image enhancements: Denoising filters, Smoothing Operation, Sharpening Operation, and Contrast stretching /enhancement, histogram and histogram equalization. **Frequency Domain Processing:** 2 dimensional Fourier transform of an image, filtering in Fourier domain.

Image segmentation: Classification of image segmentation techniques: Edge-based Segmentation, Region based techniques. Binarization: Global Thresholding, Adaptive thresholding. Types of Edge detector: derivative filters, Sobel, Canny. Edge linking. Feature Extraction- Boundary representation (Chain code), Boundary detection based techniques.

SECTION-2

Morphological Operation: Binary Morphology, Erosion Dilation, Opening and Closing.
Object Recognition: Feature points and feature detection (Line, circle and corner). Line detection: RANSAC, Hough Transform. Corner detection: Harris Corner Detector. Feature descriptors, Descriptor matching. SIFT, SURF.
Image compression: Introduction and need, Coding redundancy, classification of compression techniques (Lossy and lossless- JPEG, Run Length Coding, Huffman Coding, Shannon fano coding).

List of Course Seminar Topics:

1. Challenges in Automated Video Surveillance
2. Tumor detection in MRI images
3. Eye gaze tracking for HMI: Pros, cons and implementation
4. Roll of image processing in Industry 4.0
5. Parallelism for performance enhancement in image processing
6. Vision based ADAS
7. Computational photography
8. Computational microscopy
9. Automatic navigation using Visual SLAM
10. Animoji

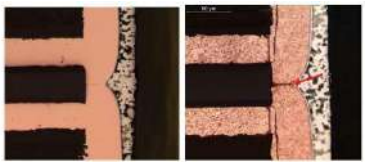
List of Course Group Discussion Topics:

1. Lines Vs. Corners as features
2. Hough Transform for line detection Vs. RANSAC
3. Fourier domain denoising Vs. Spetial domain denoising
4. Kernel size Vs. Speed of operation
5. Histogram equalization Vs. Gamma correction
6. OTSU Vs Adaptive thresholding
7. Compression techniques
8. Color models
9. SIFT Vs SURF
10. Roll of image processing in security.

List of Home Assignments:

Design:

1. Design an algorithm to identify fault in a "PCB inspection system" as shown below



2. Design an algorithm to perform segmentation of the image below to extract the mango from its background.

3. Design an algorithm to get from image 1 to image 2

4. Design an algorithm to recognize character "0" in the image below

5. Design an algorithm to compress a 300x300 pixel image with horizontal black to white gradient as shown below

Case Study:

1. Cam-scanner: Document scanning app
2. Tesseract OCR library
3. Instagram filters
4. OpenCV
5. Google Street View

Blog

1. Image processing on Embedded platforms
2. Face recognition system security analysis for authentication
3. Image processing in MSME for effective automation
4. H.264 codec for image streaming
5. Role of mathematics in image processing

Surveys

1. Image quality metrics
2. Vision based self driving car safety
3. Compression techniques & codecs
4. State of the art applications such as AR/ XR
5. Human recognition in social networking apps like Facebook

Assessment Scheme:

Mid Semester Examination - 30 Marks
Home Assignment - 10 Marks
End Semester Examination - 30 Marks
Comprehensive Viva Voce - 30 Marks

Textbooks:

1. Rafael Gonzalez & Richard Woods, "Digital Image Processing," 3rd Edition, Pearson publications, ISBN 0132345633.
2. Anil K. Jain, "Fundamental of Digital Image Processing," 5th Edition, PHI publication, ISBN 13: 9780133361650.

Reference Books:

1. Pratt, "Digital Image Processing," Wiley Publication, 3rdEdition , ISBN 0-471-37407-5.
2. K.R. Castleman, "Digital Image Processing," 3rd Edition, Prentice Hall: Upper Saddle River, NJ, 3, ISBN 0-13-211467 -4.
3. K. D. Soman and K. I. Ramchandran, "Insight into wavelets - From theory to practice," 2nd Edition PHI, 2005.

MOOCS Links and additional reading material: www.nptelvideos.in

Course Outcomes:

The student will be able to

1. Apply various corrective geometric transforms on a distorted image.
2. Determine and implement required image enhancement techniques using open source technologies such as OpenCV.
3. Deploy optimized algorithms for lossless and lossy compression techniques which ensures expected performance on a variety of hardware architectures.
4. Contribute to an algorithmic solution for social and personal security.
5. Differentiate between various mathematical transforms and its use for a given use Case.
6. Deduce a solution for a given industrial.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	3	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	2	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	2	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	1	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1- Level 3
CO2- Level 4
CO3- Level 3
CO4- Level 2
CO5- Level 1
CO6- Level 5

Future Courses Mapping:

Augmented Reality
Multimedia Processing

Job Mapping:
Augmented Reality Experience Designer
Automation Engineer
Embedded Software Developer
Image Processing Expert

FF No. : 654

ET4232: DEEP LEARNING

Course Prerequisites: Linear algebra, probability theory and statistics, Digital signal processing, Computer vision

Course Objectives:

1. To present the mathematical, statistical and computational concepts for stable representations of high-dimensional data, such as images, text
2. To introduce NN and techniques to improve network performance
3. To introduce Convolutional networks
4. To introduce Sequential models of NN
5. To build deep nets with applications to solve real world problem

Credits: 2 **Teaching Scheme Theory: 2** Hours/Week

Course Relevance:

Deep learning is revolutionizing the technology and business world today. It is a subfield of machine learning concerned with algorithms to train computers to perform tasks by exposing neural networks to large amounts of data, its analysis and prediction. It is an incredibly powerful field with capacity to execute feature engineering on its own, uses multiple neural network layers to extract patterns from the data. Top applications of Deep learning involve, self-driving cars, natural language processing, robotics, finance, and healthcare.

SECTION-1
Foundations of neural networks and deep learning, Logistic regression as a neural network, different activation function, logistic regression cost function, logistic regression gradient descent, vectorizing logistic regression, forward and backward propagation, Techniques to improve neural networks: regularization and optimizations, hyperparameter tuning, batch normalization, data augmentation, deep learning frameworks, Implementation of neural network for a case study.

SECTION-2

Convolutional Neural Networks, padding, strided convolution, pooling layers, convolutional implementation of sliding windows, Applications: object classification, object detection, face verification. ResNet, inception networks, bounding boxes, anchor boxes. Sequence modelling: recurrent nets, architecture, vanishing and exploding gradient problem, Applications & use cases.

