VISHWAKARMA INSTITUTES VI

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 2021-22

Prepared by: - Board of Studies in Electronics and Telecommunication

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

Chairman – BOS

Chairman – Academic Board

Dr. Shripad [illegible]
Professor & Head
Dept. of E&TC Engineering
Vishwakarma Institute of Technology Pune

B.R.A.C TRUST Vishwakarma Institute of Technology

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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.

Table of Contents

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure of

B.Tech. E&TC Engineering

"Pattern – B21"

Title: Course Structure - B21 **FF No. 653**

Branch: E&TC **Year:** S.Y. **A.Y.:** 2021-22 **Module:** III

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	MD2201	Data Science	3	2	1	10	10	10	20	10	20	20	100	5
S2	CS2221	Internet of Things	3	2	1	10	10	10	20	10	20	20	100	5
S3	CS2218	Object Oriented Programming	3	2	1	10	10	10	20	10	20	20	100	5
S4	IT2201	Computer Organization and Architecture	3	2	1	10	10	10	20	10	20	20	100	5
	ME2205	3-D Printing	3	2	1	10	10	10	20	10	20	20	100	5
S5	ET2233	Software Development Project - I	0	6	0	-	-	-	-	30	70	-	100	3
S6	ET2234	Engineering Design and Innovation - III	0	8	0	-	-	-	-	30	70	-	100	4
		Total	**12**	**22**	**4**									**27**

Title: Course Structure – B21 **FF No. 653**

Branch: E&TC **Year:** S.Y. **A.Y.:** 2021-22 **Module:** IV

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	ET2270	Advanced Data Structures	3	2	1	10	10	10	20	10	20	20	100	5
S2	ET2271	Digital System	3	2	1	10	10	10	20	10	20	20	100	5
S3	ET2272	Data Communication	3	2	1	10	10	10	20	10	20	20	100	5
S4	ET2273	Industrial Electronics	3	2	1	10	10	10	20	10	20	20	100	5
S5	ET2238	Software Development Project – II	0	6	0	-	-	-		30	70	-	100	3
S6	ET2236	Engineering Design and Innovation – IV	0	8	0	-	-	-		30	70	-	100	4
		Total	**12**	**22**	**4**									**27**

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

Branch: E&TC **Year:** T.Y. **A.Y.:** 2021-22 **Module:** V

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	ET3270	Signal Processing	3	2	1	10	10	10	15	15	10	10	20	100	5
S2	ET3271	Computer Vision	3	2	1	10	10	10	15	15	10	10	20	100	5
S3	ET3206	Digital Design	3	2	1	10	10	10	15	15	10	10	20	100	5
S4	ET3271	Embedded System Design	3	2	0	10	10	10	15	15	10	10	20	100	4
S5	ET3251	Machine Learning	3	2	1	10	10	10	15	15	10	10	20	100	5
	ET3252	Cyber Security	3	2	1	10	10	10	15	15	10	10	20	100	5
	ET3253	Big Data	3	2	1	10	10	10	15	15	10	10	20	100	5
	ET3254	Cloud Computing	3	2	1	10	10	10	15	15	10	10	20	100	5

S6	ET3245	Software Development Project – III	0	6	0	-	-	-	-	-	30	70	-	100	3
S7	ET3246	Engineering Design and Innovation – V	0	8	0	-	-	-	-	-	30	70	-	100	4
		Total	**15**	**24**	**4**										**31**

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

Branch: E&TC **Year:** T.Y. **A.Y.:** 2021-22 **Module:** VI

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	ET3272	Design and Analysis of Algorithms	3	2	1	10	10	10	15	15	10	10	20	100	5
	ET3207	Information Theory & Coding Techniques	3	2	1	10	10	10	15	15	10	10	20	100	5
S2	ET3209	Web Technologies	3	2	1	10	10	10	15	15	10	10	20	100	5
	ET3265	Control Systems	3	2	1	10	10	10	15	15	10	10	20	100	5
S3	ET3274	Operating Systems	3	2	1	10	10	10	15	15	10	10	20	100	5
	ET3277	Digital Communication	3	2	1	10	10	10	15	15	10	10	20	100	5
S4	ET3275	Database Management Systems	3	2	1	10	10	10	15	15	10	10	20	100	5
	ET3203	Power Electronics and Drives	3	2	1	10	10	10	15	15	10	10	20	100	5

S5	ET3247	Software Development Project – IV	0	6	0	-	-	-	-	-	30	70	-	100	3
S6	ET3276	Artificial Intelligence and Machine Learning Project	0	6	0	-	-	-	-	-	30	70	-	100	5
	ET3277	Internet of Things Project	0	6	0	-	-	-	-	-	30	70	-	100	5
		Total	**12**	**24**	**3**										**27**

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

Branch: E&TC **Year:** B.Tech. **A.Y.:** 2021-22 **Module:** VII

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	MD4203	Business Proposal Writing	2	0	0	10	-	-	-	-	30	30	30	100	2
	MD4205	Marketing Management	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
	IC4201	Industrial Electronics	2	0	0	10	-	-	-	-	30	30	30	100	2

S3	ET4232	Deep Learning	2	0	0	10	-	-	-	-	30	30	30	100	2
	ET4244	CMOS RF Integrated Circuits	2	0	0	10	-	-	-	-	30	30	30	100	2
	CS4201	Cloud Computing	2	0	0	10	-	-	-	-	30	30	30	100	2
S4	ET4262	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.:** 2021-22 **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	ET4263	Research Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4264	Project Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4265	Industry Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
	ET4266	International Internship	-	40	-	-	-	-	-	-	30	100	-	100	16
		Total	**-**	**40**	**-**	**-**	**-**	**-**	**-**	**-**	**30**	**100**	**-**	**100**	**16**

Bansilal Ramnath Agarwal Charitable Trust's

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Syllabus of

Second Year B.Tech.

Electronics & Telecommunication Engineering

"Pattern – B21"

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: 5 **Teaching Scheme** Theory: 3 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: 5 **Teaching Scheme** Theory: 3 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 & IoT Network 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: 5 **Teaching Scheme** Theory: 3 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

IT2201: COMPUTER ORGANIZATION AND ARCHITECTURE

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: 5

Teaching Scheme: Lectures: 3 Hours / Week
Lab: 2 Hours/Week
Tut: 1 Hour/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.

SECTION-1

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-Restoring algorithm, 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 operation, 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, and Multi Bus CPU organization.

SECTION-2

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, Replacement Algorithms, Cache Coherence. 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. Performance considerations: effect of instruction hazards, number of pipeline stages. Necessity of high performance, Constraints of conventional architecture.

Parallelism in Uniprocessor system, Evolution of parallel processors, Architectural Classification, Flynn's, Fengs, Handler's Classification, Multiprocessor's 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

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.

List of Seminar Topics:

1. Computer Architecture VS Computer Organization
2. Evolution of Computing Devices
3. Instruction 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

List of Group Discussion Topics:

1. GPU computing: CUDA
2. Memory System
3. Replacement Algorithms
4. Pipelining
5. Cache Coherence
6. Virtual Memory
7. Hazards in pipelining
8. Supercomputer
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. Analyse 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 pipelines 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 analysing impact of design trade offs
4. Cache Consistency Models in Modern Microprocessors

Blog:

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

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. 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, &quote; Advanced Computer Architecture &quote;, 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 Hill Publication 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, postgraduates will be able to –

1. Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.
2. Illustrate the micro-operations sequencing.

3. Evaluate various alternatives in processor organization.
4. Understand concepts related to memory & IO organization
5. Adapt the knowledge based on Pipeline and its performance
6. Design real world applications using processors.

CO PO Map:

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

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

CO attainment levels:

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

Future Courses Mapping: Advance Computer Architecture, Advance Operating Systems

Job Mapping: Application Developers, System programmer

FF No.: 654

ET2233: SOFTWARE DEVELOPMENT PROJECT-I

Course Prerequisites:

Programming concepts, 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 student centric.
4. To engage students in rich and authentic learning experiences.
5. To enhance programming skills of students

Credits: 3 **Teaching Scheme Lab:** 3 Hours/Week

Course Relevance:

Software project development comes under the category of project centric learning (PCL). Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

SECTION-1

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. The course contents are designed as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

1) Software based project to be done by each student
2) A supervisor/mentor teacher assigned who will guide in design and execution of project
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

Assessment Scheme:

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

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 issues.
3. Manage project ethically and collaborate for acquiring skills.
4. Demonstrate effectively project and technical report.

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 4 CO2: - Level 2 CO3: - Level 4 CO4: - Level 5
Job Mapping: Software Engineer, Software Developer, IT Engineer

FF No. : 654

ET2234: 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: 4 **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 – B21"

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:5 **Teaching Scheme** Theory: 3. 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: 05 **Teaching Scheme:** 6 Hours / Week

Theory: 3 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: Design procedure, Code converters, Half and Full Adder, Half and Full Subtractor, Ripple Carry Adder, Carry Look Ahead adder, Carry Save Adder, Manchester carry chain, BCD Adder, Digital Comparator, Digital Comparator with multiple inputs, Multiplexer and Demultiplexer, Encoder and Decoder, Viterbi Decoder, Parity generator and checker, Introduction to floating point arithmetic structure.

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 and Flash, Pipelined and Sigma-Delta data converters.

SECTION-2

Sequential Circuit Design: Latches and Flip-flops**,** Shift registers, Barrel shifter, Asynchronous and synchronous circuits, counters, up/down counters, modulo-N counters, Shift register counters, Pulse train generators, Pseudo Random Binary Sequence (PRBS) generators.

Finite State Machines: Finite state model, Basic Design steps for sequential circuits, State diagram, State Table, State reduction and state assignment, Transition and output table, Excitation table, Mealy machine and Moore machine representation and implementation, Hazards and deadlocks, Design problems like vending machine.

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, Bi-CMOS, ECL, RTL, I2L and DCTL, Operation of HCT NAND gate, Tri- State logic, Comparison of logic families.

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

ET2272: DATA COMMUNICATION

Course Prerequisites:

Students for this course should have a basic knowledge of Engineering Mathematics (Fourier Series, Probability distributions) and Basic Electronics.

Course Objectives:

The student will be able to

1. Understand analog and digital communication systems.
2. Perform spectral analysis of analog & Digital Modulated signals.
3. Brief about digital modulators and receivers.
4. Build an understanding of the fundamental concepts of computer networking.
5. Understand IP protocol and routing algorithms for packet switching service framework used in intranet and internetworks.
6. Understand multiple access schemes and wide area network connectivity for intranet and internetworks.

Credits: 05

Teaching Scheme: 6 Hours / Week
Theory: 3 Hours / Week
Lab/ Project: 2 Hours / Week
Tutorial: 1 Hour/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, communication 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

1.1 Introduction to Communication System: Analog & Digital Communication System Classification of noise, Noise in Cascaded Stages. Analog Modulation Techniques: Need of modulation, Mathematical treatment for an AM and FM signal, Spectral Analysis, Modulation Index, Efficiency, Power calculations, DSB-SC and SSB-SC, FM generators, pre-emphasis, and de-emphasis in FM signal. Receiver block diagram, Super Heterodyne Receiver (AM & FM), Diode Detector.

1.2 Sampling and Waveform Coding: Sampling, ideal sampling, Flat top & Natural Sampling, Aliasing, Pulse amplitude modulation, Quantization, Pulse code modulation & reconstruction, Compounded PCM, Delta modulation, Time division multiplexing, Line Coding.

1.3 Digital Modulation Techniques: Digital modulation techniques - Amplitude Shift Keying, Binary Phase Shift Keying, Quadrature Phase Shift Keying, QAM, Baseband Receiver: Integrate and Dump Filter, Optimum Filter, Matched Filter.

SECTION-2

2.1 Topologies: Star and Hierarchical; Design issues for Layers, Data communication protocols/Network Layered Protocols – OSI, TCP/IP, Physical, data link and network layer. Framing, Error Control and Flow Control. Error Control: Parity Bits, Hamming Codes and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol,

2.2 Channel allocation: Static and Dynamic, Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, CSMA/CD,

2.3 IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, Routing in Internet: RIP, OSPF, BGP TCP/UDP, Sockets, Addressing, Connection establishment, Connection release, flow control and buffering.

List of Tutorials:

1. Noise
2. Analog Modulation
3. Sampling & Line Coding
4. Pulse Code Modulation, Delta Modulation
5. ASK, BPSK & QPSK
6. Examples on network performance parameters: RTT, Delay, Bandwidth, Throughput, and efficiency

7. Analyze packet formats of Ethernet, IP, TCP and UDP captured through Wireshark for wired network.
8. Examples of Network Layer Logical Addressing Classful IP and CIDR: Subnetting, IP Prefixes
9. Examples of Network Layer Routing - Dijkstra's Algorithm, Distance Vector Routing, Link State Routing
10. Examples of Transport Layer.

List of Practicals:

1. Generation of Single and Double side band suppressed carrier (DSBSC) amplitude modulated signal.
2. Generate Frequency modulated (FM) signal and demodulate.
3. Generation of natural and flat top sampled signal and reconstruction of analog signal from sampled signal.
4. Generation of digital signal from analog signal using PCM, DM.
5. Modulation of analog signal using Binary phase shift keying BPSK/QPSK and demodulation.
6. Demonstration of line encoding methods - Unipolar NRZ, Polar NRZ, NRZ Inverted, Bipolar Encoding, Manchester Encoding, Differential Manchester Encoding with the help of utilities.
7. Implement different LAN topologies using Network Simulator.
8. Study of basic network command and Network configuration commands.
9. Configuration of Switch/Router
10. Packet capture and header analysis by wire-shark (TCP, UDP, IP)
11. Implement Routing Algorithms

List of Projects:

1. Simulation of Analog 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. TCP based Multithreaded HTTP client server
7. Access, storage, analysis and display of Sensors data over a website through webserver for Mining Industry.
8. Implementation & compare of RIP/OSPF/BGP using Packet Tracer
9. Access, storage, analysis and display of Sensors data over a website through webserver for Oil and gas Industry.
10. Build a network for Smart Building

List of Seminar Topics:

1. Pulse-Code Modulation - An Overview Ref: S.P. Lipshitz, John Vanderkooy, “ Pulse-Code Modulation - An Overview” -J. Audio Eng. Soc., Vol. 52, No. 3, 2004 March
2. Introduction to Dolby Digital Plus, an Enhancement to the Dolby Digital Coding System Ref: Louis D. Fielder et al,” Introduction to Dolby Digital Plus, an Enhancement to the Dolby Digital Coding System “AES 117th Convention, San Francisco, CA, USA, 2004 October 28–31
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
   Ref: Theodore Rapaport et al, “Simulation of Bit Error Performance of FSK, BPSK, and pi /4 DQPSK in Flat Fading Indoor Radio Channels Using a Measurement-Based Channel Model”, IEEE transaction on vehicular Technology. Nov 1991.
4. Frequency-hop spread Spectrum with QAM and Error-Control Coding.
   Ref: Wayne G Foal et al, IEEE Military communication conference MILCOM 2004.
5. An Overview of Sustainable Green 5G Networks
   Ref: Qingming Wu et al, “An Overview of Sustainable Green 5G Networks”, IEEE Wireless Communication 2017.
6. Advances in Internet Congestion Control
   Ref: Seung wan Ryu et al, “Advances in Internet Congestion Control”, IEEE Communications Surveys, 2003.
7. Behavior of UDP based applications over IEEE 802.11 wireless networks.
   Ref: M G Arranz et al , “Behaviour of UDP based applications over IEEE 802.11 wireless networks”, IEEE international symposium on Personal, Indoor and Mobile Radio Communications, August 2002.
8. Error control schemes for networks: An overview
   Ref: H Lie et al, “Error control schemes for networks: An overview”, Springer - Mobile Networks and Applications 1997
9. TCP-Probing: Towards an Error Control Schema with Energy and Throughput Performance Gains.
   Ref: Vassilios Tsaoussidis et al , “ TCP-Probing: Towards an Error Control Schema With Energy and Throughput Performance Gains”, Proceedings 2000, international conference on network protocols 2002.
10. Flow Control : A comparative Survey
    Ref: Mario Gerla et al , “Flow CControl : A comparative Survey”, IEEE transactions Communication 1980.