List of Course Seminar Topics:

1. Deep learning for Stock Market Clustering
2. Application of Deep Networks in health care
3. Credit card fraud detection
4. Classification of skin cancer with deep neural networks
5. ALEXNET
6. VCGNET
7. Accelerating Deep Network Training by Reducing Internal Covariate Shift
8. Deep learning applications for predicting pharmacological properties of drugs
9. GAN (Generalised Adversial network)
10. Auto encoders
11. LSTM

List of Course Group Discussion Topics:

1. Recurrent or Recursive Networks for sequential Modelling?
2. Initializing network weights vs performance
3. Difficulty of training deep feedforward neural networks
4. Hyperparameter tuning: Is there a rule of thumb?
5. Problem of overfitting: How to handle?

6 Which cost function: Least squared error or binary cross entropy?

7. How to tackle with loss of corner information in CNN
8. Need of hundred classifiers to solve real world classification problem
9. Which optimization: Batch gradient descent of stochastic gradient descent
10. Activation functions: Comparison of trends
11. Remedy of problem of vanishing gradient and exploding gradient in RNN

List of Home Assignments:

Design:

1. Deep learning for library shelf books identification
2. Development of control system for fruit classification based on convolutional neural networks
3. Classifying movie review using deep learning
4. Sentiment analysis of the demonetization of economy 2016 India
5. Predicting Students Performance in Final Examination

Case Study:

1. Deep learning for security
2. Bag of tricks for efficient text classification
3. Convolutional Neural Networks for Visual Recognition
4. Deep Learning for Natural Language Processing
5. Scalable object detection using deep neural networks

Blog

1. Brain tumor segmentation with deep neural networks
2. Region-based convolutional networks for accurate object detection and segmentation
3. Human pose estimation via deep neural networks
4. Content Based Image Retrieval
5. Visual Perception with Deep Learning
6. Music genre classification system

Surveys:

1. Machine translation using deep learning - survey
2. Shaping future of radiology using deep learning
3. Training Recurrent Neural Networks
4. Text generation with LSTM
5. Deep learning applications in Biomedicine

Assessment Scheme:

Mid Semester Examination - 30 Marks
Home Assignment - 10 Marks
End Semester Examination - 30 Marks
Comprehensive Viva Voce - 30 Marks

Text Books:

1. Goodfellow, I., Bengio, Y., and Courville, A., Deeep Learning, MIT Press, 2016.
2. C., M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

MOOCS Links and additional reading material:

1. www.nptelvideos.in
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs11
3. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs50

Course Outcomes: Students will be able to

1. Demonstrate understanding of a logistic regression model, structured as a shallow Neural network.
2. Build and train a deep Neural Network.
3. Apply techniques to improve neural network performance.
4. Demonstrate understanding of functionality of all layers in a convolutional neural network.
5. Implement convolutional networks for image recognition/classification tasks.
6. Demonstrate Understanding of Recurrent nets and their applications.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	4	3	3	2	4	1	-	1	1	1	-	2	1	1
2	4	3	3	2	4	2	-	1	1	1	-	2	3	3
3	4	3	3	3	4	2	-	1	1	1	-	2	3	3
4	4	3	3	3	4	2	-	1	1	1	-	2	3	3
5	4	4	3	3	4	2	-	1	1	1	-	2	3	3
6	4	4	3	3	4	2	-	1	1	1	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1 - Level 3
CO 2 - Level 3
CO 3 - Level 5
CO 4 - Level 4
CO 5 - Level 5
CO 6 - Level 4

Future Courses Mapping:

Advanced course on Deep learning including Autoencoders and Boltzmann machines, Reinforcement Learning.

Job Mapping:

Deep learning engineer, Data Scientist and Algorithm Architect with industries in domains Healthcare, Industrials & Energy, Automobiles, Finance & Insurance, Human Resources, Agriculture, Cybersecurity, Ad & Marketing, Media and Entertainment, Government, Defense

FF No. : 654

IC4201: INDUSTRIAL ELECTRONICS

Course Prerequisites: Basic knowledge electrical and electronics engineering

Course Objectives:

1. To understand the operation of various power devices
2. Knowledge of protection techniques for power devices
3. To understand power devices driving techniques and driver circuits
4. Study various power electronics circuits and their analysis
5. To Learn various power electronics circuits for industrial applications
6. To understand power electronics in Electric vehicles and solar photovoltaic systems

Credits: 2 **Teaching Scheme** Theory: 2 Hours/Week

Course Relevance:

This course gives knowledge of power electronics and its industrial applications. Almost in all industries power electronic systems are used either for power power supply, control, conversion and other applications. Power electronics is also involved in electric vehicles and renewable energy systems which have a great scope currently and also in future.

SECTION-1
Power electronics devices: Introduction to various power devices such as SCR, TRIAC, DIAC, IGBT, silicon and silicon carbide MOSFETs. Construction, characteristics, specifications and selection of the above devices. **Power dissipation and heat sink design:** Static and dynamic switching losses in power devices. Power dissipation calculations, cooling requirement, heat sink design and selection. Over current and overvoltage protection of power devices. **Power device drivers and protection techniques:** Various driver ICs such as isolated, non-isolated, low side, high side etc. Interfacing power devices with digital logic circuits and microcontrollers-based systems. Protection devices such as semiconductor fuses, resettable fuses, PTC thermistors, MOV, TVS, snubber and overcurrent protection circuits for protection of power devices. Series and parallel operation of power devices. Driving requirement for power devices.

SECTION-2

AC power control and controlled rectifiers: Single phase-controlled rectifiers, three phase half wave, full wave rectifiers, AC power control techniques. Calculations of RMS and average values. Power factor improvement. Static switches.

DC to DC converters: Non-isolated dc-dc various converters such as buck, boost, buck boost etc. Transformer isolated dc-dc converters such as flyback, forward, push-pull, half bridge and full bridge. Bidirectional converters.

Industrial applications: SMPS, Inverters and UPS systems. Induction and dielectric heating. Temperature and light intensity control. Speed control of AC and DC motors. Variable frequency drives for AC induction motor. LED drivers. Solar photovoltaic power converters. Power converters for electric vehicles. Wireless power transmission.

List of Tutorials:

1. Power device selection for a given application
2. Power dissipation calculation in a power device
3. Selection of a driver IC for a given power device
4. Comparison of power devices
5. Design of a boost converter
6. Design of an LED driver
7. Selection of a solar panel
8. Selection of batteries for UPS system
9. Calculation of efficiency of an UPS system
10. Design of a solar photovoltaic system

List of Practicals:

1. Study of various power devices.
2. Demonstration of operation of various types of protection devices
3. Design and mounting of a heat sink
4. Design of a crowbar circuit.
5. Design of a phase control circuit
6. Study of IGBT and MOSFET driver ICs
7. Interfacing of a power device with a microcontroller
8. Demonstration of an overcurrent protection circuit
9. Power electronics circuit simulation
10. Design of a driver circuit

List of Projects:

1. Speed control of a PMDC motor
2. Design of a boost converter
3. Design of a buck converter
4. Design of an inverter
5. Design of an induction heater
6. Design of an LED driver circuit
7. Battery charging system using a solar panel
8. Microcontroller based furnace temperature controller
9. Wireless battery charging system
10. Solar panel tracking system

List of Course Seminar Topics:

1. Silicon carbide power devices
2. Ferrite cores for power electronic transformers
3. Resettable fuses and applications
4. Electric vehicles
5. Hybrid electric vehicles
6. Overcurrent protection circuits for power devices
7. Super capacitors and applications
8. Smart grids
9. Resonant converters
10. Power electronics in robotics

List of Course Group Discussion Topics:

1. Scope for power electronics in various fields
2. Selection of fuses for overcurrent protection
3. HVDC transmission
4. IOT and power electronics
5. Selection of batteries for electric vehicles
6. Energy storage medium for power electronics
7. TRIAC applications
8. Renewable energy systems
9. Overcurrent sensing techniques
10. Power electronics in industrial process control

List of Home Assignments:

Design:

1. Snubber circuit design for a given application
2. Estimation of power losses and design of a heat sink
3. Design of a boost converter
4. Design of a buck converter
5. Sepic converter

Case Study:

1. Power converters in electric vehicles
2. Power electronic in wind energy system
3. Power electronics in locomotives
4. High power UPS systems
5. Rooftop solar photovoltaic system

Blog

1. GaN power devices and applications
2. Solar photovoltaic plants
3. SiC MOSFETs applications
4. Fuel cell
5. Electric vehicle battery charging

Surveys

1. Ferrite cores types and applications
2. Energy storage systems
3. Solar microinverters
4. Snubber circuits
5. Wind generators types and applications

Assessment Scheme:

Mid Semester Examination - 30 Marks
Home Assignment - 10 Marks
End Semester Examination - 30 Marks
Comprehensive Viva Voce - 30 Marks

Textbooks:

1. Singh, Khanchandani; Power Electronics; Tata McGraw-Hill Education, 2008.
2. Robert W. Erickson, Dragan Maksimovic; Fundamentals of Power Electronics, Springer.

Reference Books:

1. Ned Mohan; Power Electronics: A First Course; Wiley International.
2. Kambiz Ebrahimi, Yimin Gao, Stefano Longo; Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, 3rd Edition; CRC Press

MOOCS Links and additional reading material:

www.nptelvideos.in
http://www.nptelvideos.in/2012/11/power-electronics.html
http://www.nptelvideos.in/2012/11/industrial-drives-power-electronics.html

Course Outcomes: After completing the course the students will be able to

1. Select a suitable power device for the given applications
2. Select suitable protection devices and driver ICs for power devices
3. Design a required heatsink for the cooling requirements of the power devices
4. Analyse power electronic circuits
5. Contribute in the design and development of power electronic systems.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	4	3	3	2	4	1	-	1	1	1	-	2	1	1
2	4	3	3	2	4	2	-	1	1	1	-	2	3	3
3	4	3	3	3	4	2	-	1	1	1	-	2	3	3
4	4	3	3	3	4	2	-	1	1	1	-	2	3	3
5	4	4	3	3	4	2	-	1	1	1	-	2	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1 – Level 2
CO2 - Level 3
CO3 - Level 5
CO4 - Level 4
CO5 - Level 3
CO6 - Level 4

Future Courses Mapping: Mention other courses that can be taken after completion of this course
Job Mapping: Job opportunities in UPS and Inverter manufacturing industries. Industries manufacturing AC and DC drives or motor controllers. In instrumentation industries where power electronics components are involved. Industries related to electric vehicles and solar photovoltaic power plants.

FF654

CS4272:: NEURAL NETWORKS

Credits: 02 **Teaching Scheme Theory: 2 Hours/Week**

Course Prerequisites: Fundamentals of Mathematics, Python Programming.

Course Objectives: In this course, we will study the following topics

1. To Study the neural network models: multilayer perceptron, distance or similarity Study the based neural networks, associative memory and self-organizing feature map, radial basis function, multilayer perceptron.
2. To understand the basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing, and computer vision.
3. To Study the delta learning rule, the backpropagation delta learning rule, self-organization learning, and the r4-rule.
4. To Understand the importance of tolerance of imprecision and uncertainty for the design of robust and low-cost intelligent machines.
5. To apply basic principles of Artificial Neural networks in solutions that requires problem-solving, inference, perception, knowledge representation, and learning.
6. To build Neural Network models and implement them in real-life scenarios for different applications like detection and classification.

Course Relevance: Neural networks reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of AI, machine learning, and deep learning. Artificial neural networks (ANNs) are comprised of node layers, containing an input layer, one or more hidden layers, and an output layer. Each node, or artificial neuron, connects to another and has an associated weight and threshold. If the output of any individual node is above the specified threshold value, that node is activated, sending data to the next layer of the network. Otherwise, no data is passed along to the next layer of the network.

SECTION-I: Topics and Contents:

Unit-I **Introduction:** Biological Neuron – Artificial Neural Model - Types of activation functions – Mc_Culloch_Pitts, Hebnet, Architecture: Feedforward and Feedback, Convex Sets, Convex Hull and Linear Separability, Non-Linear Separable Problem. XOR Problem, Multilayer Networks, Backpropagation algorithm

Unit-II **Learning Techniques:** Supervised, Unsupervised, Reinforcement Learning. Learning Algorithms, Error correction and Gradient Descent Rules, Learning objective of TLNs, Perceptron Learning Algorithm, Perceptron Convergence Theorem

Unit-III **Supervised Learning:** Perceptron learning and Non Separable sets, α-Least Mean Square Learning, MSE Error surface, Steepest Descent Search, μ-LMS approximate to gradient descent, Application of LMS to Noise Cancelling, Genetic Algorithm, Regression analysis

SECTION-II :

Topics and Contents:

Unit-IV S**upport Vector Machines and Radial Basis Function:** Learning from Examples, Statistical Learning Theory, Support Vector Machines, SVM application to Image Classification, Radial Basis Function Regularization theory, Generalized RBF Networks, Learning in RBFNs, RBF application to face recognition

Unit-V **Attractor Neural Networks:** Associative Learning Attractor Associative Memory, Linear Associative memory, Hopfield Network, application of Hopfield Network, Brain State in a Box neural Network, Simulated Annealing, Boltzmann Machine, Bidirectional Associative Memory

Unit-VI **Self-organization Feature Map**: Maximal Eigenvector Filtering, Extracting Principal Components, Generalized Learning Laws, Vector Quantization, Self-organization Feature Maps, Application of SOM, Growing Neural Gas.