List of 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. Cloud Computing Networking- challenges & Opportunities.
7. Error Controlling methods in networking
8. Flow Controlling Techniques in networking
9. Computer networking and Industrial Automation
10. Networking and Smart Building Solutions

List of Home Assignments:

Design:

1. Amplitude modulator & Demodulator using transistor
2. Frequency modulator using PLL
3. Band pass filter for FM
4. Configure static and default Routes
5. Design a communication framework for irrigation system
6. RIP Routing Protocol

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

Blog:

1. Receiver performance characteristics
2. Antennas for 5G network at Home & Office
3. AI ML and Autonomous Networks
4. SD-WAN
5. Virtual Cloud Network

Survey:

1. Multiplexing Technique (Telephone Exchange)
2. Radio Studio
3. AM Radio Transmitter
4. IEEE 802.15.4 standard for IoT applications
5. Data Communication in Software Defined Networks

Assessment Scheme:

1. Seminar – 15 Marks

2. Group Discussion – 15 Marks
3. Home Assignment – 10 Marks
4. Course Viva – 20 Marks
5. MSE – 10 Marks
6. ESE – 10 Marks
7. Lab work –10 Marks
8. Course project -10 Marks

Textbooks:

1. “Principles of Electronic Communication Systems”, Louis E Frenzel, Tata McGraw Hill Publications, Third Edition.
2. “Electronic Communication”, Kennedy &Devis, Tata McGraw Hill Publications.
3. “Principles of Communication Systems”, Taub Schilling, Tata McGraw Hill Fourth Edition.
4. “Data Communication and networking”, Behrouz Forouzan, McGraw Hill Publications.
5. Kurose, Ross “Computer Networking a Top-Down Approach Featuring the Internet”, Pearson; 6th edition (March 5, 2012), ISBN-10: 0132856204

Reference Books:

1. “Electronic Communication”, Dennis Roddy &Coolen, Tata McGraw Hill Publications.
2. “Electronic Communication Systems”, Wayne Tomasi, Fourth Edition.
3. “Digital Communications”, Simon Haykin, Wiley Publications, Fourth Edition.
4. “Communication Systems”, Carlson, McGrawHill, Fourth Edition.
5. “Analog & Digital Communications”, Simon Haykin, Wiley Publications.
6. “Digital Communication”,B.Sklar, Pearson, Second Edition.
7. “Computer Networks”,Andrew Tanenbaum, Pearson, fifth Edition

MOOCs Links and additional reading material:

www.nptelvideos.in
http://wwww.mhhe.com/signal/adc
www.mhhe.com/frenzel/ees3e
https://nptel.ac.in/courses/117/105/117105143/
https://nptel.ac.in/courses/106/105/106105183/

CO-PO Map:

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

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

CO Attainment Levels:

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

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

Job Mapping:

Job opportunities that one can get after learning this course

The two major types 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, networks etc., Transportation companies (Airline, Shipping, Railroads), Government and Military.

FF No:654

ET2273: INDUSTRIAL ELECTRONICS

Course Prerequisites: Mechanics and Electronics

Course Objectives:

1. To introduce semiconductor devices, operational amplifiers, and power devices
2. To introduce applications of semiconductor devices
3. To introduce applications of operational amplifiers
4. To introduce industrial applications of power devices

Credits: 3 **Teaching Scheme** Theory: 3 Hours/Week

Tut: 2 Hours/Week

Lab: 2 Hours/Week

Course Relevance:

Industrial electronics refers to equipment, tools and processes that involve electrical equipment control in an industrial setting. It covers all the methods and facets of instrumentation, signal processing and automation of various industrial applications. This course focuses on semiconductor devices, power devices and signal conditioning required for industrial applications.

SECTION-1
Topics and Contents Semiconductor devices- BJT, MOSFET, Characteristics, Configurations, Biasing Device applications- Amplifiers, Power Amplifiers, Oscillators, Voltage regulators Opamps and Opamp circuits – Basic building blocks of operational amplifier, open loop, and closed loop operation, inverting and non-inverting configurations, ideal op-amp parameters
SECTION-2
Linear applications -Summing amplifier, difference amplifier, voltage follower, Signal phase shifter, Instrumentation amplifier, Nonlinear applications -Precision half wave and full wave rectifiers, Comparators, Signal generator etc.

Power Devices and triggering -Power diode, SCR, Power MOSFET, IGBT
Converters – AC to DC (Controlled Rectifier), DC to AC (Inverter), AC to AC (AC regulator), DC to DC (Chopper)
Industrial applications of Converters – Industrial heating, UPS, SMPS, Drives, Electric vehicles, PV cells

List of Tutorials:

1. BJT Biasing
2. MOSFET Biasing
3. BJT Amplifier Analysis
4. MOSFET Amplifier analysis
5. Opamp parameters
6. Instrumentation Amplifiers
7. Log Amplifier
8. Multivibrators
9. IC 555
10. Design of power electronic conversion system (AC-DC), with suitable load.
11. Design of power electronic conversion system (DC-DC), with suitable load.
12. Design of power electronic conversion system (DC-AC), with suitable load.

List of Practicals:

1. BJT CE Characteristics
2. CE Amplifier
3. MOSFET characteristics
4. CS amplifier
5. BJT CE Characteristics
6. CE Amplifier
7. MOSFET characteristics
8. CS amplifier
9. BJT Characteristics
10. BJT Biasing
11. BJT as a switch
12. BJT CE Amplifier
13. MOSFET characteristics
14. MOSFET as a switch
15. Design of inverting and non-inverting amplifier
16. Design of Summing and difference amplifier using Op Amp
17. Design of Comparator
18. Design of Waveform Generator
19. To study Triggering circuits for SCR.
20. To simulate power electronic converters AC to DC
21. To simulate power electronic converters AC to AC

22. To simulate power electronic converters DC to DC

List of Projects:

1. CC amplifier
2. CB amplifier
3. CD amplifier
4. Waveform generator
5. Voltage regulator
6. Oscillator
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)

List of Seminar Topics:

1. MOSFET applications
2. MOSFET based sensors for measuring systems
3. MOSFET based inverter
4. MOSFET based chopper
5. Fabrication of MOSFET
6. Power amplifiers
7. SMPS Design
8. IGBT based Rectifiers
9. Simulation software's in Power System Design
10. Industrial Heating
11. UPS
12. Photovoltaic cells
13. Industrial applications of Power circuits
14. Power management
15. Regions of Operation of MOSFET
16. SCR firing circuit
17. SiC Power Devices
18. GaN power Devices
19. Heat sink design
20. Power Electronics In Defence
21. Witricity

List of Group Discussion Topics:

1. SCR Rectifiers versus IGBT Rectifiers
2. AC Vs DC Drives
3. Power Electronics Systems and Control in Electric vehicle
5. Power Quality
6. Uncontrolled vs-controlled rectifiers
7. Solar PV System
8. Renewable Energy
9. CB Vs CE Vs CC configuration
10. CS Vs CD Vs CG Configuration
11. Audio amplifiers Vs Power amplifiers
12. Non idealities in opamps
13. Inverting Vs Noninverting operation in Opamp
14. BJT Vs MOSFET
15. Applications of IC555
16. Do power systems need transformers?
17. Thyristor family vs Transistor family
18. Firing pulses generation schemes: Need, Working, Features
19. SMPS, UPS OR Regulated power supply?

List of Tutorials:

1. Design of Op Amp based Integrator Circuit
2. Design of Op Amp based Differentiator circuit
3. Design of V to I and I to V converters
4. Design of Schmitt Trigger
5. Design of based signal conditioning circuit
6. Design of single-phase semi and full converters
7. Design of Ac-to-AC converters
8.Design of basic Chopper configurations
9. Design of MOSFET as switch
10. Design of MOSFET amplifier
11. Design of BJT as switch
12. Design of BJT amplifier

List of Home Assignments:

Design:

1. Design of Controlled Converter System
2. Design of Inverter
3. Design of D to A converters using Op Amp
4. Design of Multistage amplifier
5.Design of Oscillator
6. Design of Power amplifier

Blog

1. Power Applications in Domestic Uses
2. Growth in Power demand
3. Power Systems in self driving vehicles
4. Selection guide for Op Amp
5. IC 555 applications
6. CMOS logic
7. Operational amplifier applications

Surveys:

1. Op Amp in data converters
2. Magnetics in Power Systems
3. Commercial CMOS and bipolar op amps
4. Commercially available MOSFETs and specifications
5. Commercially available BJTs and specifications
6. Commercially available Opamps and specifications

Case Study:

1. Simulation Software Tool for Power System Design
2. Power Management System
3. Architecture of IC 555
4. IC 555 application
5. Application of converters in industry
6. Data sheet of MOSFET
7. Data sheet of BJT

Assessment Scheme:

1. Seminar – 10 Marks
2. Group Discussion – 10 Marks
3. Home Assignment – 10 Marks
4. Course Viva – 20 Marks
5. MSE – 15 Marks
6. ESE – 15Marks
7. Lab work –10 Marks
8. Course project -10 Marks

Textbooks:

1. Frederick F. Driscoll and Robert Coughlin, "Operational Amplifiers and Linear Integrated Circuits" Prentice Hall 2001.
2. M.D. Singh , K.B. Khanchandani, "Power Electronics" Tata McGraw-Hill, 2008
3. Thomas L. Floyd, "Electronic Devices", Pearson Education
4. , Donald Neamen, "Semiconductor Physics and Devices" Tata McGraw Hill

5. Ramakant Gaikwad, "Op-Amps and Linear Integrated Circuits", Fourth Edition, Pearson

Reference Books:

1. Ron Mancini, "Op amp for Everyone", Texas Instruments, 2002
2. Muhammad H. Rashid, "Power Electronics" 2014
3. R. L. Boylestad, L. Nashelsky, Electronic Devices & Circuit Theory PHI, New Delhi

MOOCs Links and additional reading material:

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

Course Outcomes: Students will be able to

1. Understand semiconductor devices
2. Understand applications of semiconductor devices
3. Understand working of Opamps
4. Understand linear and non-linear and linear applications of Opamps
5. Understand Power devices
6. Understand industrial applications of power circuits

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	0	1	1	1	0	2	2	2
2	3	3	3	3	3	2	0	1	1	1	0	2	2	2
3	3	3	3	3	3	2	0	1	1	1	0	2	2	2
4	3	3	3	3	3	2	0	1	1	1	0	2	2	2
5	3	3	3	3	3	2	0	1	1	1	0	2	2	2
6	3	3	3	3	3	2	0	1	1	1	0	2	2	2

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

CO attainment levels:

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

Future Courses Mapping: Industrial automation, VLSI Design

Job Mapping:

Engineers in Manufacturing / Automation and VLSI industries

FF No.: 654

ET2238: SOFTWARE DEVELOPMENT PROJECT-II

Course Prerequisites:

Programming concepts, 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 student centric.
4. To engage students in rich and authentic learning experiences.
5. To enhance programming skills of students

Credits: 3 **Teaching Scheme Lab:** 6 Hours/Week

Course Relevance:

Software project development comes under the category of project centric learning (PCL). Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom’s Taxonomy.

SECTION-1

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. The course contents are designed as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

1) Software based project to be done by each student
2) A supervisor/mentor teacher assigned who will guide in design and execution of project
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

Assessment Scheme:

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

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 issues.
7. Manage project ethically and collaborate for acquiring skills.
8. Demonstrate effectively project and technical report.

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 4 CO2: - Level 2 CO3: - Level 4 CO4: - Level 5
Job Mapping: Software Engineer, Software Developer, IT Engineer

FF No. : 654

ET2236: ENGINEERING DESIGN AND INNOVATIONS-IV

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: 4 **Teaching Scheme:** Lab 8 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

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 – C21"

Module – V&VI

FF No. : 654

ET3270: SIGNAL PROCESSING

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 time Fourier series and Fourier transform to analyze continuous time systems
3. Use z-transform and discrete Fourier transform to analyze digital systems
4. Apply DFT-FFT algorithm to perform spectral analysis of discrete time signals
5. Provide an understanding of different methods to design digital filters
6. 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: 3 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
Continuous and discrete-time signals and sequences , Continuous and discrete-time systems properties : Linearity, Time variance and causality , analysis of Continuous and discrete-time LTI systems: impulse response , convolution and difference equation Continuous-Time Fourier Series, Continuous-Time Fourier Transform Discrete-Time Fourier Series, Discrete-Time Fourier Transform, DFT, FF
SECTION-2
Sampling theorem , Z transform , Rational Z-transform, System function ,Inverse Z-transform , causality and stability considerations for LTI systems Design and implementation of FIR filter, Linear phase FIR filter,FIR Fiter design using Forier series method , Windows method, Realization of FIR filter – Transverse structure, Linear phase structure Design and implementation of IIR filter Analog lowpass Butterworth filter, Design of IIR filters from analog filters – Impulse invariance technique , Bilnear transformation , Realization of digital filters – Direct form I, Direct form II,cascade form , parallel form
List of Tutorials: 1. Continuous time and 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. Continuous 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:

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. 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	3	2	0	0	1	0	0	0	0	0	0	0	0	0
2	2	2	0	0	0	0	0	0	2	0	0	0	3	0
3	2	2	0	0	1	0	0	0	0	0	1	2	0	0
4	3	2	2	0	2	3	0	0	2	1	1	0	3	3
5	3	2	2	0	2	3	0	0	2	1	1	0	3	3
6	3	0	2	0	2	3	0	0	2	1	1	2	3	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:5

Teaching Scheme Theory: 3. 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: 5 **Teaching Scheme** Theory: 3 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: 5

Teaching Scheme Theory: 3 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

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

Critical section of code, race condition , Shared resource, multitasking, Context switching , Intertask Communication, Priority Inversion, Deadlock, memory management, ISR, Timer.

Introduction to Industrial IoT (IIoT) Systems : Industrial revolution, Historical context, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, 4th industrial revolution, scope of 4th industry revolution, Introduction to industry 4.0 (building blocks, its applications and advantages compared to conventional production techniques) Globalization and Emerging Issues, The Fourth Revolution Smart and Connected Business Perspective, Smart Factories

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

ET3245: SOFTWARE DEVELOPMENT PROJECT-III

Course Prerequisites:

Programming concepts, 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 student centric.
4. To engage students in rich and authentic learning experiences.
5. To enhance programming skills of students

Credits: 3 **Teaching Scheme Lab: 6** Hours/Week

Course Relevance:

Software project development comes under the category of project centric learning (PCL). Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

SECTION-1

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. The course contents are designed as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

1) Software based project to be done by each student
2) A supervisor/mentor teacher assigned who will guide in design and execution of project
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

Assessment Scheme:

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

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 issues.
3. Manage project ethically and collaborate for acquiring skills.
4. Demonstrate effectively project and technical report.

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 4 CO2: - Level 2 CO3: - Level 4 CO4: - Level 5
Job Mapping: Software Engineer, Software Developer, IT Engineer

FF No.: 654

ET3246: ENGINEERING DESIGN AND INNOVATIONS-V

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: 4 **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: 5 **Teaching Scheme Theory: 3** 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. 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). Dynamic Programming: General strategy, simple dynamic programming-based algorithms to compute Fibonacci numbers, binomial coefficients, Matrix Chain multiplication, Optimal binary search tree (OBST) construction, Coin change problem, 0-1 Knapsack, Traveling Salesperson Problem, All pair shortest path algorithm, Longest increasing subsequence problem, Largest independent set for trees.
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 coloring, subset sum problem, SUDOKU) 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 and implication to P versus NP question, NP-hardness of halting problem. 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, subset sum problem, Integer Linear Programming.), reducing NP problems to Integer Linear Programming. 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, solving SAT for formulas with "many" satisfying assignments, randomized quick sort, Las-Vegas and Monte-Carlo

algorithms for majority search, Karger's Min-cut algorithm, coupon collector problem, randomized data structures (randomized BST, skip lists)

Introduction to Approximation algorithms for NP-optimization problems, Approximation algorithm for Vertex Cover, metric Traveling-Sales-Person Problem (metric-TSP), Hardness of approximation for TSP.

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: **3** 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 : 654

ET3273: WEB TECHNOLOGY

Course Prerequisites: Basic understanding of fundamentals of any programming language and Database

Course Objectives:

1. To learn concepts of the HTML and CSS.
2. To use client-side web technologies
3. To acquire skills of server-side web technologies
4. To obtain the knowledge of various concepts of PHP scripting language.
5. Able to understand the concept of object-oriented programming
6. Gain the knowledge of using PHP to access database.

Credits: 3

Teaching Scheme Theory: 3 Hours/Week
Tutorial: 1 Hours/Week
Lab: **2** Hours/Week

Course Relevance: Web development is the work involved in developing a website for the Internet or an intranet. Web development can range from developing a simple single static page of plain text to complex web-based internet applications (web apps), electronic businesses, and social network services. This learning will provide you with the foundational skills you need to begin mastering the core technologies to become a web developer, from HTML, CSS to JavaScript and much more!

SECTION-1

Introduction: Introduction to web technology, Internet and WWW, web site planning and design issues, structure of html document, document structure tags, page structure tags, logical and physical tags, alignment, heading, commenting, formatting tags, text level formatting, block level formatting, list tags, hyperlink tags, image and image maps, table tags, frame tags, form tags, Difference between HTML and HTML5.

Cascaded Style Sheet (CSS): introduction, need, types, text formatting properties, CSS Border, margin properties, positioning, use of classes in CSS, colour properties

Client-Side Technologies: JavaScript: Introduction, Data types, Identifiers, Operators, Control Structures, Arrays, Functions and Scopes, Objects in JS, Event handling, Form validation DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM,

JQuery: Introduction, Loading jQuery, selecting elements, changing styles, creating elements, appending elements, removing elements, handling events.

SECTION-2

Server-Side Technologies: PHP: Introduction, configuration and installation, features, sample code, PHP syntax, control structures, functions, arrays, string manipulation, form handling, include and require statements, file handling- creating, reading, copying, moving, deleting, updating, uploading, Error Handling and Reporting, PHP and HTTP environment variables, Using GET, POST, SESSION and COOKIE variables,

Introduction to Object-oriented PHP: Introduction, Defining PHP Classes, Creating Objects in PHP, Member Functions, Constructor, Destructor, Inheritance, Function Overriding, Access Specifiers: Private, Public, Protected ,Interfaces ,Abstract classes

MySQL with PHP: built-in database functions, connecting to a MySQL, selecting a database, building and sending query to database engine, retrieving, updating and inserting data

AJAX: introduction to AJAX, AJAX with PHP, AJAX with database.