List of Home Assignments:

List of Design Based Home Assignments

HA_D1.Based on Integrate-and-Fire Neurons
HA_D 2. Based on Mac_Culloch_PittsNeuronsmodel
HA_D 3. Based on Heb Net
HA_D 4. Based on the Backpropagation algorithm.
HA_D 5. Based on Support Vector Machine
HA_D 6. Based on Linear and nonlinear models.
HA_D 7. Based on K means Clustering algorithm.
HA_D 8. Based on Boltzmann Machine.
HA_D 9. Based on a self-organizing feature map.
HA_D 10. Based on Integrate-and-Fire Neurons

List of Case Study Based Home Assignments

HA_CS 01 A case study of using artificial neural networks for classifying causes of death from verbal autopsy.

HA_CS 02A case study of using artificial neural networks for wind energy

HA_CS 03A case study of using artificial neural networks for medical diagnostics.

HA_CS 04A case study of using artificial neural networks for the banking sector.

HA_CS 05A case study of using artificial neural networks for Industry.

HA_CS 06A case study of using artificial neural networks forthe Film industry.

HA_CS 07A case study of using artificial neural networks forthe agriculture sector.

HA_CS 08A case study of using artificial neural networks for Education system or teaching-learning process.

HA_CS 09A case study of using artificial neural networks forsafety and security.

HA_CS 10A case study of using artificial neural networks for rainfall prediction.]

List of Blog Based Home Assignment

HA_Blog 01:Two Dimensional Feature Extraction and Blog Classification using Artificial Neural Network

HA_Blog 02:An intelligent personalized web blog searching technique using neural networks

HA_Blog 03:An author gender detection method using whale optimization algorithm and artificial neural network

HA_Blog 04:A comparative study of machine learning techniques in blog comments spam filtering

HA_Blog 05:A document-level sentiment analysis approach using artificial neural network and sentiment lexicons

HA_Blog 06:Automatic classification of unstructured text

HA_Blog 07:Product related information sentiment-content analysis based on neural networks

HA_Blog 08:Customer segmentation and classification by using data mining: an example of VOIP phone

HA_Blog 09:Travel blogs and the implications for destination marketing

HA_Blog10:An event driven neural network system for evaluating public moods from online users' comments

List of Survey Based Home Assignments

HA_Survey 01: State-of-the-art in artificial neural network applications: A survey

HA_Survey 02: -Personality traits analysis using Artificial Neural Networks: A survey

HA_Survey 03: Artificial neural networks in accounting and finance: Modeling issues

HA_Survey 04: Neural networks for control systems—a survey

HA_Survey 05: Student's success prediction model based on artificial neural networks (ANN) and a combination of feature selection methods

HA_Survey 06: Reusability in artificial neural networks: An empirical study

HA_Survey 07: Survey on neural networks used for medical image processing

HA_Survey 08: Artificial neural networks: A powerful tool for cognitive science, A Survey

HA_Survey 09: A model selection approach to real-time macroeconomic forecasting using linearmodels and artificial neural networks

HA_Survey10: Predicting students' performance based on learning style by using artificial neural networks

Assessment Scheme: Ensures 360 degree assessment and covers all aspects of Bloom's Taxonomy.
MCQ Exam – Section I - Mid Semester 30 Marks converted to 30 equivalent Marks **Home Assignment** - End of Semester 100 Marks converted to 10 equivalent Marks **MCQ Exam – Section II** - End of Semester 30 Marks converted to 30 equivalent Marks
Comprehensive Viva Voce -End of Semester 100Marks converted to 30 equivalents Marks

Text Books: ***(As per IEEE format)***

1. Introduction to Artificial Neural Systems Jacek M. Zurada, JAICO Publishing House Ed. 2006.
2. Neural Networks A Classroom Approach —Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.
3. Neural Networks a Comprehensive Foundations, Simon S Haykin, PHI Ed.

Reference Books: ***(As per IEEE format)***

1. Neural Networks A Classroom Approach —Satish Kumar, McGraw Hill Education (India) Pvt. Ltd, Second Edition.
2. Neural Networks in Computer Inteligance, Li Min Fu TMH 2003
3. Neural Networks -James A Freeman David M S Kapura Pearson Ed., 2004.
4. Artificial Neural Networks – B. Vegnanarayana Prentice Hall of India P Ltd 2005

MOOCs Links and additional reading material:

1. www.nptelvideos.com
2. www.coursera.com

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

1. Understand the concepts, techniques, and building blocks of neural network models like Mac_Culloch_Pitts, Hebnet and Artificial Neural Networks.
2. distinguish between supervised, unsupervised and reinforcement learning techniques.
3. Apply basic principles of Artificial Neural networks in solutions that require problem-solving, inference, perception, knowledge representation, and learning.
4. Implement neural network models to solve real-world problems.
5. Evaluate different most appropriate parameters for performance calculation.
6. Build Neural Network models and implement them in real-life scenarios for different applications.

IT4216: DATA MANAGEMENT, PROTECTION AND GOVERNANCE

Course Prerequisites: Database Management System, Operating System
Course Objectives:

To facilitate the learner to –
1. Get acquainted with the high-level phases of data life cycle management.
2. Acquire knowledge about the various aspects of data storage, data availability, data protection.
3. Gain exposure to various solutions/reference architectures for various use-cases.
4. Understand the technical capabilities and business benefits of data protection.

Credits: 2 Teaching Scheme Theory: 2... Hours/Week

Course Relevance: Since technology trends such as Machine Learning , Data science and AI rely on data quality, and with the push of digital transformation initiatives across the globe, data management, governance and security is very much important.

SECTION-I

Data Storage, Availability and Security

Introduction to data life cycle management (DLM): - Goals of data life cycle management,Challenges involved: Volume of data source, Ubiquity of data locations, User demand for access;Stages of data life cycle - creation, storage, usage, archival, destruction;Risks involved without DLM, benefits, best practices.

Data storage and data availability :- Storage technology: Hard Disk Device (HDD), Solid State Devices (SSD), memory devices, Data access - block, files, object ; Data center End to End View – overview of complete stack including storage, network, host, cluster, applications, virtual machines, cloud storage ; Storage virtualization technologies - RAID level, storage pooling, storage provisioning ; Advance topics in storage virtualization – storage provisioning, thin provisioning; Cloud storage – S3, glacier, storage tiering; **High Availability**: Introduction to high availability, clustering, failover, parallel access

Data Threats and Data center security: - **Type of Threats:** Denial of Service (DoS), man in the middle attacks, Unintentional data loss,Repudiation,Malicious attacks to steal data;**Introduction to Ransomware**; **Understanding, Identification and Threat modelling tools**
;**Security:** Authorization and authentication - access control, Transport Layer Security (TLS), key management, security in cloud, Design and architecture considerations for

security

SECTION-II

Data Protection, Regulation and Governance

Introduction to data protection: - Introduction- Need for data protection,basic of back-up/restore;Snapshots for data protection, copy-data management (cloning, DevOps);De-duplication;Replication;Long Term Retention – LTR;Archival;Design considerations: System recovery, Solution architecture,Backup v/s Archival,media considerations and management (tapes, disks, cloud), challenges with new edge technology (cloud, containers)

Data regulation, compliance and governance: - Regulations requirements and Privacy Regulations: The Health Insurance Portability and Privacy Act of 1996 (HIPPA), PII (Personally Identifiable Information), General Data Protection Regulation (GDPR)
;Information Governance : Auditing, Legal Hold,Data classification and tagging (Natural Language Processing); India's Personal Data Protection bill

Applications uninterrupted: - Understand data management aspects of traditional and new edge applications;Reference architecture/best practices *(pick 2-3 case studies from below topics):* Transactional Databases (Oracle, MySQL, DB2), NoSQL Databases (MongoDB, Cassandra),Distributed applications (micro service architectures),Cloud applications – Platform as Service (PaaS), Software as Service (SaaS), Kubernetes,Multi-Tiered applications,ETL workloads,Data analytics (AI/ML)

List of Home Assignments:

Design:

1. Design data management aspects for cloud applications.
2. Design data management aspect for MongoDB/Cassandra.
3. Design data management aspect Distributed applications.
4. Design data life cycle management for any application.
5. Design data management for any Multi-Tiered application.

Case Study:

1. Consider different Transactional and NoSQL Data bases. Comparative study.
2. Compare various cloud applications based on Platform as service and Software as service.
3. Data Analytics based study for data management.
4. Study of Multi-Tiered Applications
5. Study data management in DevOps

Blog:

1. Comparative study of data protection schemes.
2. study of The Health Insurance Portability and Privacy Act of 1996 (HIPPA)
3. Need of data management, protection and governance
4. How Threat modelling tools are useful? Consider any application related to it.
5. Role of storage Technology for cloud storage.

Surveys:

1. Survey on data protection challenges with new edge technology like cloud
2. Survey on General Data Protection Regulation (GDPR)
3. Survey on Data classification and tagging in Natural Language Processing
4. Survey on Ransomware data security.
5. Survey on Kubernetes.

Suggest an assessment Scheme:

MSE, ESE, HA

Text Books: (As per IEEE format)

1. Robert Spalding, **'Storage Networks: The complete Reference'**.
2. Vic (J.R.) Winkler, **'Securing The Cloud: Cloud Computing Security Techniques and Tactics'**, Syngress/Elsevier - 978-1-59749-592-9

Reference Books: (As per IEEE format)

1. Martin Kleppmann, **'Designing Data-Intensive Applications'** , O'Reilly

Web References:

1. https://www.enterprisestorageforum.com/storage-hardware/storage-virtualization.html
2. https://searchstorage.techtarget.com/definition/data-life-cycle-management
3. https://www.hitechnectar.com/blogs/three-goals-data-lifecycle-management/
4. https://www.bmc.com/blogs/data-lifecycle-management/
5. https://www.dataworks.ie/5-stages-in-the-data-management-lifecycle-process/
6. https://medium.com/jagoanhosting/what-is-data-lifecycle-management-and-what-phaseswould- it-pass-through-94dbd207ff54
7. https://www.spirion.com/data-lifecycle-management/
8. https://www.bloomberg.com/professional/blog/7-phases-of-a-data-life-cycle/
9. https://www.datacore.com/storage-virtualization/
10. https://www.veritas.com/content/dam/Veritas/docs/solutionoverviews/
11. V0907_SB_InfoScale-Software-Defined-Infrastructure.pdf
12. https://www.veritas.com/solution/digital-compliance
13. https://www.veritas.com/solution/data-protection
14. https://www.veritas.com/gdpr

Course Outcome:

By taking this course, the learner will be able to –

1. Understand the data management world, challenges and best practices.
2. Compare various concepts and technologies for enabling data storage and high availability.
3. Illustrate various types of data threats and approaches to ensure data center security.
4. Explain the various concepts related to data protection.
5. Outline different standards for compliance and governance of data.
6. Understand various approaches for designing data intensive enterprise applications and industry standard solutions in data management.

FFNo.654

IT4218: NETWORK SECURITY

Credits: 2 **Teaching Scheme: 2 Hours/Week**

Prerequisites: Computer Networks.

Unit 1: **(5 Hours)**

Introduction

Introduction to Security: Vulnerabilities, Threats, Threat Modeling, Risk, attack and attack types, Avoiding attacks, Security services.
key security properties - Confidentiality, Integrity, Availability.
Protocol Vulnerabilities: DoS and DDoS, session hijacking, ARP spoofing, Pharming attack, Dictionary Attacks.
Software vulnerabilities: Phishing, buffer overflow, Cross-site scripting attack, Virus and Worm Features, Trojan horse, Social engineering attacks, ransomware, SYN-Flooding, SQL- injection, DNS poisoning, Sniffing

Unit 2: **(4 Hours)**

Private key cryptography

athematical background for cryptography: modulo arithmetic, GCD (Euclids algorithm),
Role of random numbers in security, Importance of prime number, DES, AES.
Chinese remainder theorem

Unit 3: **(5 Hours)**

Public key cryptography

RSA: RSA algorithm, Key generation in RSA, attacks on RSA.
Diffie-Hellman key exchange: Algorithm, Key exchange protocol, Attack.
Elliptic Curve Cryptography (ECC), Elliptic Curve arithmetic. Diffie-Hellman key exchange

Unit 4: (**5 Hours)**

Authentication and access control

Message authentication and Hash Function. Authentication: One-Way Authentication, Mutual Authentication, SHA-512, The Needham-Schroeder Protocol.
Kerberos, X.509 authentication service, public key infrastructure.
Access Control in Operating Systems: Discretionary Access Control, Mandatory Access Control, Role Based Access Control.