List of Tutorials:

1. Use of HTML5 tags
2. Study of CSS tags
3. Use of Bootstrap
4. JavaScript Objects
5. Study of jQuery in web page designing
6. Installation of WAMP/LAMP/XAMP
7. Study of PHP
8. Inheritance in Object Oriented PHP
9. PHP MySQL database connectivity
10. Web page using AJAX

List of Practicals:

1. Design static web page to demonstrate the use of different HTML tags.
2. Design static web page to demonstrating the use of CSS tags.
3. Design a form for student registration using HTML tags.
4. Design a form using HTML tags and perform validation using JavaScript.
5. Design a web page demonstrating various effects using jQuery.
6. Write a PHP program to create a simple calculator that can accept two numbers and perform operations like add, subtract, multiplication and divide.
7. Write a PHP Script to perform file handling operations like creating, reading, copying, moving, deleting, updating and uploading
8. Design a student registration form and display details in the next page using PHP.
9. Write a program demonstrating concept of class, object, constructor and inheritance using Object Oriented PHP.
10. Design a dynamic web application using PHP and MYSQL as back-end for student data with insert, delete, view and update operation.

11. Write a PHP program using AJAX for addition of two numbers.
12. Design a dynamic web application using PHP, AJAX and MYSQL as back-end for student data with insert and view operation.

List of Projects:

1. Student Registration System
2. Tours and Travel System
3. Canteen Food Ordering and Management System.
4. Online personal counselling
5. Online recruitment System
6. Farming Assistant Web Service
7. E-book shop
8. Online Reservation System
9. Online Hospital Management 9.
10. Online shopping System
11. Doctor Patient portal
12. Online Pizza ordering

List of Course Seminar Topics:

1. HTML5
2. CSS3
3. Embedded web technology
4. XML
5. Progressive Web Apps
6. Client-side technology
7. Server-side technology
8. Servlet
9. Bootstrap
10. JDBC

List of Course Group Discussion Topics:

1. PHP
2. Object Oriented PHP
3. Spring Framework
4. Joomla
5. Web Technology frameworks
6. AJAX
7. Web services
8. Databases and uses
9. SOAP
10. REST

List of Home Assignments:

Design:

1. Design, Develop and Deploy social web applications using Bootstrap.
2. Design, Develop and Deploy web applications using CMS.
3. Design, Develop and Deploy web application for department/college
4. Design, Develop and Deploy web application for social help

5. Design, Develop and Deploy web application feedback system

Case Study:

1. Wordpress
2. Angular JS
3. MongoDB
4. Angular JS
5. Web servers

Blog:

1. Recent web development trends
2. Databases for web developers
3. Web services
4. Web hosting providers
5. Mark up languages

Surveys:

1. Comparison of web services
2. Frameworks for web development
3. Scripting languages for Web Designing.
4. Web server Vs Application server 5. Data centre providers

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. Thomas A. Powell ; "Complete reference HTML"; 4th edition, Tata McGraw-Hill Publications
2. Black book; “Web Technologies: HTML, JS, PHP, Java, JSP, ASP, .NET, XML and AJAX” Dreamtech Press, 2016.
3. Dave Mercer, Allan Ken; "Beginning PHP 5"; Dreamtech Publications.
4 Powell Thoma;.” JavaScript The Complete Reference”; 3rd Edition; Paperback

Reference Books:

1. Jeremy McPeak & Paul Wilton; “Beginning JavaScript”; 5th Edition, Wrox Publication.
2. Robin Nixon; “Learning PHP, MySQL, JavaScript, CSS and HTML 5”; 4th Edition, Reilly publication.
3. Adam Bretz & Colin J Ihrig, “Full Stack Javascript Development with MEAN”, SPD, 1st Edition 2015, Indian Reprint September 2015

4. Jeremy McPeak & Paul Wilton;“ Beginning JavaScript”; 5th Edition; Wrox Publication, 2015
5. Ralph Moseley & M. T. Savaliya; “Developing Web Applications”;2nd Edition; Wiley publications ISBN 13 : 9788126538676
6. Chaffer Jonathan;” jQuery Reference Guide”; 3rd Edition ;McGraw-Hill Education;
7. Alan Forbes “The Joy of PHP Programming: A Beginner’s Guide”; 3rd Edition; Create space Independent Pub

MOOCs Links and additional reading material:

1. www.nptelvideos.in
2. https://www.udemy.com
3. https://www.coursera.org
4. https://swayam.gov.in
5. https://www.w3schools.com

Course Outcomes:

The student will be able to –

1. Understand use of various HTML tags in web pages.
2. Describe the effective use of CSS with Bootstrap framework in the web page.
3. Develop the web pages more dynamic and interactive using JavaScript and jQuery.
4. Differentiate between client-side and server-side validation
5. Establish database connectivity between frontend and backend using PHP-MySQL.
6. Develop solutions to complex problems using appropriate methods and technologies.

CO PO Map

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

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

CO attainment levels:

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

Future Courses Mapping: Advance web technology

Job Mapping: Web developer, Front end developer, Back end developer, Full stack developer

FF No. : 654

ET3265 : CONTROL SYSTEMS

Course Prerequisites:

Linear algebra Calculus

Credits:5

Teaching Scheme Theory: 3 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:** 3 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: Linux commands, OS shell, Shell programming, What is OS?, Interaction of OS and hardware, Goals of OS, Basic functions of OS, OS Services, System Calls, Types of System calls, Types of OS: Batch, Multiprogramming, Time Sharing, Parallel, Distributed & Real-time OS. **Process management:** Process Concept, Process States: 2, 5, 7 state models, Process Description, Process Control, Multithreading models, Thread implementations – user level and kernel level threads, Symmetric Multiprocessing, Concurrency: Issues with concurrency, Principles of Concurrency, Mutual Exclusion: OS/Programming Language Support: Semaphores, Mutex and Monitors, Classical Process Synchronization problems.

Scheduling: Uniprocessor Scheduling, Scheduling Algorithms: First Come First Serve (FCFS), Shortest Job First (SJF), Round Robin and Priority.

SECTION-II

Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Deadlock Recovery

Memory Management: Memory Management requirements, Memory Partitioning, Fragmentation, Paging, Segmentation, Address translation, Placement Strategies: First Fit, Best Fit, Next Fit and Worst Fit. Virtual Memory (VM), VM with Paging, Page Table Structure, Translation Lookaside Buffer, Page Size, VM with Segmentation, Page Replacement Policies: First In First Out (FIFO), Least Recently Used (LRU) and Optimal.

I/O Management: I/O Devices - Types, Characteristics of devices, OS design issues for I/O management, I/O Buffering. Disk Scheduling: FCFS, Shortest Seek Time First (SSTF), SCAN, C-SCAN, LOOK and C-LOOK. File Management: Concepts, File Organization, File Directories, File Sharing. Record Blocking, Secondary Storage Management and Free Space management.

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 Architec

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:5

Teaching Scheme Theory**: 3** 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.

FF:654

ET3275:DATABASE MANAGEMENT SYSTEMS

Course Prerequisites: Data structures, Discrete Mathematics

Course Objectives:

1. Learn the fundamentals of different data modeling techniques.
2. Design and development of relational database management systems.
3. Study the theory behind database systems, the issues that affect their functionality and performance
4. Design of query languages and the use of semantics for query optimization.
5. Understand the latest trends of data management systems.

Credits: 4 **Teaching Scheme Theory: 3** Hours/Week

Tut: No Tutorial

Lab: **2** Hours/Week

Course Relevance: The course emphasizes on the fundamentals of database modeling and design, the languages and models provided by the database management systems, and database system implementation techniques. The goal is to provide an in-depth and up-to-date presentation of the most important aspects of database systems and applications, and related technologies.

SECTION-I
Introduction: Need of Database Management Systems, Evolution, Database System Concepts and Architecture, Database Design Process Data Modeling: Entity Relationship (ER) Model, Extended ER Model, Relational Model, Codd's Rules; Database Design: Need of Normalization, Functional Dependencies, Inference Rules, Functional Dependency Closure, Minimal Cover, Decomposition Properties, Normal Forms: 1NF, 2NF, 3NF and BCNF, Multi-valued Dependency, 4NF, Relational Synthesis Algorithms Query Languages: Relational Algebra, SQL: DDL, DML, Select Queries, Set, String, Date and Numerical Functions, Aggregate Functions ,Group by and Having Clause, Join Queries, Nested queries, DCL, TCL, PL/SQL: Procedure, Function, Trigger, Mapping of Relational Algebra to SQL

SECTION-II

Storage and Querying: Storage and File structures, Indexed Files, Single Level and Multi Level Indexes; Query Processing, Query Optimization
Transaction Management: Basic concept of a Transaction, ACID Properties, State diagram, Concept of Schedule, Serializability – Conflict and View, Concurrency Control Protocols, Recovery techniques
Parallel and Distributed Databases: Architecture, I/O Parallelism, Interquery, Intraquery, Intraoperation and Interoperation Parallelism, Types of Distributed Database Systems, Distributed Data Storage, Distributed Query Processing
NOSQL Databases and Big Data Storage Systems: Introduction to NOSQL Databases, Types of NOSQL Databases, BASE properties, CAP theorem, Big Data, HADOOP: HDFS, MapReduce. Data Warehousing: Architecture and Components of Data Warehouse, Warehouse Schemas, OLAP.

List of Practicals:

1. Create a database with appropriate constraints using DDL and populate/modify it with the help of DML.
2. Design and Execute "SELECT" queries using conditional, logical, like/not like, in/not in, between...and, is null/is not null operators in where clause, order by, group by, aggregate functions, having clause, and set operators. Use SQL single row functions for date, time, string etc.
3. Write equijoin, non equijoin, self join and outer join queries. Write queries containing single row / multiple row / correlated sub queries using operators like =, in, any, all, exists etc.
4. Write DML queries containing sub queries. Study a set of query processing strategies.

a. Write PL/SQL blocks to implement all types of cursor.

5. Write useful stored procedures and functions in PL/SQL to perform complex computation.
6. Write and execute all types of database triggers in PL/SQL.
7. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
8. Create a database with suitable example using MongoDB and implement Inserting and saving document, Removing document, Updating document
9. Execute at least 10 queries on any suitable MongoDB database that demonstrates following querying techniques:find and findOne, Query criteria, Type-specific queries
10. Implement Map Reduce operation with suitable example using MongoDB.

List of Projects:
1. Hospital Management System
2. Hostel Management System
3. Tour and Travel Management System
4. College Management System
5. Housing Society Management System
6. Medical Store Management System
7. Airline Reservation System
8. Insurance Policy Management System
9. Event Management System
10. Car Rental Management System

List of Course Seminar Topics:
1. Object and Object-Relational Databases
2. XML data model, XML documents and associated languages
3. Database Security
4. Modern Storage Architectures
5. Google Cloud- SQL Databases
6. Google Cloud- NOSQL Databases
7. Amazon Databases
8. Oracle NoSQL Database
9. Cassandra DB
10. Data Center Engineering

List of Course Group Discussion Topics:
1. RDBMS Vs NOSQL
2. ER model Vs UML diagrams
3. Normalized vs unnormalized database
4. OLTP Vs OLAP
5. Data Warehouse Vs Data Lake
6. RDBMS and OODBMS
7. Neo4J and GraphBase
8. DynamoDB Vs Voldemort
9. Google File System (GFS) Vs HDFS (Hadoop Distributed File System)
10. Hive SQL Vs Pig Latin

List of Home Assignments:
Design:
1. Suppose you want to build a video site similar to YouTube. Identify disadvantages of keeping data in a file-processing system. Discuss the relevance of each of these points to the storage of actual video data, and to metadata about the video, such as title, the user who uploaded it, tags, and which users viewed it.
2. Illustrate data model that might be used to store information in a social-networking system such as Facebook
3. Describe the circumstances in which you would choose to use embedded SQL rather than SQL alone or only a general-purpose programming language.
4. Give the DTD and XML Schema for Library Management System. Give a small

example of data corresponding to this DTD and XML.Write ten queries in Xpath and XQuery

5. If you were designing a Web-based system to make airline reservations and sell airline tickets, which DBMS architecture would you choose? Why? Why would the other architectures not be a good choice?Design a schema and show a sample database for that application. What types of additional information and constraints would you like to represent in the schema? Think of several users of your database, and design a view for each.

Case Study:

1. PostgreSQL
2. Oracle
3. IBM DB2 Universal Database
4. Microsoft SQL Server
5. SQLite database

Blog

1. OLAP tools from Microsoft Corp. and SAP
2. Views in database
3. Dynamic SQL and Embedded SQL
4. Active databases and Triggers
5. SQL injection attack

Surveys

1. Keyword queries used in Web search are quite different from database queries. List key differences between the two, in terms of the way the queries are specified, and in terms of what is the result of a query.
2. List responsibilities of a database-management system. For each responsibility,explain the problems that would arise if the responsibility were not discharged
3. List reasons why database systems support data manipulation using a declarative query language such as SQL, instead of just providing a a library of C or C++ functions to carry out data manipulation
4. Consider a bank that has a collection of sites, each running a database system. Suppose the only way the databases interact is by electronic transfer of money between themselves, using persistent messaging.Would such a system qualify as a distributed database? Why?
5. Data warehousing products coupled with database systems

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. Abraham Silberschatz, Henry F. Korth, S. Sudarshan; "Database System Concepts"; 6th Edition, McGraw-Hill Education
2. Ramez Elmasri, Shamkant B. Navathe; "Fundamentals of Database Systems"; 7th Edition, Pearson

Reference Books:

1. Thomas M. Connolly, Carolyn E. Begg," Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition ;Pearson
2. Raghu Ramakrishnan, Johannes Gehrke; "Database Management Systems", 3rd Edition; McGraw Hill Education
3. Kristina Chodorow, MongoDB The definitive guide, O'Reilly Publications, ISBN: 978-93-5110-269-4, 2nd Edition.
4. Dr. P. S. Deshpande, SQL and PL/SQL for Oracle 10g Black Book, DreamTech.
5. Ivan Bayross, SQL, PL/SQL: The Programming Language of Oracle, BPB Publication. 6. Reese G., Yarger R., King T., Williums H, Managing and Using MySQL, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition.
7. Dalton Patrik, SQL Server – Black Book, DreamTech Press.
8. Eric Redmond, Jim Wilson, Seven databases in seven weeks, SPD, ISBN: 978-93-5023-918-6.
9. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition.

Moocs Links and additional reading material:

https://nptel.ac.in/courses/106/105/106105175/
https://onlinecourses.nptel.ac.in/noc21_cs04/preview
https://www.datacamp.com/courses/introduction-to-sql
Oracle MOOC: PL/SQL Fundamentals - Oracle APEX

Course Outcomes:

1. Design and draw ER and EER diagrams for real life applications.
2. Transform conceptual schema of high-level data model into implementation data model
3. Apply the concepts of normalization to develop the quality relational data model
4. Formulate queries in relational algebra, SQL and write PL/SQL blocks.
5. Acquaint with physical database file structures
6. Identify the use of database techniques such as NOSQL

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

1	0	2	3	0	3	2	0	3	3	2	3	3	0	2
2	0	2	0	2	3	2	0	3	3	2	3	3	0	2
3	0	2	0	0	3	2	0	3	3	2	3	3	0	2
4	0	2	3	0	3	2	0	3	3	2	3	3	0	2
5	0	2	0	0	3	2	0	3	3	2	3	3	0	2
6	0	2	3	3	3	2	0	3	3	2	3	3	3	2

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

CO attainment levels

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

Future Courses Mapping:

Advanced databases
Big Data Management
Cloud Databases
Database Administrator

Job Mapping:

Database Engineer
SQL developer
PL/SQL developer

FF:654

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:5 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.

FF No.: 654

ET3247: SOFTWARE DEVELOPMENT PROJECT-IV

Course Prerequisites:

Programming concepts, 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 student centric.
9. To engage students in rich and authentic learning experiences.
10. To enhance programming skills of students

Credits: 3 **Teaching Scheme Lab: 6** Hours/Week

Course Relevance:

Software project development comes under the category of project centric learning (PCL). Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

SECTION-1

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. The course contents are designed as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

1) Software based project to be done by each student
2) A supervisor/mentor teacher assigned who will guide in design and execution of project
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

Assessment Scheme:

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

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 issues.
7. Manage project ethically and collaborate for acquiring skills.
8. Demonstrate effectively project and technical report.

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

Job Mapping:

Software Engineer, Software Developer, IT Engineer

ET3276: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING PROJECT

Course Prerequisites: Linear Algebra and Calculus, Probability Basics, C, C++, Python Programming language, OpenCV

Course Objectives:

1. Understanding Human learning aspects.
1. Acquaintance with primitives in the learning process by computer.
2. Understanding the nature of problems solved with Machine Learning.
3. To study different supervised learning algorithms.
4. To study different unsupervised learning algorithms.
5. To understand the application development process using ML

Credits: 5

Course Relevance: Data Science, Artificial Intelligence

SECTION-I
Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation. **Types of Learning**: Supervised, Unsupervised and Semi-Supervised Learning. Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis. **Concept Learning:** Concept Learning, General-to-Specific Ordering: Task, search, Find S algorithm, Version space and the candidate elimination algorithm, List-then-eliminate algorithm, inductive bias.

Classification: Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

Regression and Generalization: Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

SECTION-II

Logic Based and Algebriac Models: Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K-medoids, Hierarchical clustering. Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters. TreeBased Models: Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split.

Probabilistic Models: Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods, Gaussian Mixtures

Trends in Machine Learning: Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties Deep Learning: The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons, reinforcement learning.

Machine Learning with Large Datasets => scalable learning techniques, such as streaming machine learning techniques; parallel infrastructures such as map-reduce; practicaltechniques for reducing the memory requirements for learning methods, such as feature hashing and Bloom filters; and techniques for analysis of programs in terms of memory, disk usage, and (for parallel methods) communication complexity.

List of Projects:

1. Chat bot
2. Stock market prediction
3. Sentiment analysis
4. Iris Flowers Classification Project.
5. Housing Prices Prediction Project.
6. MNIST Digit Classification Project.
7. Stock Price Prediction using Machine Learning.
8. Fake News Detection Project.
9. Bitcoin Price Predictor Project.
10. Uber Data Analysis Project.
11. Credit card fraud detection project

Text Books:

1. T. Mitchell, " Machine Learning", McGraw-Hill, 1997.

2 Anup Kumar Srivastava, Soft Computing, Alpha Science International limited. 2009.

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT press, 2004.

2.Jacek M. Zurada, "Introduction to Artificial neural System", JAICO publishing 'house,2002,

Moocs Links and additional reading material:

www.nptelvideos.in

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 Mapping

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

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

CO Attainment

CO1: Level 3

CO2: Level 4

CO3: Level 3

CO4: Level 4

Future Courses Mapping: MS in Machine Learning

Job Mapping:
ML Engineer, Data Scientist

FFNo. : 654

ET3277: INTERNET OF THINGS PROJECT

Credits: 05

Course Prerequisites:

Prerequisites: Students for this course should have a basic knowledge of Operating Systems, Fundamentals of Computer Networks, C, C++, Python Programming Language, Networking

Course Objectives: The student will be able to

1. To become familiar with Cloud Computing and its ecosystem
2. To learn basics of virtualization and its importance
3. To evaluate in-depth analysis of Cloud Computing capabilities
4. To give a technical overview of Cloud Programming and Services.
5. To understand security issues in cloud computing

Credits: 5

Course Relevance:

Cloud computing to enable transformation, business development and agility in an organization.

SECTION-1
Introduction to Cloud Computing: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Evolution of cloud computing Cloud Computing Architecture: Cloud versus traditional architecture, Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), , Public cloud, Private cloud, Hybrid cloud, Community cloud, Google Cloud architecture, The GCP Console, Understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs. Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Storage options in the cloud, Structured and unstructured storage in the cloud, unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud

Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL option.

SECTION-2

Platform as a Service (PaaS): Introduction to PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine.
Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing and accounting, Billing in GCP
Cloud Security: Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM. Case study on Open Source and Commercial Clouds – Amazon EC2, Google Compute Engine, Microsoft Azure, Cloudfoundry, OpenStack.

List of Projects:

1. Designing of sample cloud services.
2. Create File Hosting Services using cloud platform.
3. Create an Interview Bot using cloud
4. Precision Agriculture on Cloud
5. Access, storage, analysis and display of Sensors data over a cloud for Oil and gas Industry.
6. Access, storage, analysis and display of Sensors data over a cloud for Mining Industry.
6. Smart Building on cloud
7. Smart City on cloud

Textbooks:

1. Rajkumar Buyya, \Cloud computing principles and paradigms", Wiley.
2. Gautam Shroff. “Enterprise Cloud Computing”, Cambridge
3. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, “Cloud Computing for Dummies”, Wiley,India.
4. Barrie Sosinsky, “Cloud Computing Bible”, Wiley India

Reference Books:

1. Antohy T Velte, et.al, “Cloud Computing : A Practical Approach”, McGraw Hill.
2. Michael Miller, “Cloud Computing”, Que Publishing.
3. Ronald Krutz and Russell Dean Vines, “Cloud Security”, Wiley-India
4. Tim Malhar, S.Kumaraswammy, S.Latif, “Cloud Security & Privacy”, SPD,O’REILLY
5. Scott Granneman, “Google Apps”, Pearson

Moocs Links and additional reading material:

1. www.nptelvideos.in
2. https://nptel.ac.in/courses/106/105/106105167/
3. https://swayam.gov.in/nd1_noc20_cs55/preview
4. https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/
5. https://aws.amazon.com/what-is-cloud-computing/
6. https://www.ibm.com/in-en/cloud/learn/cloud-computing

Course Outcomes: 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 Mapping:

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

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

Job Mapping:

Cloud Architect, Cloud Engineer, Cloud Administrator, Solutions Architect - Cloud Computing - AWS / Kubernetes, Cloud Computing Technical Consultant, Associate Cloud Computing Engineer, Cloud Computing Trainer.

FF No. : 654

ET3251:MACHINE LEARNING

Course Prerequisites: Linear Algebra and Calculus, Probability Basics

Course Objectives:

1. Understanding Human learning aspects.
2. Acquaintance with primitives in the learning process by computer.
3. Understanding the nature of problems solved with Machine Learning.
4. To study different supervised learning algorithms.
5. To study different unsupervised learning algorithms.
6. To understand the application development process using ML

Credits: 5 **Teaching Scheme Theory: 3** Hours/Week

Tut: 1 Hours/Week

Lab: **2** Hours/Week

Course Relevance: Data Science, Artificial Intelligence

SECTION-I
Introduction: What is Machine Learning, Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation. **Types of Learning**: Supervised, Unsupervised and Semi-Supervised Learning. Dimensionality Reduction: Introduction to Dimensionality Reduction, Subset Selection, Introduction to Principal Component Analysis. **Concept Learning:** Concept Learning, General-to-Specific Ordering: Task, search, FindS algorithm, Version space and the candidate elimination algorithm, List-then-eliminate algorithm, inductive bias.

Classification: Binary and Multiclass Classification: Assessing Classification Performance, Handling more than two classes, Multiclass Classification-One vs One, One vs Rest Linear Models: Perceptron, Support Vector Machines (SVM), Soft Margin SVM, Kernel methods for non-linearity

Regression and Generalization: Regression: Assessing performance of Regression – Error measures, Overfitting and Underfitting, Catalysts for Overfitting, VC Dimensions Linear Models: Least Square method, Univariate Regression, Multivariate Linear Regression, Regularized Regression - Ridge Regression and Lasso Theory of Generalization: Bias and Variance Dilemma, Training and Testing Curves Case Study of Polynomial Curve Fitting.

SECTION-2

Logic Based and Algebriac Models: Distance Based Models: Neighbors and Examples, Nearest Neighbor Classification, Distance based clustering algorithms - K-means and K- medoids, Hierarchical clustering. Rule Based Models: Rule learning for subgroup discovery, Association rules mining – Apriori Algorithm, Confidence and Support parameters. TreeBased Models: Decision Trees, Minority Class, Impurity Measures – Gini Index and Entropy, Best Split.

Probabilistic Models: Conditional Probability, Joint Probability, Probability Density Function, Normal Distribution and its Geometric Interpretation, Naïve Bayes Classifier, Discriminative Learning with Maximum Likelihood. Probabilistic Models with Hidden variables: Expectation-Maximization methods, Gaussian Mixtures

Trends in Machine Learning: Ensemble Learning: Combining Multiple Models, Bagging, Randomization, Boosting, Stacking Reinforcement Learning: Exploration, Exploitation, Rewards, Penalties Deep Learning: The Neuron, Expressing Linear Perceptron as Neurons, Feed Forward Neural Networks, Linear Neurons and their Limitations, Sigmoid, Tanh and ReLU Neurons, reinforcement learning.

Machine Learning with Large Datasets => scalable learning techniques, such as streaming machine learning techniques; parallel infrastructures such as map-reduce; practicaltechniques for reducing the memory requirements for learning methods, such as feature hashing and Bloom filters; and techniques for analysis of programs in terms of memory, disk usage, and (for parallel methods) communication complexity.

List of Tutorials:

1. Feature Selection Techniques
2. Supervised Learning
3. Unsupervised Learning
4. Reinforcement Learning
5. Collaborative filtering
6. Q Learning
7. Item based Recommender system
8. Real time application

List of Practicals:

1. Normalization
2. Detection
3. Optimization
4. Classification
5. Clustering
6. Regression Analysis
7. Collaborative filtering
8. Recommendation system

List of Projects:

1. Chat bot
2. Stock market prediction
3. Sentiment analysis
4. Iris Flowers Classification Project.
5. Housing Prices Prediction Project.
6. MNIST Digit Classification Project.
7. Stock Price Prediction using Machine Learning.
8. Fake News Detection Project.
9. Bitcoin Price Predictor Project.
10. Uber Data Analysis Project.
11. Credit card fraud detection project

List of Course Seminar Topics:

1. Naive Bayes Algorithm
2. Machine And Privacy
3. Limitations of ML
4. Ensemble Learning
5. Dimensionality reduction algorithms
6. Comparison of Machine Learning algorithms
7. Feature Extraction In Machine Learning
8. Reinforcement Learning
9. Probabilistic Model
10. Role of preprocessing

11. SVM and its application
12. PCA and its application
13. Clustering algorithms
14. Role of Evaluation and testing of model
15. Autonomous vehicles
16. Medical care and diagnosis
17. Use of ML in software design(CAD CAM, PCB Layouts)

List of Course Group Discussion Topics:

1. Supervised Vs Unsupervised
2. Univariate Vs Multivariate analysis
3. Accuracy measuring methods
4. Bias Vs Variance Tradeoff
5. Data Reduction Vs Dimensionality reduction
6. Continuous Vs Discrete variables
7. Bias Vs Variance
8. Deep Leaning Vs Tradition Learning
9. Selection of Hyper parameters for Deep learning
10. Comparison between different classification techniques
11. Comparison between different clustering techniques
12. Role of Evaluation of model
13. Role of dimension reduction techniques
14. Techniques used for sequential data
15. Descriptive and generative models

List of Home Assignments:
Design:

1. Propensity to Foreclose: Predicting propensity of the customer to foreclose their loans. The objective is to retain the customer for the maximum tenure.
2. Portfolio & Price Prediction for Intra-day trades: Price movement prediction using a maskedset of features - This involves predicting short-term to mid-term price movements using a combination of multiple features.
3. Smart Building Energy Management System using Machine Learning
4. Quick analysis of quality of cereals, oilseeds and pulses using ML
5. Video Library Management System using Machine Learning

Case Study:

1. Product Recommendation: Given a purchase history for a customer and a large inventory of products, identify those products in which that customer will be interested and likely to purchase. A model of this decision process would allow a program to make recommendations to a customer and motivate product purchases. Amazon has this capability. Also think of Facebook, GooglePlus and LinkedIn that recommend users to connect with you after you sign-up.
2. Medical Diagnosis: Given the symptoms exhibited in a patient and a database of anonymized patient records, predict whether the patient is likely to have an illness. A model of this decision problem could be used by a program to provide decision support

to medical professionals.

3. Stock Trading: Given the current and past price movements for a stock, determine whether the stock should be bought, held or sold. A model of this decision problem could provide decision support to financial analysts.
4. Customer Segmentation: Given the pattern of behaviour by a user during a trial period and the past behaviors of all users, identify those users that will convert to the paid version of the product and those that will not. A model of this decision problem would allow a program to trigger customer interventions to persuade the customer to covert early or better engage in the trial.
5. Shape Detection: Given a user hand drawing a shape on a touch screen and a database of known shapes, determine which shape the user was trying to draw. A model of this decision would allow a program to show the platonic version of that shape the user drew to make crisp diagrams. The Instaviz iPhone app does this.

Blog

1. Focusing Too Much on Algorithms and Theories.
2. Mastering ALL of ML.
3. Having Algorithms Become Obs mgolete as Soon as Data Grows.
4. Getting Bad Predictions to Come Together With Biases.
5. Making the Wrong Assumptions.
6. Receiving Bad Recommendations.
7. Having Bad Data Convert to Bad Results.

Surveys

1. AI and ML in speech processing
2. AI and ML in Video Processing
3. AI and ML assistive living
4. AI and ML in the field of agriculture
5. AI and ML in Forensic science
6. AI and ML in surveillance
7. AI and ML in Defense field
8. AI and ML in Traffic and crowd management
9. AI and ML Use in software design(CAD CAM, PCB Layouts)
10. AI and ML In Automation
11. AI and ML Medical care and diagnosis

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. T. Mitchell, " Machine Learning", McGraw-Hill, 1997.
2. Anup Kumar Srivastava, Soft Computing, Alpha Science International limited. 2009.

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT press, 2004.
2. Jacek M. Zurada, "Introduction to Artificial neural System", JAICO publishing house,2002.

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

Course Outcomes:

1. Demonstrate knowledge of learning algorithms and concept learning through implementation for sustainable solutions of applications.
2. Evaluate decision tree learning algorithms.
3. Analyze research based problems using Machine learning techniques.
4. Apply different clustering algorithms used in machine learning to generic datasets andSpecific multidisciplinary domains.
5. Formulate a given problem within the Bayesian learning framework with focus onBuilding lifelong learning ability.
6. Evaluation of different algorithms on well formulated problems along with statingValid conclusions that the evaluation supports.

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)

CO attainment levels

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

Future Courses Mapping:
MS in Machine Learning

Job Mapping:
ML Engineer, Data Scientist

FF No.: 654

ET3252: CYBER SECURITY

Course Prerequisites:

Data Communication

Course Objectives:

1. Understand the need of Cyber Security.
2. To analyse the system for vulnerabilities.
3. To acquaint with information Security threats
4. Apply security measures to real time scenarios
5. Learn various cryptographic techniques and Network security methods.
6. Understand Cyber Law space

Credits: 5 **Teaching Scheme Theory:** 3 Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance:

This course aims at providing the students with a broad introduction to the profound concepts in Cyber Security by exposing them to practical scenarios in order to make them industry ready. It's beneficial for their career as well as budding Engineers to start their career as Ethical Hacking Data Scientist, Cyber Security Engineer, Anti Cyber Terrorism Scientist, etc.

SECTION-1
Introduction to Cyber Security Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats - Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, need for comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace. **Cyber Security Vulnerabilities and Cyber Security Safeguards** Cyber Security Vulnerabilities: Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness.

Cyber Security Safeguards: Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

Securing Web Application, Services and Servers
Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

SECTION-2

Intrusion Detection and Prevention
Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

Cryptography and Network Security
Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.

Cyberspace Law and Cyber Forensics
Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013. Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis etc

List of Tutorials:

1. Develop the program to implement DES algorithm for encryption and decryption. Assume suitable key.
2. Develop the program to implement RSA algorithm for encryption and decryption. Assume suitable Private and Public Keys.
3. Write a program to implement SHA1 algorithm using libraries (API)
4. Configure and demonstrate use of vulnerability assessment tool like Wireshark or SNORT

List of Practicals:

6. Implementation to gather information from any PC's connected to the LAN using whois,
1. port scanners, network scanning, Angry IP scanners etc.
2. Implementation of Symmetric and Asymmetric cryptography.
3. Implementation of Steganography.
4. Implementation of MITM- attack using wireshark/ network sniffers
5. Implementation of Windows security using firewall and other tools
6. Implementation to identify web vulnerabilities, using OWASP project
7. Implementation of Mobile Audit and generate the report of the existing Artiacts.

List of Course Projects:

1. Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery.
2. Implementation of OS hardening and RAM dump analysis to collect the Artifacts and other information's.
3. Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report.
4. Analysis and comparison of key performing parameters to compare various cyber security tools.
5. Implement system hacking using tools.
6. Create virus with python script and implement attack and analyse the effect of various viruses.
7. Sniffing Website Credentials using Social Engineering Toolkit.

List of Course Seminar Topics:

1. Networking models
2. OS Security
3. Wireless Networks and Security
4. Security Management Practices
5. Common trade-offs and compromises that are made in the design and
6. development process of Information Systems
7. use of standards and cyber laws to enhance information security in the development process and infrastructure protection.

List of Course Group Discussion Topics:

1. Security for VPN and Next Generation Technologies
2. System and Application Security
3. Security Architectures and Models
4. Attacks, Malicious Logic and Countermeasure

List of Home Assignments:

Case Study:
Security related issues and reports

Surveys:

1. Data Breaches
2. Cloud Security
3. Social Engg
4. Internet security

Design:

1. Implement system hacking using tools.
2. Create virus with python script and implement attack and analyse the effect of various viruses.
3. Sniffing Website Credentials using Social Engineering Toolkit.

Blog: Wireless and wired communication security issues

1 Passwords
2 Social Media Handles
3 Internet Banking

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:

- Hossein, "Handbook of Information Security, Threats, Vulnerabilities, Prevention, Detection, and Management", Wiley, Volume 3 edition, ISBN-13: 978-0470323069.
- Georgia Weidman, "Penetration testing: A Hands-On Introduction to Hacking", No Starch Press, 2014, ISBN-13: 978-1593275648.
- Michael Sikorski and Andrew Honig, " Practical Malware Analysis", No Starch Press, 1st Edition, 2012, ISBN-13: 978-1593272906

Reference Books:

- "Practical Internet of Things Security" by Brian Russell, Drew Van Duren, Packt publishing, 2016, ISBN: 9781785889639
- T. Mather, S. Kumaraswamy, S. Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly Series, 2009, ISBN-13: 978-0596802769.
- "Cyberlaw: the Indian perspective"; Pavan Duggal; Saakshar Law Publications, 1st edition,
  2002, ISBN: 8189121022, 9788189121020.

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

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

1. Identify & Evaluate Information Security threats and vulnerabilities in Information Systems
2. Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information.
3. Analyse the malwares, social networking websites and impact of cyber-crime on ecommerce.
4. Apply methods for authentication, access control, intrusion detection and prevention.
5. Use cryptographic techniques in secure application development.
6. Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection.