Unit 5: **(5 Hours)**

Security application and design

Part A: Network layer security: IPSec for IPV4 and IPV6.
Transport layer security: SSL and TLS.
Application layer security: Security services, S/MIME, PGP, Https, Honey pots.
Security design: End-to-end security, Security composability, Open design, Cost and tradeoffs

Unit 6: (4 Hours)

Cyber Security:

Cyber Attack, Cyber Reconnaissance, Crimes in Cyber Space-Global Trends & classification, e-commerce security, Computer forensics, facebook forensic, mobile forensic, cyber forensic, digital forensic

Text Books

1. "Cryptography and Network Security-Principles and Practices" by William Stallings, Pearson Education, 2006, ISBN 81-7758-774-9, 4th Edition.

2. "Network Security and Cryptography", by Bernard Menezes, Cengage Learning, 2010, ISBN 81-315-1349-1, 1st Edition.

Reference Books

1. "Computer Security: Art and Science", by Matt Bishop, Pearson Education, 2002, ISBN 0201440997, 1st Edition.

2. "Network security, private communication in a public world", by Charlie Kaufman, Radia Perlmanand Mike Spencer, Prentice Hall, 2002, ISBN 9780130460196, 2nd Edition.

3. *"Cryptography and Information Security", by V.K. Pachghare, PHI, 2015, ISBN-978-81-203-5082-3, Second Edition.*

Additional Reading

1."Security architecture, design deployment and operations", by Christopher M. King, Curtis Patton and RSA press, McGraw-Hill, 2001, ISBN 0072133856, 1st Edition.

2 'Inside Network Perimeter Security" by Stephen Northcott, Leny Zeltser, et al, Pearson Education Asia, ISBN 8178087618, 1st Edition.

Course Outcomes

Upon completion of the course, the students will be able to:

1. Analyze cryptographic techniques using a mathematical approach by examining nature of attack.
2. Establish type of attack on a given system.
3. Identify different types of attacks.
4. Justify various methods of authentication and access control for application of technologies to various sections of industry and society.
5. Design a secure system for protection from the various attacks for 7 layer model by determining the need of security from various departments of an organization.
6. Estimate future needs of security for a system by researching current environment on a continuous basis for the benefit of society

FF No. : 654

ET 4292 MODERN DIGITAL COMMUNICATION TECHNIQUES

Teaching Scheme

Credits:.2..... **Theory:** 2 Hours/Week

Section 1: Topics/Contents

Introduction to digital communication systems, Source Coding, Characterization of Communication Signals & Systems, Signal space Representation, Representation of Memory less Modulation Methods, Nonlinear modulation methods

Section2: Topics/Contents

Optimal receivers of AWGN, Receiver for non-ideal channel, Probability of error of different modulation schemes, Fundamentals of estimation and detection theory used in digital communication, Carrier phase and symbol timing synchronization techniques, Channel estimation and equalization techniques, Power Adaptation methods for colored noise channel

Text Books:

1. Digital Communications by John G. Proakis
2. Digital Communications by Bernard Sklar
3. Digital Communications by Robert Gallager
4. Digital Communications by Simon Haykin
5. Modern Digital and Analog communications by B.P. Lathi.

FF No. : 654

ET 4292 APPLIED ELECTROMAGNETICS FOR ENGINEERS

Teaching Scheme

Credits:.2..... **Theory:** 2 Hours/Week

Section 1: Topics/Contents

Section 1:
Week 1:

- Introduction to Applied EM theory
- Lossless Transmission line equations
- Frequency-domain behavior: Characteristic impedance of T-line
- Reflection and transmission coefficients
- Complete solution for sinusoidal propagation

Week 2:

- More general T-lines
- Attenuation and propagation coefficients
- Transmission line techniques: Standing wave ratio (SWR) and line impedance
- Visual aid: Smith Chart derivation
- Smith chart applications: Impedance to admittance conversion, SWR and impedance calculation

Week 3:

- Impedance matching techniques - Part 1
- Impedance matching techniques - Part 2
- T-lines in time-domain: Reflection from mismatched loads
- Lattice diagram calculations
- Pulse propagation on T-lines

Week 4:

- Case study: High-speed digital signals on PCBs
- Transients with reactive termination
- Application: Time-domain reflectometry
- Review of Coordinate Systems
- Review of Vector analysis -1

Week 5:

- Review of Vector analysis -2
- Vector fields -Part 1
- Vector fields - Part 2
- Overview and importance of Maxwell's equations
- Boundary conditions between two media

Week 6:

- Solution of Laplace's and Poisson's equation -- Analytical techniques
- Solution of Laplace's and Poisson's equation in two dimensions
- Numerical solution of Laplace's equation: Finite difference method
- Numerical technique: Method of moments
- Quasi-statics: Does an ideal capacitor exist?

Section 2

Week 7:

- Magnetostatic fields: Biot Savart and Ampere's laws
- Magnetic field calculations
- Inductance and inductance calculation
- Quasi-statics: Fields of a wire
- Quasi-static analysis of skin effect

Week 8:

- Uniform plane waves - one dimensional wave equation
- Uniform plane waves: propagation in arbitrary direction, phase velocity, polarization
- Plane waves in conductors an dielectric media
- Reflection and transmission of plane waves at a planar interface
- Oblique incidence and reflection of plane waves - s and p polarization

Week 9:

- Total internal reflection and Snell's laws
- Application: Multilayer thin films
- Application: Fabry-Perot cavity
- Waveguides - General introduction
- Rectangular metallic waveguide modes

Week 10:

- Dispersion and attenuation
- Dielectric planar waveguides
- Case study: Optical fibers
- Application: Fiber-optic communications
- WDM optical components

Week 11:

- Wave propagation in crystals and index ellipsoid
- Wave propagation in Ferrites
- Wave propagation in periodic structures: Diffraction
- Vector potential and wave equation
- Radiation by dipole

Week 12:

- Fundamental Antenna parameters

- Half-wave dipole
- Antenna array and diffraction
- Application: RFID
- Looking ahead

Text Books:

1. Electromagnetics with applications, 5th ed, J. D. Kraus and D. Fleisch, McGraw Hill, 1999

Reference Books:

1. Engineering Electromagnetics, Hayt and Buck, 7th edition, McGraw Hill.
2. Electromagnetic waves, D. Staelin, A. Morgenthaler, and J. A. Kong, Pearson, Pearson, 1993.
3. Applied Electromagnetics: Early Transmission Line Approach, S. M. Wentworth, Wiley, 2007.
4. Practical Electromagnetics, D. Misra, Wiley, 2007.

Course Outcomes: The Student will be able to-

1. discuss the fundamentals of transmission line theory and impedance matching in high frequency lines.
2. Discuss the behavior of EM fields in matter and Polarization concepts.
3. Classify the basic Magneto static theorems and laws and infer the magnetic properties of matter.
4. Define various antenna parameters.
5. Analyze radiation patterns of antennas.