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)

Job Mapping:

Job opportunities that one can get after learning this course

Network Security Specialist, Cyber Security Architect/Administrator, IT Security Advisor / Manager, Security Consultant, Forensics Investigator, Security Auditor/Investigating Officer Ethical Hacker, Entrepreneur

FF No.: 654

ET3253: BIG DATA

Course Prerequisites: Data Science, Python

Course Objectives:

1. To optimize business decisions and create competitive advantage with Big Data analytics
2. To explore the fundamental concepts of big data analytics.
3. To learn to analyze the big data using intelligent techniques.
4. To understand the various search methods and visualization techniques.
5. To learn to use various techniques for mining data stream.
6. To understand the applications using Map Reduce Concepts.
7. To introduce programming tools PIG & HIVE in Hadoop echo system

Credits: 5 **Teaching Scheme Theory:** Hours/Week
Tut: Hours/Week
Lab: Hours/Week

Course Relevance:

To produce world-class data scientists in diverse domains. An avenue for a graduate of any discipline to earn an MSc in Computer Science with a special training for making a career in the domain of his / her liking by employing innovations and applications that are based on data science and artificial intelligence. This Programme is a quality assured alternative for the employed learners who generally prefer Distance learning.

SECTION-1
Definition of Big Data, Big data characteristics & considerations, Traits of big data, Characteristics of Big Data and Dimensions of Scalability, Typical analytical architecture, Business Intelligence Vs Data science, Drivers of Big data analytics, Scalability and Parallel Processing. Hadoop, its Ecosystem, Core components, Streaming, Pipes, Hadoop Distributed File System, MapReduce framework and programming model, MapReduce Map Tasks Databases NoSQL, MongoDB, DynamoDB, Storage type, Comparative analysis

SECTION-2

Apache Spark: RDD (Resilient Distributed dataset), Spark Architecture and Components, Deployment and APIs, Spark Core, Spark - SQL, Streaming, Data Stream Mining and Real-Time Analytics Platform—SparkStreaming, Graph Analytics for Big Data and Spark GraphX Platform, Apache Zookeeper , Apache Kafka(very important), Apache Pig

Hive: Architecture, Data types, File formats, Hive integration, HiveQL data definition language, HiveQL Data Manipulation Language, Querying data, Aggregation

Case studies – ModelOp, Docker containers
Big data modeling with specific approaches including vector space models, graph data models

List of Tutorials:

1. Process of Data Analysis
2. Characteristics and challenges of Big Data
3. Information and process fusion for analytics algorithms with MapReduce
4. Unit Testing MapReduce functions, jobs and pipelines
5. Using stack dumps to discover unoptimized user code
6. Extracting and visualizing task execution times
7. Launching a Spark Cluster on EC2
8. Crunch log parsing and basic analytics
9. Testing MapReduce functions, jobs and pipelines
10. Debugging and error handling
11. MapReduce anti-patterns

List of Practicals:

1. Implement the following file management tasks in Apache spark: Adding Files and Directories, Retrieving Files, Deleting Files
2. Word Count Map Reduce program to understand Map Reduce Paradigm
3. Generate regression model and interpret the result for a given data set.
4. Generate forecasting model and interpret the result for a given data set.
5. Write Pig Latin program to sort, group, join, project, and filter your data. Find out Number of Products Sold in Each Country
6. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.
7. Write a program for measuring similarity among documents and detecting passages which have been reused.
8. Collecting and processing parallel data in a distributed system (Apache)
9. Network clustering using k-means or MapReduce implementations

10. Predicting effective missing data by using Multivariable Time Series on Apache Spark

List of Course Projects:

1. Integrating Hadoop with DW Appliances
2. Integrating Hadoop with Enterprise Data Warehouses
3. Trend analysis of weblogs
4. Text mining using Apache
5. Link prediction for social media sites
6. Streaming ETL (Extract Transform Load) task and pipelines
7. Speech Analysis
8. Rank documents in text search operation
9. Sentiment analysis
10. Credit card fraud detection

List of Course Seminar Topics:

1. Data as Service
2. Responsible and Smarter Artificial Intelligence
3. SQL connectivity initiatives to Big Data
4. Predictive Analytics
5. Multi-Platform Analytical Environment
6. Query performance enabler
7. In-memory analytics
8. Analyzing Big Data using Self-Service BI Tools
9. NoSQL BI Tools
10. Tools for Data Cleaning and Munging

List of Course Group Discussion Topics:

1. Big data Security and Social Challenges
2. Noisy and Incomplete data
3. Distributed and complex data
4. Scalability and Efficiency of algorithms
5. Improvement of data mining algorithms
6. Ethics and Privacy in Learning analytics
7. Data integration and governance
8. MapReduce vs SQL developers
9. Cloud hosting vs physical procurement
10. Spark vs Flink

List of Home Assignments:

Case Study:

1. Kisan Call Centers operating across multiple districts in India
2. Big data lakes
3. Anomaly detection in cloud servers
4. Yandex.Traffic - Real time map of traffic conditions in a city
5. Tourist Behaviour analysis

Surveys:

1. Tracking Cyber attacks and hacking attempts
2. Big data for Cyber security
3. Tools and Techniques for Big data analysis
4. Platforms for Big Data Analytics
5. Big Data analytics in Intelligent transportation systems

Design:

1. Program to minimize the response time of the query.
2. Malicious user detection in Big data collection
3. Big HDT Semantic Data Compression
4. Predict mixed type multi-outcome by using the paradigm in healthcare application
5. Hadoop for health care application

Blog:

1. Big HDT Semantic Data Compression
2. Recent developments in data science and analytics world
3. Statistical Errors
4. Text mining, visualization
5. Predictive modeling

Assessment Scheme:

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

Textbooks:

1. BIG DATA ANALYTICS, Introduction to Hadoop, Spark, and Machine-Learning By Raj Kamal, Preeti Saxena · 2019
2. Hadoop: The Definitive Guide, 4th Edition by Tom White
3. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014

Reference Books:

1. Balamurugan Balusamy, Manju Khari, Pethuru Raj, T Poongodi, "The Internet of Things and Big Data Analytics, Integrated Platforms and Industry Use Cases", CRC Press, 2020
2. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph, David Loshin, Morgan Kaufmann Publishers, 2013
3. Arshdeep Bahga, Vijay Madisetti, "Big Data Science & Analytics: A HandsOn Approach ",VPT, 2016
4. Bart Baesens "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series)", John Wiley & Sons,2014

Moocs Links and additional reading material:

1. www.nptelvideos.in
2. https://nptel.ac.in/courses/106/104/106104189/
3. https://nptel.ac.in/courses/110/106/110106072/
4. https://onlinecourses.nptel.ac.in/noc21_cs45/preview
5. https://www.docker.com/resources/what-container
6. https://cwiki.apache.org/confluence/display/Hive/GettingStarted#GettingStarted-MovieLensUserRatings
7. https://awesomeopensource.com/projects/pyspark

Course Outcomes:

1. Work with big data platform and explore the big data analytics techniques business applications.
2. Design efficient algorithms for mining the data from large volumes.
3. Analyze the HADOOP and Map Reduce technologies associated with big data analytics.
4. Explore on Big Data applications Using Pig and Hive.
5. Understand the fundamentals of various big data analytics techniques.
6. Build a complete business data analytics solution

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)

Future Courses Mapping:
Deep learning, Natural Language Processing, Pattern Recognition

Job Mapping:
Job opportunities that one can get after learning this course

2. Data Scientist
3. Data Analyst
4. Data Architect
5. Data Engineer
6. Statistician
7. Database Administrator
8. Business Analyst
9. Business Intelligence Developer
10. Enterprise Architect
11. Machine Learning Expert
12. AI Engineer
13. Statistician

FF No. : 654

ET3254: CLOUD COMPUTING

Credits: 05 **Teaching Scheme:** Theory: 3 Hours / Week
Lab: 2 Hours / Week
Tut : 1 Hour/Week

Course Prerequisites:

Prerequisites: Students for this course should have a basic knowledge of Operating Systems, Fundamentals of Computer Networks

Course Objectives:

The student will be able to

1. To become familiar with Cloud Computing and its ecosystem
2. To learn basics of virtualization and its importance
3. To evaluate in-depth analysis of Cloud Computing capabilities
4. To give a technical overview of Cloud Programming and Services.
5. To understand security issues in cloud computing

Course Relevance:

Cloud computing to enable transformation, business development and agility in an organization.

SECTION-1
Introduction to Cloud Computing: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Evolution of cloud computing Cloud Computing Architecture: Cloud versus traditional architecture, Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), , Public cloud, Private cloud, Hybrid cloud, Community cloud, Google Cloud architecture, The GCP Console, Understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs. Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with

autoscaling, Storage options in the cloud, Structured and unstructured storage in the cloud, unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL option

SECTION-2

Platform as a Service (PaaS): Introduction to PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine.
Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing and accounting, Billing in GCP
Cloud Security: Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM. Case study on Open Source and Commercial Clouds – Amazon EC2, Google Compute Engine, Microsoft Azure, Cloud foundry, OpenStack.

List of Tutorials:

1. Cluster and Distributed Computing
2. GCP architecture and Control
3. Configure Cloud SDK
4. Use of Cloud Shell
5. Virtual Machine
6. No SQL Managed services
7. Create dummy cloud
8. Hypervisors
9. Web OS
10. Compute Engine

List of Practicals:

1. Hands on virtualization using XenServer
2. Hands on containerization using Docker
3. Deployment and Configuration options in Amazon (AWS)
4. Deployment and Configuration options in Google Cloud
5. Deployment and Configuration options in Microsoft Azure
6. Building a 'HelloWorld' app for the cloud
7. Deploying the 'HelloWorld' app for the cloud
8. Creating a virtual machine on GCP

9. Create a Windows Server instance in the Google Compute Engine and access it with RDP
10. Provides a managed environment for deploying, managing, and scaling your containerized applications using google kubernetes engine.

List of Course Projects:

1. Designing of sample cloud services.
2. Create File Hosting Services using cloud platform.
(upload and download files, which enable users to access and control file systems remotely, as well as synchronize files in real-time across multiple devices)
3. Create an Interview Bot using cloud
4. Precision Agriculture on Cloud
5. Access, storage, analysis and display of Sensors data over a cloud for Oil and gas Industry.
6. Access, storage, analysis and display of Sensors data over a cloud for Mining Industry.
6. Smart Building on cloud
7. Smart City on cloud

List of Course Seminar Topics:

1. Storage Cost Optimization On Cloud
2. Cloud Security And Cryptography
3. Infrastructure As A Code (IAC)
4. Cloud Computing In Healthcare
5. Serverless Architecture
6. Deployment Of Microservices In Kubernetes Engine
7. RPA Using AWS Cloud
8. Cloud Trends In Supporting Ubiquitous Computing
9. Mobile Cloud Computing
10. Modern Data Center Architecture

List of Course Group Discussion Topics:

1. Data Storage Security in Cloud
2. Cloud Services for SMB's
3. Monitoring Services Provided by GCP and AWS
4. Docker and Kubernetes
5. SaaS vs FaaS (Function as a service)
6. Hybrid Cloud
7. GCP Vs AWS Web Service Architecture
8. Cloud based security issues and threats
9. Authentication and identity

List of Home Assignments:

Case Study:

1. PayU Migration to AWS
2. Cloud object storage
3. Deployment and Configuration options in AWS
4. Deployment and Configuration options in Microsoft Azure
5. Deployment and Configuration options in GCP

Surveys:

1. Disaster Recovery in Cloud Computing
2. Cloud Economics
3. Data archiving solutions
4. Salesforce
5. Dropbox

Design:

1. Serverless Web App to order taxi rides using AWS lambda.
2. Deploying App on Kubernetes
3. Serverless web Application (GCP Cloud Functions)
4. Demonstration of EBS, Snapshot, Volumes
5. Single Node Cluster Implementation (Hadoop)

Blog:

1. Comparing design of various cloud computing platforms
2. AWS EKS and Google Cloud Functions
3. App Engine
4. Cloud Endpoints
5. Cloud Pub/Sub

Assessment Scheme:

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

Text Books:

1. Rajkumar Buyya, \Cloud computing principles and paradigms", Wiley.
2. Gautam Shroff. "Enterprise Cloud Computing", Cambridge
3. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, "Cloud Computing for Dummies", Wiley,India.
4. Barrie Sosinsky, "Cloud Computing Bible", Wiley India

Reference Books:

1. Antohy T Velte, et.al, "Cloud Computing : A Practical Approach", McGraw Hill.
2. Michael Miller, "Cloud Computing", Que Publishing.
3. Ronald Krutz and Russell Dean Vines, "Cloud Security", Wiley-India
4. Tim Malhar, S.Kumaraswammy, S.Latif, "Cloud Security & Privacy", SPD,O'REILLY
5. Scott Granneman, "Google Apps", Pearson

Moocs Links and additional reading material:

1. www.nptelvideos.in
2. https://nptel.ac.in/courses/106/105/106105167/
3. https://swayam.gov.in/nd1_noc20_cs55/preview
4. https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/
5. https://aws.amazon.com/what-is-cloud-computing/
6. https://www.ibm.com/in-en/cloud/learn/cloud-computing

Course Outcomes:

The student will be able to –

1. Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
2. Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
3. Identify problems, and explain, analyze, and evaluate various cloud computing solution using google kubernetes.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.

5. Implement Saas for various applications
6. Perform cloud security checks using open source tools.

CO PO Map:

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

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

CO1:- Level 2

CO2:- Level 2

CO3:- Level 3

CO4:- Level 4

CO5:- Level 4

CO6:- Level 3

Job Mapping:

Job opportunities that one can get after learning this course: Cloud Architect, Cloud Engineer, Cloud Administrator, Solutions Architect - Cloud Computing - AWS / Kubernetes, Cloud Computing Technical Consultant, Associate Cloud Computing Engineer, Cloud Computing Trainer.

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus of

Final Year B.Tech.

Electronics & Telecommunication Engineering

"Pattern – D21"

Module - VII

FF No.: 654

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

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 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
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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

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1. Understand basic marketing management concepts and their relevance to business development
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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

ET4205: INDUSTRIAL AUTOMATION

Course Prerequisites: Digital Electronics, Concepts of physics

Course Objectives: To impart knowledge about

1. Architecture of Industrial Automation Systems
2. Sensors and actuators required for automation
3. Programmable logic controllers
4. PID controllers
5. Functionality of SCADA, HMI, and networking in automation.
6. Fuzzy logic control system

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

Course Relevance:

Advantages commonly attributed to automation include higher production rates increased productivity, more efficient use of materials, better product quality, improved safety and reduced timelines. Industries are embracing technology to streamline production, IT, business, development and service processes and hence automation has become an inseparable part of today's industries. Thus this course is highly relevant in the current scenario.

SECTION-1
Architecture of Industrial Automation Systems, types, pyramid of automation, Sensors and measurement systems, Actuators -Hydraulic, Pneumatic and Electrical, Programmable logic controllers: Architecture, Standalone and Distributed PLCs, Relay logic, I/O module, Scan cycle, Ladder programming, Programming languages, Instruction set, Case studies.
SECTION-2
Introduction to Process Control, P-I-D Control, Comparison of P,PI,PD,PID Control systems and applications, SCADA, HMI: Concepts and functionality, Communication and Networking

protocols, Fuzzy Controllers - concepts, membership functions, fuzzy inference, Fuzzy controller in automation, Case studies of Industrial automation systems.

List of Seminar Topics:

1. Spinning Mill automation
2. Industrial Networking: Impact on SCADA performance
3. Industry 4.0
4. State of the art of HMI
5. Automation in oil and gas industry
6. PID controllers in Process control application: A case study
7. Control of chemical processes using Fuzzy logic
8. Cybersecurity in IA
9. Electrical, Pneumatic, Hydraulic controllers: Pros and cons
10. Top five disruptive trends in automation.

List of Group Discussion Topics:

1. Interfacing signals to PLC: Analog or Discrete?
2. Automation for ICU in a hospital – challenges and solutions
3. Should use of HMI be made compulsory in industrial automation?
4. IA boon or bane?
5. Functioning of Timer instructions in PLCs: AB, Siemens, Mitsubishi
6. Language choice for PLCs
7. What is effective networking protocol in automation: Proprietary or open source
8. Rack PLC-Modular PLC: a right choice?
9. PID or PLC controllers: a right choice?
10. DCS or SCADA: Better choice?

List of Home Assignments:

Design:

1. Designing SCADA for Multiplex Theatre
2. SCADA system for VIT
3. Design of Intelligent Multilayer car parking system
4. Design of PLC based elevator system
5. Interfacing of analog sensors to PLC: design approach

Case Study:

1. 2-wire transmitter using HART protocol
2. Intelligent Building Automation

3. Comparing instruction set of AB and Siemens PLC
4. Programming languages of PLC
5. Fuzzy control in an industrial application

Blog

1. Industry 4.0-thinking Industry further
2. RPA Software: UIPATH
3. RPA Software: Blue prism
4. Top 5 disruptive trends in automation
5. Human machine interface in plant Automation

Surveys

1. Survey of Industrial Networking protocols
2. A survey of automation practices in food industry
3. Intelligent PID control algorithms
4. PLC:safety, Troubleshooting, Installation and Maintenance
5. Effects of automation in manufacturing.

Assessment Scheme:

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

Textbooks:

1. Frank D Petruzella, “Programmable logic controller “, McGraw-Hill Education.
2. SCADA by Stuart A Boyer: ISA 1999
3. Peng Zhang,” Handbook on Industrial Control Technology”, William Andrew Inc.,USA.

Reference Books:

1. S. Mukhopadhyay, S. Sen and A. K. Deb, “Industrial instrumentation, control and automation”, Jaico Publishing House
2. L. A. Bryan and E. A. Bryan, “Programmable controllers, Theory and Implementation”.An Industrial Text Company Publication, USA
3. C. D. Johnson, “Process Control Instrumentation Technology”, John Wiley and Sons Ltd. Eighth ed.

MOOCS Links and additional reading material:

https://nptel.ac.in/courses/108/105/108105088/
https://nptel.ac.in/courses/108/105/108105063/

Course Outcomes:

1) Describe Architecture of Industrial Automation
2) Demonstrate understanding of sensors / actuators
3) Demonstrate PLC programming skills
4) Compare P, PI, PD, PID controllers
5) Understand the functionality of SCDA, HMI, DCS and networking in automation.
6) Design fuzzy controller.

CO PO Map

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

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

CO attainment levels

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

Future Courses Mapping:

IoT based industrial automation, Robotic process automation.

Job Mapping:

Entrepreneur, Automation Engineer, PLC programmer, Design Engineer-Automation, IT automation Engineer, Automation test Engineer, RPA developer.

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

ET4240: POWER ELECTRONICS

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: 2 **Teaching Scheme** Theory: 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, SCR, IGBT- Structure, Characteristics, Selection, Driver Circuits-Analysis of Single phase controlled converters, Power factor analysis. DC motor drives – Performance and Speed Control. AC Voltage Controllers: Configurations and Applications.
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 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 10. Harmonic Control in Inverter
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
10. Modern Control Tehniques for Converters

List of Home Assignments:

Design:

1. Design of Controlled Converter System
2. Design of Inverter System
3. Design of UPS
4. Design of Converter driven DC Drive
5. Design of Inverter driven AC Drive

Case Study:

1. Simulation Software Tool for Power System Design
2. Motor Control in Robotics
3. BLDC Motors
4. Battery Management Systems
5. Buck-Boost Converters

Blog

1. Growth in Power demand
2. Latest Control technology of Power Systems
3. Power Regeneration Electric Tractions
4. Power Systems in Self-driving Vehicles
5. Power Applications in Domestic Uses

Surveys

1. Power electronics in Space Applications
2. Power Electronics in Telecommunication
3. Generations of Power Devices
4. Filters in Power Circuits
5. Magnetics in Power Systems.

Assessment Scheme:

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

Textbooks:

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. Select power device for given voltage- current specifications.
2. Analyze DC Drives with controlled converter.
3. Analyze AC to AC converters.
4. Analyze AC Drives with inverter.
5. Analyze DC to DC converters.
6. Select power converters for real life applications.

CO PO Map

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	0	0	0	0	1	0	1	0	2	2	2
CO2	3	3	2	0	2	0	0	1	1	1	0	2	1	3
CO3	3	3	2	0	0	0	0	1	1	1	0	2	1	3
CO4	3	3	2	0	2	0	0	1	1	1	0	2	1	3
CO5	3	3	2	0	0	0	0	1	1	1	0	2	1	3
CO6	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 2
CO2:- Level 5
CO3:- Level 4
CO4:- Level 5
CO5:- Level 4
CO6:- Level 3

Job Mapping:

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 entrepreneur in Solar Systems, Energy Management Services, Power Control Units, Drives and Drives Control etc.

FF No.: 654

ET4241: ADVANCED COMMUNICATION ENGINEERING

Course Prerequisites: Communication Engineering, Digital Signal Processing, Wireless Communication

Course Objectives:

1. Analyze the path loss and shadowing effects in wireless communication.
2. Understand diversity techniques of communication.
3. Understand wireless channel modelling.
4. Analyze Orthogonal Frequency Division Multiplexing system.
5. Evaluate the performance of Multiple Input Multiple Output systems.
6. Simulate MIMO receivers

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

Course Relevance:

Future generations of cellular communication require higher data rates and a more reliable transmission link. The transmission data rates can be increase by increasing transmission bandwidth and using higher transmitter power. Wireless communication channels suffer from various factors. Fading problem is the major impairment problem. To improve the performance of those fading channels, diversity techniques are used. Advanced Communication Engineering begins with wireless channel modelling. Also it covers Bit Error Rate performance in fading wireless channel. It covers deep fading issues in wireless communication. Also, it covers how to solve fading problems. It also covers advanced technologies like OFDM (Orthogonal Frequency Division Multiplexing) and MIMO (Multiple Input Multiple Output. An integral part of the course is MATLAB based computer assignments, which are designed to reinforce theoretical concepts.

SECTION-1

Wireless Communication and Diversity

Path Loss and Shadowing, Wireless Channel Modelling, Bit Error Rate (BER) performance in Additive White Gaussian Noise (AWGN) communication channel-Analysis, Bit Error Rate (BER) performance in fading wireless channel, Deep fade phenomenon in wireless channels.

Diversity in Wireless System

Multiple antenna Wireless Systems, optimal receiver combining, Bit Error Rate (BER) performance with diversity, Types of diversity, Deep Fade Analysis with Diversity.

SECTION-2

Orthogonal Frequency Division Multiplexing

Multicarrier modulation, Introduction to Orthogonal Frequency Division Multiplexing (OFDM), OFDM system model, IFFT/ FFT Transceiver Model, OFDM -BER and SNR performance, multiuser OFDM.

Multiple Input Multiple Output (MIMO) Technology

MIMO System model, MIMO- Zero-Forcing (ZF) and Minimum Mean Square Error (MMSE) Receivers, Singular Value Decomposition (SVD), MIMO channel capacity, Optimal water filling power allocation.

List of Course Seminar Topics:

1. Performance analysis of multiple-input multiple-output singular value decomposition transceivers.
2. Modeling the Indoor MIMO Wireless Channel
3. Channel Modelling for 5G mobile Communication
4. Comparison of Indoor Geolocation methods in DSSS and OFDM Wireless Lan Systems
5. Analysis of MIMO system through Zero Forcing and MMSE detection scheme
6. SVD for Engine design of High Throughput MIMO OFDM system
7. Measured capacity gain using water filling in frequency selective MIMO Channels
8. MIMO channel capacity in Co-channel interference.
9. OFDM Channel estimation using Singular value decomposition
10. Increase in capacity of Multiuser OFDM system

List of Course Group Discussion Topics:

1. Fading Environment
2. Deep Fade Phenomenon in Wireless Communication
3. OFDM versus CDMA
4. Filtered -OFDM & OFDM modulation

5. OFDM vs MIMO-OFDM
6. OFDM for Optical Communication
7. MIMO -opportunities and challenges
8. MIMO Radar
9. Massive MIMO for next generation wireless systems
10. 5G - Spectrum, Deployment & Customer Trends

List of Home Assignments:

Design:

1. Design of OFDM for UWB environment
2. Design of 4G MIMO OFDM wireless system
3. OFDM for underwater Acoustic communication
4. Design LMSE algorithm for equalization
5. Design Zero forcing Algorithm

Case Study:

1. Role of digital communication in digital transformation
2. Digital Communication over fading channels
3. Network coding for wireless Mesh Networks
4. Capacity of wireless communication systems employing antenna arrays
5. MIMO OFDM

Blog

1. 5G and Industrial IoT
2. Equalization Techniques for MIMO
3. Diversity Techniques for 4G wireless Communication
4. Massive MIMO
5. Will 5G change the world?

Surveys

1. Diversity techniques in Wireless Communication
2. Space time coding scheme for MIMO
3. Survey on resource allocation techniques in OFDM (A) networks
4. Survey on Mobile WiMax
5. Performance Analysis in MIMO OFDM system.

Assessment Scheme:

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

Textbooks:
1. Principles of Modern wireless communication systems. Theory and practice , Aditya K. Jagannatham, McGraw –Hill publication. 2. Wireless Communications-Andrea Goldsmith –Cambridge university press. 3. Wireless Communications- Principle and practice- Theodore S, Rappaport, Pearson. 4. Digital communications -Fundamentals and applications –Bernard Sklar, Prentice Hall
Reference Books:
1. Baseband Receiver Design for wireless MIMO-OFDM communications, Tzi-Dar Chiueh, Pei-Yun Tsai, I-Wei Lai, Wiley-IEEE Press, 2012. 2. Theory and applications of OFDM and CDMA : Wideband Wireless Communications, Henrik Schulze, Christian Lueders, Wiley, 2005. 3. Radio Propagation and Adaptive Antennas for Wireless Communication Networks, Nathan Blaunstein, Christos G. Christodoulou, Wiley , 2014. 4. Fundamentals of Wireless Communication , David Tse, Pramod Vishwanath, Cambridge University Press, 2005
MOOCS Links and additional reading material: www.nptelvideos.in Advanced 3G, 4G Wireless Mobile Communications https://nptel.ac.in/courses/117/104/117104099/#
Course Outcomes: Upon completion of the course, the student will be able to – 1. Calculate received power by system and keep required margin 2. Differentiate between diversity techniques 3. Understand channel modelling 4. Illustrate OFDM System 5. Discuss performance behavior of MIMO systems 6. Differentiate between ZF & MMSE receivers

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)

Future Courses Mapping:

1. Mobile Communication

Job Mapping:

Students will have good opportunities in the communication industry as service engineers for operations and maintenance, network planning, software product developer, analytics engineer and so many.

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:

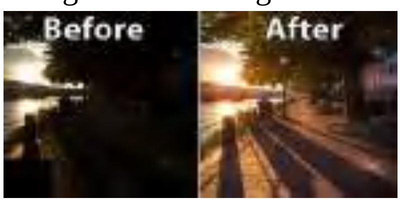
1. Lines Vs. Corners as features
2. Hough Transform for line detection Vs. RANSAC
3. Fourier domain denoising Vs. Spetial domain denoising
4. Kernel size Vs. Speed of operation
5. Histogram equalization Vs. Gamma correction
6. OTSU Vs Adaptive thresholding
7. Compression techniques
8. Color models
9.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

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.

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

ET4244: CMOS RF INTEGRATED CIRCUITS

Course Prerequisites

Good Understanding of Semiconductor Devices (more specifically MOSFET), Knowledge of Analog Circuit Design**,** SPICE Simulations, Frequency response of Devices and Circuits.

Course Objectives

The overall objective of this course is to present the concepts of design and analysis of modern RF and wireless communication integrated circuits.

1. Introduce to the students the RF and Wireless Technology (the Big Picture)
2. Understand the MOSFET from RF perspective
3. Learn analysis of circuits at high frequencies using Scattering parameters
4. Understand the issue of Input Matching and then learn various LNA topologies
5. Design of Loop Filters, VCO and PLL

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

Course Relevance:

The rapid expansion of wireless communications services over the last decade has led to an explosion in the development of integrated circuit approaches in the RF area. Highly integrated RF components, low-noise and power amplifiers, and frequency synthesizers, are now commonplace, replacing hybrid circuits employing discrete semiconductor devices. The successive growth of electronics, Internet-of-Things (IoT), and wireless communication have been advanced due the development of complementary-metal-oxide-semiconductor (CMOS) technology. These developments result in low-power and high-performance integrated circuit (IC) designs for analog and radio-frequency applications especially in the area of new generation handheld devices. With exploration and development of CMOS technology, we could have low cost, small size and low voltage circuitry promising to integrate the whole system on a single chip. The challenges are continuous and imply motivation in exploration of RF Architectures.

SECTION-1
Introduction to RF and Wireless Technology, Basic Concepts in RF Circuits, MOSFET - RF perspective, Transmission media and Reflections, Passive Components - Resistor, Inductor, Capacitor, Series and Parallel RLC networks, S parameters.

SECTION-2
Noise, Low Noise Amplifier (LNA), HF Power Amplifier, Mixer, Voltage Controlled OScillator (VCO), Phase-Locked Loop (PLL), Integrated Circuit Fabrication process (various steps), materials, and techniques involved in IC Fabrication.
List of Course Seminar Topics: 1. Mobile RF Communications 2. Wireless Standards 3. Transceiver Architectures 4. Oscillators 5. Noise in Electronics 6. Frequency Synthesizers 7. Power Amplifier - Classes 8. Digital Modulation 9. Multiple Access Techniques 10. TCAD Tools for RF Design
List of Course Group Discussion Topics: 1. Impact of On-Chip Interconnections on CMOS RF Integrated Circuits 2. CMOS-compatible RF-MEMS devices for integrated circuit design 3. Impact of semiconductor technology scaling on CMOS RF and digital circuits for wireless application 4. CMOS integrated digital RF MEMS capacitors 5.SiGe BiCMOS and CMOS platforms for Optical and Millimeter-Wave Integrated Circuits 6. Improving Yield on RF-CMOS ICs 7. CMOS LNA for healthcare applications 8. Efficiency improvement techniques for RF power amplifiers in deep submicron CMOS 9. Track-and-Hold circuit in 0.18 µm CMOS process for RF applications 10. Nano-Power CMOS Voltage References for RF-Powered Systems
List of Home Assignments: **Design:** 1. Low power CMOS low noise amplifier for wideband wireless systems 2. Differential LNA using 180 nm CMOS Technology 3. Digitally controlled oscillator in 65-nm CMOS technology 4. Design and optimization of a CMOS power amplifier 5. RF MEMS Capacitive Shunt Switch **Case Study:** 1. Cryogenic performance of a 3–14 GHz bipolar Si - Ge low-noise amplifier

2. On chip miniaturized antenna in CMOS technology
3. RF Schottky diode in 22-nm CMOS
4. Zero-IF double-balanced mixer for WiMAX receivers
5. Linearity of RF mixers in GHz applications

Blog

1. RF LDMOS Transistors
2. RF SOI Devices
3. Tri-state inverter based DCO
4. A direct digital-to-RF converter (DRFC)
5. Thermoelectric Generators: Technologies and common applications

Surveys

1. Linear wideband LNA
2. RF transistors: Recent developments and roadmap toward terahertz applications
3. CMOS based capacitive sensors
4. GaN HEMT broadband power amplifiers
5. Materials: Silicon and beyond.

Assessment Scheme:

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

Textbooks:

1. RF Microelectronics, 2nd Edition, by Behzad Razavi, Prentice Hall
2. The Design of CMOS Radio-Frequency Integrated Circuits, by Thomas H. Lee.

Reference Books:

1. Journal and Conference papers

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

Course Outcomes: The students will be able to

1. differentiate between HF and LF MOSFET model
2. Calculate S - parameters
3. perform impedance matching
4. identify various LNA topologies
5. list the techniques of improving MIXER linearity
6. Draw the basic block schematic of PLL

CO PO Map

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

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

CO attainment levels

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

Future Courses Mapping:

RF Circuit Design, CMOS Mixed Circuit Design

Job Mapping:

This course will begin with the notion of Radio Frequency, CMOS and Integrated Circuits (in fact, the whole course will revolve around these three words). Brief contents - MOS device (from RF perspective), RF Architectures, Passive Components, HF Amplifier design, Low Noise Amplifier (LNA), Phase Locked Loop (PLL), Mixers, Oscillators, etc. Alongside, the students will also learn about some fundamentals like impedance matching, power measurements, bandwidth estimation and so on. The course will also glance through the captivating Integrated Circuit Fabrication process and the various steps, materials, and techniques involved in IC Fabrication. Overall, the course will enhance knowledge of the learner about Radio Frequency Design which is applied in most of the jobs available in ALL Wireless and Telecommunication based companies designing RF products.

FF No. : 654

CS4201: CLOUD COMPUTING

Course Prerequisites: Operating Systems, Fundamentals of Computer Networks

Course Objectives:
1. To become familiar with Cloud Computing and its ecosystem
2. To learn basics of virtualization and its importance
3. To evaluate in-depth analysis of Cloud Computing capabilities
4. To give a technical overview of Cloud Programming and Services.
5. To understand security issues in cloud computing

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

Course Relevance:
Cloud computing to enable transformation, business development and agility in an organization.

SECTION-1
Introduction to Cloud Computing: Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Evolution of cloud computing Cloud Computing Architecture: Cloud versus traditional architecture, Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS), , Public cloud, Private cloud, Hybrid cloud, Community cloud, Google Cloud architecture, The GCP Console, Understanding projects, Billing in GCP, Install and configure Cloud SDK, Use Cloud Shell, GCP APIs Infrastructure as a Service (IaaS): Introduction to IaaS, Introduction to virtualization, Different approaches to virtualization, Hypervisors, Machine Image, Virtual Machine(VM), Compute options in the cloud, Exploring IaaS with Compute Engine, Configuring elastic apps with autoscaling, Storage options in the cloud, Structured and unstructured storage in the cloud, unstructured storage using Cloud Storage, SQL managed services, Exploring Cloud SQL, Cloud Spanner as a managed service, NoSQL managed service options, Cloud Datastore, a NoSQL document store, Cloud Bigtable as a NoSQL option.