Syllabus Template **FF No. : 654**

ET4429: BIOMEDICAL SIGNAL PROCESSING

Credits: **Teaching Scheme: 2 Hours / Week**

Section I

Preliminaries, Biomedical signal origin & dynamics (ECG), Biomedical signal origin & dynamics (EEG, EMG etc.)
Filtering for Removal of artifacts: Statistical Preliminaries, Time domain filtering (Synchronized Averaging, Moving Average), Time domain filtering (Moving Average Filter to Integration, Derivative-based operator), Frequency Domain Filtering (Notch Filter), Optimal Filtering: The Weiner Filter.**:Filtering for Removal of artifacts contd.:** Optimal Filtering: The Weiner Filter, Adaptive Filtering Selecting Appropriate Filter**:Event Detection:** Example events (viz. P, QRS and T wave in ECG), Derivative based Approaches for QRS Detection Pan Tompkins Algorithm for QRS Detection, Dicrotic Notch Detection Correlation Analysis of EEG Signal
Waveform Analysis: Illustrations of problem with case studies, Morphological Analysis of ECG, Correlation coefficient, The Minimum phase correspondent.:**Waveform Analysis contd.:** Signal length, Envelop Extraction, Amplitude demodulation, The Envelogram, Analysis of activity, Root Mean Square value, Zero-crossing rate, Turns Count, Form factor.

Section II

:**Frequency-domain Analysis:** Periodogram, Averaged Periodogram, Blackman-Tukey Spectral Estimator, Daniell's Spectral Estimator, Measures derived from PSD.:
Modelling of Biomedical Systems: Motor unit firing pattern, Cardiac rhythm, Formants and pitch of speech, Point process, Parametric system modelling, Autoregressive model, Autocorrelation method, Application to random signals, Computation of model parameters, Levinson-Durbin algorithm, Computation of gain factor, Covariance method, Spectral matching and parameterization, Model order selection, Relation between AR and Cepstral coefficients.
Modelling of Biomedical Systems ARMA model, Sequential estimation of poles and zeros, Notch filter design, Synchronized averaging, Design Butterworth low pass filter.

Text Books: ***(As per IEEE format)***

1. R M Rangayyan “Biomedical Signal Analysis: A case Based Approach”, IEEE Press, John Wiley & Sons. Inc, 2002
2. Willis J. Tompkins “ Biomedical Digital Signal Processing”, EEE, PHI, 2004
3. D C Reddy “Biomedical Signal Processing: Principles and Techniques”, Tata McGraw-Hill Publishing Co. Ltd, 2005
4. J G Webster “Medical Instrumentation: Application & Design”, John Wiley & Sons Inc., 2001
5. C Raja Rao, S K Guha “Principles of Medical Electronics and Biomedical Instrumentation”, Universities Press, 2001
6. AV Oppenheim and RW Shafer "Discrete-time Signal Processing", Prentice Hall, Englewood Cliffs, NJ, 1989.
7. Steven M. Kay, "Modern spectral estimation-theory and application ", Prentice Hall, Englewood Cliffs, NJ, 198

Course Outcomes:

The student will be able to –

1. To identify and explain various types of biomedical signals, including electrocardiogram (ECG), electroencephalogram (EEG), electromyogram (EMG), and their physiological significance
2. Identifying and removing artifacts from biomedical signals, enhancing signal quality for accurate analysis and interpretation.
3. Detect specific events within biomedical signals, such as peaks and waves in electrocardiograms (ECG) or electroencephalograms (EEG), using appropriate algorithms and methodologies.
4. Develop skills in analyzing the morphology and characteristics of biomedical signals, including feature extraction, envelope extraction, amplitude demodulation, and waveform parameterization.
5. Model complex biomedical systems using mathematical and computational techniques, including autoregressive (AR) modeling, autoregressive moving average (ARMA) modeling, and parametric system modeling.
6. Apply signal processing techniques and models to real-world biomedical data sets, gaining practical experience in analyzing, interpreting, and drawing conclusions from biomedical signals.

Syllabus Template **FF No. : 654**

ET4428 Industrial Automation And Control

Credits: **Teaching Scheme: 2 Hours / Week**

Section 1: Topics/Contents

Module I

Introduction, Architecture of Industrial Automation Systems
4 Architecture of Industrial Automation Systems (Cont.)

Module II

5 Measurement Systems Characteristics
6 Measurement Systems Characteristics (Cont.)
7 Data Acquisition Systems
8 Data Acquisition Systems (Cont.)

Section2: Topics/Contents

Module III

9 Introduction to Automatic Control
10 Introduction to Automatic Control (Cont.)
11 P-I-D Control
12 P-I-D Control (Cont.)
13 PID Control Tuning
14 PID Control Tuning(Cont.)
15 Feedforward Control Ratio Control
16 Feedforward Control Ratio Control(Cont.)
17 Time Delay Systems and Inverse Response Systems
18 Time Delay Systems and Inverse Response Systems(Cont.)
19 Special Control Structures
20 Special Control Structures(Cont.)
21 Concluding Lesson on Process Control (Self-study)
22 Introduction to Sequence Control, PLC , RLL
23 Introduction to Sequence Control, PLC , RLL(Cont.)
24 Sequence Control. Scan Cycle, Simple RLL Programs
25 Sequence Control. Scan Cycle, Simple RLL Programs(Cont.)
26 Sequence Control. More RLL Elements, RLL Syntax
27 Sequence Control. More RLL Elements, RLL Syntax(Cont.)
28 A Structured Design Approach to Sequence Control
29 A Structured Design Approach to Sequence Control(Cont.)
30 PLC Hardware Environment
31 PLC Hardware Environment(Cont.)

Module IV

32 Flow Control Valves
33 Flow Control Valves(Cont.)
34 Hydraulic Control Systems - I
35 Hydraulic Control Systems - I(Cont.)
36 Hydraulic Control Systems - II
37 Hydraulic Control Systems - II(Cont.)
38 Industrial Hydraulic Circuit
39 Industrial Hydraulic Circuit(Cont.)
40 Pneumatic Control Systems - I

41 Pneumatic Control Systems - I(Cont.)
42 Pneumatic Systems - II
43 Pneumatic Systems - II(Cont.)
44 Energy Savings with Variable Speed Drives
45 Energy Savings with Variable Speed Drives(Cont.)
46 Introduction To CNC Machines
47 Introduction To CNC Machines(Cont.)