SECTION-2
Platform as a Service (PaaS): Introduction to PaaS, Service Oriented Architecture (SOA). Cloud Platform and Management, Exploring PaaS with App Engine, Event driven programs with Cloud Functions, Containerizing and orchestrating apps with Google Kubernetes Engine Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0, Web OS, Service Management in Cloud Computing: Service Level Agreements(SLAs), Billing and accounting, Billing in GCP Cloud Security: Introduction to security in the cloud, the shared security model, Encryption options, Authentication and authorization with Cloud IAM, Identify Best Practices for Authorization using Cloud IAM. Cloud Network : Introduction to networking in the cloud, Defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, Multiple VPC networks, Building hybrid clouds using VPNs, interconnecting, and direct peering, Different options for load balancing.
List of Course Seminar Topics: 1. Storage Cost Optimization On Cloud 2. Cloud Security And Cryptography 3. Infrastructure As A Code (IAC) 4. Cloud Computing In Healthcare 5. Serverless Architecture 6. Deployment Of Microservices In Kubernetes Engine 7. RPA Using AWS Cloud 8. Cloud Trends In Supporting Ubiquitous Computing 9. Mobile Cloud Computing 10. Modern Data Center Architecture
List of Course Group Discussion Topics: 1. Data Storage Security in Cloud 2. Cloud Services for SMB's 3. Monitoring Services Provided by GCP and AWS 4. Docker and Kubernetes 5. SaaS vs FaaS (Function as a service) 6. Hybrid Cloud 7. GCP Vs AWS Web Service Architecture 8. Cloud based security issues and threats 9. Authentication and identity 10. Future of Cloud-Based Smart Devices

List of Home Assignments:

Design:

1. Serverless Web App to order taxi rides using AWS lambda.
2. Deploying App on Kubernetes
3. Serverless web Application (GCP Cloud Functions)
4. Demonstration of EBS, Snapshot, Volumes
5. Single Node Cluster Implementation (Hadoop)

Case Study:

1. PayU Migration to AWS
2. Cloud object storage
3. Deployment and Configuration options in AWS
4. Deployment and Configuration options in Microsoft Azure
5. Deployment and Configuration options in GCP

Blog

1. Comparing design of various cloud computing platforms
2. AWS EKS and Google Cloud Functions
3. App Engine
4. Cloud Endpoints
5. Cloud Pub/Sub

Surveys

1. Disaster Recovery in Cloud Computing
2. Cloud Economics
3. Data archiving solutions
4. Salesforce
5. Dropbox

Assessment Scheme:

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

Textbooks:

1. Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper, “Cloud Computing for Dummies”, Wiley,India.
2. Ronald Krutz and Russell Dean Vines, “Cloud Security”, Wiley-India
3. Gautam Shroff. “Enterprise Cloud Computing”, Cambridge

Reference Books:

1. Barrie Sosinsky, “Cloud Computing Bible”, Wiley India
2. Antohy T Velte, et.al, “Cloud Computing : A Practical Approach”, McGraw Hill.
3. Michael Miller, “Cloud Computing”, Que Publishing.
4. Tim Malhar, S.Kumaraswammy, S.Latif, “Cloud Security & Privacy”, O’REILLY
5. Scott Granneman, “Google Apps”, Pearson

MOOCS Links and additional reading material:

https://nptel.ac.in/courses/106/105/106105167/
https://swayam.gov.in/nd1_noc20_cs55/preview
https://www.coursera.org/specializations/cloud-computing

Course Outcomes:

1. Describe the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
2. Explain the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud.
3. Identify problems, and explain, analyze, and evaluate various cloud computing solutions.
4. Choose the appropriate technologies, algorithms, and approaches for the related issues.
5. Display new ideas and innovations in cloud computing.
6. Collaboratively research and write a paper on the state of the art (and open problems) in cloud computing.

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	3	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	2	0	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	1	0	0	0
6	0	3	0	0	0	0	0	0	0	0	0	0	0	0

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

CO attainment levels **CO1**- Level 1 **CO2**- Level 2 **CO3**- Level 3 **CO4**- Level 5 **CO5**- Level 4 **CO6**- Level 3
Future Courses Mapping: After completing this course different certifications courses in cloud be taken such as AWS, Azure, Google cloud certifications. One can go for higher studies in specialization of cloud computing and allied subjects.
Job Mapping: Cloud Architect, Cloud Engineer, Cloud Administrator, Solutions Architect - Cloud Computing - AWS / Kubernetes, Cloud Computing Technical Consultant, Associate Cloud Computing Engineer, Cloud Computing Trainer

IT4215: DISTRIBUTED COMPUTING

Course Prerequisites: Operating System, Data Structures and Programming languages

Course Objectives:

1. To learn fundamentals of distributed systems.
2. To discuss different interprocess communication and clock synchronization approaches.
3. To gain knowledge of distributed transaction and distributed deadlock.
4. To understand Fault tolerance and Distributed Shared Memory.

Credits: 2

Teaching Scheme

Theory: 2 Hours/Week

Course Relevance: This course focuses on key principles in designing and implementing distributed system concepts like inter process communication, clock synchronization, deadlock, transaction, fault tolerance and distributed shared memory.

SECTION-1
Introduction: Motivation, Examples,Design issues, Hardware and Software Concepts,Applications, Architectural Model **Interprocess Communication:**Communication primitives, Message Oriented Communication, Stream Oriented Communication, RPC, Model, Transparencies in RPC, Implementation, Stub Generation, RPC Messages, Server Management, Call Semantics, Communication Protocols, Distributed Objects: Remote Method Invocation, Java RMI **Clock Synchronization**: Introduction, Logical Clocks, Scalar time, Vector time,Election Algorithm,Mutual Exclusion

SECTION-2

Distributed Transaction: Transaction Model, Classification, Implementation, Concurrency Control: Serializability, 2 Phase Locking, Strict 2 PL, Distributed Commit: 2 Phase Commit, Recovery, **Distributed Deadlock:** Avoidance, Prevention, Detection and Recovery,**Fault Tolerance:**Introduction, Failure Models, Failure Masking by Redundancy, Process Resilience, Agreement in Faulty Systems: Two Army Problem, Byzantine Generals Problem, Reliable Client Server Communication, Reliable Group Communication,**Distributed Shared Memory:**Introduction, Advantages, Disadvantages, Architecture, Design and Implementation issues of DSM

List of Home Assignments:

Design:

1. Client-Server application using RMI
2. Client-Server application using socket programming
3. Distributed application using MapReduce under Hadoop
4. Distributed application using Mutual exclusion
5. Distributed Deadlock

Case Study:

1. GFS:Google file system
2. Hadoop
3. DCE RPC
4. Bigtable: A Distributed Storage System for Structured Data
5. HPC: High performance computing

Blog:

1. Consistency protocols in distributed system
2. Security in distributed system
3. Distributed programming models
4. Resource management in distributed system
5. Wireless distributed computing

Surveys:

1. Distributed file system
2. Distributed database system
3. Cloud computing vs Cluster computing vs Grid computing
4. Challenges and Benefits in designing distributed computing
5. Recent trends in distributed computing

Suggest an assessment Scheme:

1. Home Assignment: Design, Case study, Blog and Survey
2. MSE
3. ESE
4. CVV

Text Books:

1. Andrew S. Tanenbaum & Maarten Van Steen; "Distributed Systems Principles and Paradigms";5th Edition, Prentice Hall India.
2. Pradeep K. Sinha; "Distributed Operating Systems Concepts and Design;1997, Prentice Hall India.

Reference Books: (As per IEEE format)

1. Ajay Kshemkalyani, Mukesh Singhal; "Distributed Computing: Principles, Algorithms, and Systems";2008, Cambridge University Press.
2. George Coulouris, Jean Dollimore & Tim Kindberg;"Distributed Systems – Concepts and Design"; 5th Edition, Addison-Wesley.
3. Mukesh Singhal, Niranjan G. Shivaratri; "Advanced Concepts In Operating systems",2001, McGrawHill.
4. M. L. Liu ;"Distributed Computing: Principles and Applications";2004, Addison-Wesley.

Moocs Links and additional reading material:

1. https://.nptel.ac.in
2. https://www.udemy.com
3. https://www.coursera.org

Course Outcomes:

The student will be able to –

1. Identify the basic principles, design issues and architectural aspects of distributed systems.
2. Analyze the different techniques used for Communication in distributed system.
3. Compare the mechanisms used forClock synchronization, Mutual exclusion in distributed system.
4. Determine an optimal solution for Distributed Deadlock.
5. Apply important methods in distributed systems to support Fault tolerance.
6. Illustrate architecture and design issues of Distributed Shared Memory.

CO PO Map:

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	PSO1	PSO2
1	2	3	3	0	0	0	0	2	0	0	0	0	0	0
2	2	2	3	0	2	0	0	0	0	0	0	0	0	3
3	3	2	0	0	2	0	0	0	2	2	0	0	0	2
4	0	0	2	2	0	0	2	0	0	0	0	4	0	2
5	3	2	0	0	0	0	2	0	0	0	0	0	2	0
6	0	0	0	3	0	2	0	2	0	0	2	0	0	0

CO attainment levels:

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

Job Mapping:

Senior manager- Distributed storage system, Distributed software engineer, Distributed system automation tool maintenance

CS4209: PARALLEL COMPUTING

Course Prerequisites: Computer Organization, Operating System, Design & Analysis of Algorithms, Data Structure

Course Objectives: Students will be able to

1. To introduce the basic concepts of parallel computing
2. To understand various GPU Architecture.
3. To write CUDA programs for parallel implementation
4. To organize the memory management in GPU
5. To optimize parallel programs on GPU using CUDA
6. To solve the scientific problems using GPUs

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

Course Relevance: Parallel computing, on the other hand, uses multiple processing elements simultaneously to solve a problem. This is accomplished by breaking the problem into independent parts so that each processing element can execute its part of the algorithm simultaneously with the others. This course is required in the industry & used to set up data centres.

SECTION-1
Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Parallelism vs Concurrency, Types and levels of parallelism, Flynn's classification, Amdhal's law; Parallel computer architectures : PRAM, Distributed memory systems ,Shared memory systems and cache coherence, Concept of thread and process, programming parallel computers, Parallel computing architectures, interconnection networks, Modern GPU architecture (in brief), Performance comparison: Speedup, Gain time and scalability. **Parallel Programming Model:** Common Unified Device Architecture (CUDA), CUDA programming model, Concept of grid, block and thread, thread index generation, warp, kernel & kernel launch. Programming for GPU's in C/C++ using CUDA API: Memory transfers, Writing and executing kernel functions, Writing device functions, Thread synchronization, Data Dependences and Race Conditions, Organizing Parallel Threads.

Section 2

GPU Architecture: GPU architecture, Overview of the graphics pipeline, Components of GPU: Parallel streaming processors, Multiprocessors, Shared instruction caches ,Memory hierarchy – Global, Constant, Shared, and Texture memory; Case studies: NVIDIA Kepler K20/K40/K80/GP100/GV100/ Ampere.

Memory Organization and Optimization: Global, Shared, constant and texture memory. Memory coalescing, memory banks and bank conflicts, Page locked host memory. Reduction operation, CUDA code optimization. Need of profilers and analyzers, Introduction to CUDA Tools: MemCheck, Command line & Visual Profilers.

Problem solving using GPUs: Single vs. double precision, light weight scientific computing exercises, Image processing applications, Matrices etc.

List of Home Assignments:

Design:

1. Parallelizing Search Trees for Chess
2. Parallel Algorithm for Searching
3. Parallel Algorithm for sorting
4. Parallel Algorithm for Data mining
5. Parallel Algorithm for Image Processing

Case Study:

1. Nvidia DGX2
2. Jetson nano Developer Kit
3. GPU Accelerated Apache Spark
4. The Jetson Xavier NX Developer Kit
5. NVIDIA Ampere architecture

Blog

1. Cuda library
2. Turing mesh shaders
3. Low level GPU Virtual memory management
4. Memory Hierarchy of GPU
5. Comparison of Various GPUs

Surveys

1. Smart Hospitals through AI with GPUs
2. Clara Models to help fight with COVID 19
3. GPU Accelerated Molecular Dynamics Applications
4. Medical Imaging applications of GPU
5. Ray Tracing Applications of GPU

Suggest an assessment Scheme:

MSE: 30
ESE : 30)
HA :10
CVV :30

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

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar; Introduction to parallel computing; second edition., Addison-Wesley, 2003, ISBN: 0201648652
2. David Kirk, Wen-mei HwuCUDA: Programming Massively Parallel Processors: A Hands-On Approach. © ELSEVIER Inc.

3 Jason Sanders and Edward KandrotCUDA by Example: An Introduction to General-Purpose GPU Programming"

Reference Books:

1. Hwang and Briggs,"Computer Architecture and Parallel Processing", Tata McGraw Hill Publication ISBN 13: 9780070315563.
2. John Cheng, Max Grossman, Ty McKercherProfessional CUDA C Programming,
3. CUDA C PROGRAMMING GUIDE by NVIDIA

Moocs Links and additional reading material:

www.nptelvideos.in
http://developer.nvidia.com/

Course Outcomes:

The student will be able to –

1. Recognize various parallel computing architectures and their fundamentals
2. Investigate parallel solutions to complex real world problems
3. Code the parallel programs on GPU using CUDA
4. Evaluate the performance on various GPU architectures
5. Optimize the parallel programs on GPU using CUDA
6. Design and develop new solutions to research problems

CO PO Mapping:

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

CO attainment levels

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

Job Mapping:

What are the Job opportunities that one can get after learning this course
Full Stack Architect-GPU
Developer Technology Engineer
Software Engineer Cloud
Data Analytics Engineer
Cloud Developer
Senior Software Engineer
HPC GPU Application Developer & Consultant
GPU Programming Professional
GPU Performance Analysis Lead / Architect
GPU Advocate Associate

CS4221: INFORMATION RETRIEVAL

Course Prerequisites: Data Structures, Basic probability and statistics

Course Objectives:

1. To study basic principles and practical algorithms used for information retrieval
2. To introduce students about insights retrieval models, retrieval feedback and applications in web information management
3. To provide comprehensive details about various Evaluation methods.
4. To provide implementation insight about the topics covered in the course
5. To apply information retrieval in the domain of natural language processing (NLP)
6. Learn tools and techniques to do cutting-edge research in the area of information retrieval

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

Course Relevance: This course provides an overview of the important issues in information retrieval, and how those issues affect the design and implementation of search engine software. The course emphasizes the technology used in Web search engines and the information retrieval theories and concepts that underlie all search applications. Mathematical experience including basic probability is strongly desirable.

SECTION-1
Introduction: Definition, Objectives, Search and Browse Capabilities; A Formal Document Representation, Characterization of IR Models Text operations, Pre - processing, Porter's Stemming Algorithm, term weighting techniques, Zipf's law, Heap's law Information Retrieval Models; Boolean Retrieval, Extended Boolean Models, Vector Space Model, Probabilistic Model, Naïve Bayes, Text Classification, Document and Term Clustering, Flat and Hierarchical Clustering, Matrix Decomposition, Latent Semantic Indexing, Bayesian Model, Models for Browsing.

SECTION-2

Query Processing and Retrieval Evaluation: Digital libraries, Morphological, Lexical Analysis, Thesaurus Construction, Ontology. Retrieval Performance, Evaluation Measures for Ranked and Unranked Results Query Languages, Structural Queries, Relevance Feedback, Query Expansion

Indexing and Searching: Automatic Indexing, Inverted Files, Fast Inversion (FAST-INV) Algorithm, Signature Files, Partitioning, Tries, Suffix Trees and Suffix Arrays, PAT Tree, Distributed Indexing, Index Compression.

Web Searching: Index Construction. Search Engines, Browsing, Met searchers, Searching using Hyperlinks, Crawling, Link Analysis, Architectures (Agents, Buses, Wrappers/Mediators), Page Rank Algorithm, Hilltop Algorithm

List of Course Seminar Topics:

1. Parallel IR
2. Distributed IR
3. A Generic Multimedia Indexing (GEMINI)
4. Automatic image annotation and retrieval
5. Audio retrieval algorithms
6. Multimedia search engine
7. Semantic search engine
8. Text summarization
9. Cross-lingual search engine
10. Search Engine Spamming

List of Course Group Discussion Topics:

1. Querying Structured and unstructured Data
2. Relevance ranking
3. Similarity of documents metric: which one to choose
4. Measures of the effectiveness of an information retrieval system
5. Similarity-based retrieval techniques
6. Link analysis techniques
7. Crawling and near-duplicate pages
8. Personalized search
9. Collaborative filtering approaches
10. XML indexing and search

List of Home Assignments:

Design:

1. Build and evaluate a "person search engine". The search engine should automatically crawl and build textual representations of people that can be queried against. Example queries might include specific names (e.g., "george bush"), job descriptions (e.g., "car company ceos"), facts about the person (e.g., "highest paid female musician"), etc.

2. Build and evaluate a search engine that adapts to implicit user feedback. This requires developing a user interface that tracks various user behavioural signals (e.g., clicks, dwell times, mouse movement, etc.) and uses that information to improve the quality of the ranking function over time as more and more information becomes available.

3. Develop and evaluate an algorithm that will automatically summarize, each hour, the most widely discussed topics on Twitter. The summary should be short (e.g., tweet-length) and provide an adequate summary of the topic.

4. Develop and evaluate a tool that will automatically associate images with news articles. More specifically, given the text of a news article, the task is to automatically identify a single relevant that could be placed alongside the article. For example, for a news article about the positive effects of green tea, relevant images would include tea leaves, cups of tea, health related symbols/logos, etc.