Module V

48 The Fieldbus Network - I
49 The Fieldbus Network - I(Cont.)
50 Higher Level Automation Systems
51 Higher Level Automation Systems(Cont.)
52 Course Review and Conclusion (Self-study)

Text Books: ***(As per IEEE format)***

1. Industrial Instrumentation, Control and Automation, S. Mukhopadhyay, S. Sen and A. K. Deb, Jaico Publishing House, 2013
2. Chemical Process Control, An Introduction to Theory and Practice, George Stephanopoulos, Prentice Hall India, 2012
3. Electric Motor Drives, Modelling, Analysis and Control, R. Krishnan, Prentice Hall India, 2002
4. Hydraulic Control Systems, Herbert E. Merritt, Wiley, 1991

Course Outcomes:

The student will be able to –

1. Understanding of Industrial Automation Systems Architecture
2. To be Proficient in Measurement and Data Acquisition Systems
3. Design the Control System
4. Proficiency in PLC Programming
5. Understanding the Application of Hydraulic and Pneumatic Control Systems
6. To acquire Knowledge of Advanced Automation Technologies

FF No. : 654

ET4207: MAJOR PROJECT

Course Prerequisites: Basic Electronics, Physics, Engineering Mathematics, Statistics, Programming Languages

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposing solutions to realistic/social problems.
2. To Evaluate alternative approaches, and justify the use of selected tools and methods,
3. To emphasize learning activities those are long-term, inter-disciplinary and student-centric.
4. To engage students in rich and authentic learning experiences.
5. To provide every student the opportunity to get involved either individually or as a group to develop team skills and learn professionalism.
6. To develop entrepreneurship attitude

Credits: 10 **Teaching Scheme** Lab: 20 Hours/Week

Course Relevance:

Project Centric Learning (PCL) is a powerful tool for students to work in areas of their choice and strengths. Students can solve socially relevant problems using various technologies from relevant disciplines. The various socially relevant domains can be like Health care, Agriculture, Defense, Education, Smart City, Smart Energy and Swaccha Bharat Abhiyan. Students can be evaluated for higher order skills of Blooms taxonomy like ‘analyze, design and apply’. This course is capable of imparting hands-on experience and self learning to the students which will help themthroughout their career. It emphasizes on learning by doing for a complete project life cycle, requirement analysis, realistic planning and transforming ideas into product. This is a step ahead in line with national policy of Atmanirbhar Bharat.

Major-Project Guidelines:

- The Major-project is a team activity having 3-4 students in a team. This is electronic product design work
- The Major-project may be a complete hardware or a combination of hardware and software work. The software part in Major-project should be less than 50% of the total work.
- After interactions with course instructor and based on comprehensive literature survey / requirement analysis, the student shall identify the title and define objectives of the Major-project.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
- The student is expected to meet the timelines on design, development and testing of the proposed work.
- The student is instructed to have discussion with faculty instructor on standard practices used for electronic circuit / product design, converting the circuit design into a complete electronic product, PCD design using suitable simulation software, estimation of power budget analysis of the product, front panel / user interface design and mechanical aspects of the product.
- Completed Major-project and documentation in the form of Major-project report is to be submitted at the end of the semester. The project group will deliver the presentation of the Project Work which will be assessed by the panel.

Note: The student can identify a technological problem in the following sectors (The list is open ended):

1. Social relevance (Agriculture/ Water Management / Transportation / Waste Management / etc.)
2. Renewable Energy (Solar / Wind / Waves / etc.)
3. Green Technology (Carbon footprint / Pollution control / etc)
4. Assistive System for Weaker People (Blind / Deaf / Handicap assistive)
5. Security Enhancement (Cyber Security / Forensics) 6. Government Projects (Smart City / Smart Grid / Smart Gram / Swach Bharat / etc.)

Core Technology domains identified for E&TC Engg are as below. However, this list can be extended as per the need of project and multidisciplinary approach

1. VLSI Design
2. Embedded System
3. Signal Processing
4. Communication Engineering
5. Machine Learning

Assessment Scheme:

Mid Semester Examination - 30 Marks

End Semester Examination - 70 Marks

MOOCS Links and additional reading material:

www.nptelvideos.in

https://worldwide.espacenet.com/

Course Outcomes:

1. Review the literature to formulate problem statement to solve real world problems.
2. Apply knowledge of technology and modern tools to design solution considering sustainability and environmental issues.
3. Manage project ethically as team member/ lead.
4. Demonstrate effectively technical report/ research paper/ prototype/ patent.

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	3	1	0	0	3	1	3	0	2	2	2
2	3	3	3	3	3	3	3	2	1	2	0	2	3	3
3	0	1	1	1	0	2	0	3	3	3	3	2	0	0
4	3	1	1	1	0	0	0	3	1	3	3	2	1	0

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels

CO1-Level 3

CO2- Level 4

CO3- Level 3

CO4- Level 4

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus of

Final Year B.Tech.

Electronics & Telecommunication Engineering

"Pattern – D23"

Module - VIII

FF No. : 654

ET4251: Industry Internship
ET4222: Research Internship
ET4250: Project Internship
ET4252: International Internship

Credits: 16 **Teaching Scheme** Lab: 32 Hours/Week

Industry/ Research/ Global Internship is an educational innovation seeking to link industry experience with university instruction. Internship enables students to acquire learning by applying the knowledge and skills they possess in open-ended real-life situations of a rapidly changing needs and challenges in a professional workplace. Internship provides the required platform for experiential and cooperative learning and education, by providing students with an opportunity to work on industry assignments, under the guidance of professional experts and under the supervision of faculty. Students are offered 18 weeks industry internship to enhance their skillset and get exposure of industry front. Internship facilitates and promotes partnership and intellectual exchange between academia and industry.

Course Outcomes:

1. Acquire practical knowledge within the chosen area of technology for project development.
2. Identify, analyze, formulate and develop projects with a comprehensive and systematic approach.
3. Cooperate with diverse teams and effectively communicate with all the stake holders.
4. Produce solutions within the technological guidelines and standards.
5. Develop effective communication skills for presentation of project related activities.

Assessment Scheme:

Mid Semester Examination - 30 Marks
End Semester Examination - 70 Marks

CO PO Map:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	1	2	2	3	3	3	2	3	3	3
2	1	1	1	1	1	2	2	3	3	3	2	3	3	3
3	1	1	1	1	1	2	2	3	3	3	2	3	3	3
4	1	1	1	1	1	2	2	3	3	3	2	3	3	3
5	1	1	1	1	1	2	2	3	3	3	2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO attainment levels:

CO1:- Level 1
CO2:- Level 1
CO3:- Level 1
CO4:- Level 1
CO5:- Level 1
CO6:- Level 1