5. Build and evaluate a cross-lingual search engine. For example, use Wikipedia as a source of parallel corpora.

Case Study:

1. Online multiplayer game
2. Pattern Matching techniques
3. Latent Semantic Indexing
4. Learning-based ranking algorithms
5. Classical evaluation metrics,

Blog

1. Index creation for IR system: Inverted Files
2. Index creation for IR system: Signature Files
3. Index creation for IR system: Suffix Trees and Suffix Arrays
4. Development of semantic search engine to deal with polysemy, synonymy issues of text documents
5. Development of text search engine

Surveys

1. Crawling and near-duplicate pages
2. Content- based filtering
3. Unified filtering
4. Topic detection and tracking
5. Cross language information retrieval

Suggest an assessment Scheme:

MSE,
ESE,
GD,
Seminar,
HA

Text Books:

1. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval The Concepts and Technology behind Search", , Pearson Education: New Delhi, 2007

2. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze "Introduction to Information Retrieval", Cambridge University Press, 2012

Reference Books:

1. Gerald Kowalski, Mark Maybury, "Information Storage and Retrieval Systems Theory and Implementation", Springer Pvt. Ltd., 2006
2. William Frakes, Ricardo Baeza-Yates, "Information Retrieval Data Structures & Algorithms" Pearson Education, 2008
3. C. J. Van Rijsbergen, "Information Retrieval", Information Retrieval Group, University of Glasgow

Moocs Links and additional reading material:

https://nptel.ac.in/courses/106/101/106101007/
http://www.dcs.gla.ac.uk/Keith/Preface.html
https://nlp.stanford.edu/IR-book/pdf/01bool.pdf
https://www.coursera.org/learn/google-cbrs-cpi-training
https://www.coursera.org/learn/text-retrieval

Course Outcomes:

Students will be able to

1. Describe various information retrieval system architectures and models
2. Validate retrieval performance of an information retrieval system
3. Construct various indexes using suitable techniques
4. Apply sequential search and pattern matching techniques
5. Illustrate working of parallel, distributed and multimedia information retrieval system
6. Explain various information retrieval algorithms and different types of queries

CO PO Map

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	03	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	2	0	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	3	0	0	0	0	0	1	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0

CO attainment levels CO1- 3 CO2- 4 CO3- 2 CO4- 5 CO5- 1 CO6- 3
Future Courses Mapping: Applied Natural Language Processing
Job Mapping: Applied Scientist Data Engineering

IC4271: MACHINE INTELLIGENCE

Credits: 2

Teaching Scheme :
Theory: 2 Hours/Week

Section I

Unit I

Definition of intelligent systems. Goals and applications of machine intelligence. Aspects of developing an intelligent system: training data, concept representation, function approximation. Different types of learning for intelligent systems

Unit II

Language learning: Introduction to Natural Language processing, Fundamental techniques of natural language processing. Applications of NLP in machine intelligence

Unit III

Supervised learning: Linear and multiple regression, logistic regression, regularization, introduction to neural networks, support vector machines, k nearest neighbor classifier, decision trees, random forest classifier.

Section 2

Unit IV

Unsupervised learning: Introduction, clustering. Dimensionality reduction, anomaly detection, applications of machine learning algorithms to large scale data, metrics for classification

Unit V

Neural networks, neural network representation, Activation Functions, gradient descent and back propagation, convolution neural network, introduction to deep learning

Unit VI

Machine Intelligence applications to real time systems like text to speech, amazon alexa, chatbots for different API, google translation, autonomous vehicles etc

Home Assignments

Design

1. Design of Image and data classification applications using different classifiers
2. Design of deep learning algorithms for pattern recognition, computer vision
3. Design of algorithms for text analysis
4. Design of Disease prediction algorithms
5. Design of chat bot for given application
6. Back propagation algorithm for data classification
7. Develop algorithm for data classification
8. Implement feedforward network in NN for given application
9. Implement back propagation algorithm in NN for given application
10. Any other design applications after discussion with course faculty

Case Study

1. Case study on how Google assistant works
2. Case study on algorithms used in Google translation
3. Case study on how text to speech works
4. Application of neural networks to classification application
5. Analysis of SVM for OCR
6. Application of SVM for classification
7. Any other case study applications after discussion with course faculty

Survey

1. Survey on learning algorithms for pattern recognition applications
2. Survey on learning algorithms for computer vision applications
3. Survey on classification algorithms for biomedical applications
4. Survey of different algorithms for disease prediction
5. Videos Surveillance application
6. Social Media Services
7. Online Customer Support
8. Any other case study applications after discussion with course faculty

Blog

1. Applications of machine learning for hand written digit classification in Hindi andMarathi scripts
2. Use of different tools for deep learning applications
3. Use of different classification metrics for classification
4. Use of machine intelligence in autonomous vehicles
5. Machine intelligence for game playing applications
6. Email Spam and Malware Filtering
7. Recommendation system
8. Any other application after discussion with course faculty

Course Outcomes and

The students will be able to

1. Understand the concept of machine intelligence.
2. Comprehend use of language learning to real world cases.
3. Apply learning algorithms to real world applications
4. Illustrate the use of neural networks for different machine intelligence applications
5. Identify the applications of machine intelligence in real world.

Mapping with PO and PSO

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

CO Level

CO1: 4

CO2: 3

CO3: 4

CO4: 4

CO5: 3

Text Books and Reference Books

1. S. Rogers and M. Girolami, A First Course in Machine Learning, 2nd edition, Chapman &Hall/CRC 2016, ISBN: 9781498738484.
2. K. Murphy, “Machine Learning: A Probabilistic Perspective” MIT Press 2012.
3. D. Barber, Bayesian Reasoning and Machine Learning Cambridge University Press 2012.
4. C. Bishop, Pattern Recognition and Machine Learning, Springer 2011.
5. R. Duda, P. Hart, D. Stork, Pattern Recognition (2nd Edition) Wiley 2000.

Goodfellow, Bengio and Courville, “Deep learning”. Available for free on the web. Inprint from MIT press on Amazon.

FF No. : 654

ET4262: 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 them throughout 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

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Syllabus of

Final Year B.Tech.

Electronics & Telecommunication Engineering

"Pattern – D21"

Module - VIII

FF No. : 654

ET4263: Research 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

FF No. : 654

ET4264: Project 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

FF No. : 654

ET4265: Industry 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

FF No. : 654

ET4266: 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

Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

M. Tech (E & TC Engg.)

Effective from Academic Year 2021-22

Prepared by: - E & TC ENGG

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

Signed by

Chairman – BOS

Chairman – Academic Board

M.TECH (E & TC ENGG.) Structure (applicable w.e.f. AY 2020-2021)

Structure

FY – SEM – 1 Module -I

Subject Head	Course Code	Course Name	Contact hours per week			Credits
			Theory	Lab	Tut	
S1	ES5001	Linear Algebra and Applied Statistics	3			3
S2	CS5101	Computer Vision	3	2	1	5
S3	ET5205	Cyber Security	3	2	1	5
S4	IC5207	Internet of Things	3	2	1	5
S5	ET5209	SOFTWARE DEVELOPMENT PROJECT – I		-		2
						20

Structure

FY – SEM – 2 Module -II

Subject Head	Course Code	Course Name	Contact hours per week			Credits
			Theory	Lab	Tut	
S1	ET5202	Advanced Digital Signal Processing	3			3
S2	ET5204	Neural Network and Deep Learning	3	2	1	5
S3	ET5206	Natural Language Processing	3	2	1	5
S4	ET5208	Wireless sensor network	3	2	1	5
S5	ET52010	SOFTWARE DEVELOPMENT PROJECT – II		-		2
						20

FF No.: 654

Structure

SY – SEM – 1 Module -I

	Course Code	Course Name	Contact hours per week			Credits
			Theory	Lab	Tut	
	ET 6002	Dissertation by Internship				12
OR						
	ET6003	Dissertation by Research				12

Structure

SY – SEM – 2 Module -II

	Course Code	Course Name	Contact hours per week			Credits
			Theory	Lab	Tut	
	ET 6001	Dissertation by Internship				12
OR						
	ET6004	Dissertation by Research				12

FF No. : 654

ES5001:: Linear Algebra And Applied Statistics

Credits: 3 **Teaching Scheme: Theory: 3 Hours / Week**

Section I : Linear Algebra

Matrices: Matrix algebra, The Inverse of matrix, the LU factorization, Rank, Solving simultaneous equations using matrices: Gaussian Elimination.

Vector spaces: Vector spaces and subspaces, spanning set and Linear independence, Basis and dimension, The Four fundamental subspaces.

Linear Transformation: The kernel and range of linear transformation, Change of Basis, The Matrix of the linear transformation.

Applications: Markov chains, linear economic model, Population Growth,

Orthogonality: Inner Product, Orthogonality, Gram-Schmidt Orthogonalization and QR factorization, Least square approximations, The Singular value decomposition.

Eigen values and Eigen vectors: A Dynamical system on graphs, Introduction to eigen values, eigenvectors, Similarity and diagonalization.

Applications: Markov chains, Population Growth, Linear recurrence relations, System of linear differential equations, Discrete linear dynamical systems.

Section II : Applied Statistics

Probability and Statistics : Sample points and Sample spaces: Events, algebra of events, partitions, Bayes theorem, probability axioms, joint and conditional probability.

Random Variables : Introduction to random variables and random vectors, Discrete and continuous random variables, random vectors, some standard distributions, Central limit theorem, Simulation.

Statistics: Introduction, Random sampling, confidence interval, Testing of Hypothesis, correlation and simple linear regression.

Text Books:

1. Gilbert Strang, ‘Linear Algebra and Its Applications’, Fourth Edition- Cengage Learning, 2006
2. William Navidi, ‘Statistics for Engineers and Scientists’, Third Edition-McGraw Hill Education, 2013

COURSE CODE: ET5205
COURSE NAME: Cyber Security

Course Prerequisites:

Data Communication, Computer Networks, Programming

Course Objectives:

- To learn foundations of Cyber Security and Ethical Hacking analysis
- To provide with a practical and theoretical knowledge of cryptography and network security
- To understand the concepts of Cyber Security, Ethical Hacking
- To Explore the threat landscape
- To understand the policies and mechanisms for securing the systems

Credits: 5 **Teaching Scheme Theory:** **3** Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: This course introduces the concept of cyber security, its interdisciplinary nature and its relation to nation, businesses, society and people. Students would gain knowledge of various cyber security terminologies, technologies, protocols, threat analysis, security principles, security mechanisms, policies and practices to secure systems.

SECTION-1
Introduction to Cyber Space: History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Securing web browser, Antivirus. **Security Issues:** E mail security, secure password and wi-fi security, social media and basic Windows security, Smartphone security guidelines. **Online Services and issues:** Online Banking, Credit Card and UPI Security, Micro ATM, e-wallet and POS Security.
SECTION-2

Social Engineering: Types of Social Engineering, How Cyber Criminal Works, How to prevent for being a victim of Cyber Crime.

Cyber Security Threat Landscape and Techniques: Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques, Firewall

IT Security Act, Information Destroying and Recovery Tools: IT Act, Hackers-Attacker-Countermeasures, Web Application Security.

List of Tutorials:

1. Implement Substitution and Transposition Cipher Algorithm
2. Implement RSA Algorithm
3. Study of different wireless network components and features of any one of the Mobile Security Apps.
4. Study of the features of firewall in providing network security and to set Firewall Security in windows.
5. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
6. Study of different types of vulnerabilities for hacking a websites / Web Applications.
7. Analysis the security vulnerabilities of E-Mail Application

List of Practicals: (Any Six)

1. Install VM Workstation in Ubuntu and set up windows and kali.
2. Set up and provide password credentials with Secure Socket Layer.
3. Write a program to sniff packet sent over the local network.
4. To perform attack using any method on computers in a LAN Environment.
5. Implement system hacking using tools.
6. Create virus with python script and implement attack and analyse the
7. effect of various viruses.
8. Sniffing Website Credentials using Social Engineering Toolkit.

List of Course Projects:

Analysis and comparison of key performing parameters to compare various cyber security tools.

List of Course Seminar Topics:

1. Data Breaches
2. Cloud Security

3. Social Engg
4. Internet security

List of Course Group Discussion Topics:

1. Wireless and wired communication security issues
2. Passwords
3. Social Media Handles
4. Internet Banking

List of Home Assignments:

Case Study
Surveys
Design
Blog

Assessment Scheme:

1. HA :10 marks
2. GD :10 marks
3. Seminar :10 marks
4. Lab and Course Project :20 marks
5. Viva voce :20 marks
6. MSE :15 marks
7. ESE :15 marks

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

1. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity, -How to Build a Successful Cyber defense Program Against Advanced Threats, A-press.
2. Nina Godbole, Sumit Belapure, Cyber Security, Willey

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

1. Hacking the Hacker, Roger Grimes, Wiley
2. Cyber Law by Bare Act, Govt of India, It Act 2000.

Moocs Links and additional reading material:

1. www.nptelvideos.in

Course Outcomes:

The students will be able to

- Define and classify cyber-crime, information security and types of malware.
- Apply different cyber security techniques.
- Understand issues, challenges and guidelines for safe internet browsing , smart phone security, social media security and Wi-Fi security.
- Relate Social engineering and cyber-criminal.
- Identify and apply various I.T security acts.
- Use Information destroying and recovery tools.

Future Courses Mapping:

1.

Job Mapping:

Job opportunities that one can get after learning this course

- Network Security Specialist
- Cyber Security Architect/Administrator
- IT Security Advisor / Manager
- Security Consultant, Forensics Investigator
- Security Auditor/Investigating Officer
- Ethical Hacker
- Entrepreneur

IC5207 :: Internet Of Things

Credits: 05

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

Tut: 1 Hour/Week

Section 1: [IC5207_CO1, IC5207_CO2, IC5207_CO3]

Introduction to Internet of Things – Definition & Characteristics, Physical Design of IOT, Logical Design of IOT, IOT Enabling technologies, IOT Levels & Deployment Templates

Domain specific IOTs – Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle

IoT and M2M, IoT System Management with NETCONF-YANG,

IOT Platform Design Methodology – Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information model Specification, Service specification, IOT level Specifications, Functional View Specifications, Operational View Specification, device and component integration, application development, case study on IOT system for weather monitoring

Embedded suite for IoT

Physical device – Arduino / Raspberry Pi Interfaces, Hardware requirement of Arduino / Pi, Connecting remotely to the Arduino /Raspberry Pi , GPIO Basics, Controlling GPIO Outputs Using a Web Interface,– Programming , APIs / Packages, Arduino Interfaces, Integration of Sensors and Actuators with Arduino, Introduction to Python programming – Python data types & data structure, Control flow (if, for, while, range, break/continue, pass), Functions, Modules, packages, file handling, date/time operations, classes, Python packages of interest for IOT

Section 2 : [IC5207_CO4, IC5207_CO5, IC5207_CO6]

Connectivity Technologies and Communication Protocols in IOT

RFID: Introduction, Principle of RFID, Components of an RFID system, Wireless Sensor Networks: WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications,

Protocols in IOT: CoAP, XMPP, AMQP, MQTT, Communication Protocols: IEEE 802.15.4, Zig-bee,6LoWPAN, Bluetooth, WirelessHART

IOT Physical Server and Cloud Offerings

cloud architecture standards and interoperability- Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public, private clouds community cloud, Fog Computing, SDN

Cloud Storage Models & Communication APIs, Web Application Messaging Protocol (WAMP), Python

web application framework – Django, Developing Application with Django, Developing REST web services, SkyNet IoT Messaging Platform

Case Studies Illustrating IOT Design – Smart lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Weather Report Bot, Air Pollution Monitoring, Forest fire Detection, Smart Irrigation, IoT Printer

List of Practicals

1. Python programming : data type
2. Python Programming : data structure
3. Python Programming : Control statements
4. Python Programming : functions
5. Python Programming : modules
6. Python Programming : File handling
7. Arduino / Raspberry Pi interface Sensor

List of Project areas

1. IoT Based Humidity and Temperature Monitoring Using Arduino Uno
2. IoT System for agriculture
3. IoT system for smart lighting
4. IoT Based Intelligent Traffic Management System
5. IoT based Smart Irrigation system
6. IoT based Smart parking system

Text Books

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015

Reference Books

1. Pethuru Raj, Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms, and Use Cases, CRC Press Taylor & Francis Group, International

Standard Book Number-13: 978-1-4987- 6128-4

2. Rajkumar Buyya, Amir Vahid Dastjerdi Internet of Things – Principals and Paradigms, Morgan Kaufmann is an imprint of Elsevier, ISBN: 978-0-12-805395-9
3. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-

   140-7, Willy Publications

4. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications andProtocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications
5. Daniel Kellmereit, Daniel Obodovski, "The Silent Intelligence: The Internet of Things",. Publisher:Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978- 0989973700.
6. Fang Zhaho, Leonidas Guibas, "Wireless Sensor Network: An information processing approach",Elsevier, ISBN: 978-81-8147-642-5.
7. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2MCommunications", ISBN: 978-1-118-47347-4, Willy Publications
8. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer

Course Outcomes

The student will be able to –

1. IC5207_CO1: Learn and demonstrate concepts of Internet of Things [1] (PO 1, 2, 3, 4, 12) (PSO 2, 3)
2. IC5207_CO2: Develop and demonstrate embedded tools usage for IOT. [2] (PO 1, 2, 3, 4, 5, 12) (PSO2, 3)
3. IC5207_CO3: Demonstrate Python programming skills for IOT [3] (PO 1, 2, 3, 4, 5, 12) (PSO 2, 3)
4. IC5207_CO4: Understand, develop and demonstrate the connectivity technologies and protocols inIOT, Demonstrate Cloud technology concepts [3] (PO 1, 2, 3, 4, 12) (PSO 2, 3)
5. IC5207_CO5: Develop Web Application framework using Django [5] (PO 1, 2, 3, 4, 5, 12) (PSO 2, 3)
6. IC5207_CO6: Illustrate IOT design for application of Home automation, Smart Parking, Environment,Agriculture, Productivity applications etc [4] (PO 1, 2, 3, 4, 12) (PSO 2, 3)

F No. : 654

ET5209: SOFTWARE DEVELOPMENT PROJECT-I

Course Prerequisites:

Programming concepts, Programming Languages

Course Objectives:

1. To develop critical thinking and problem-solving ability by exploring and proposingsolutions 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 student centric.
4. To engage students in rich and authentic learning experiences.
5. To enhance programming skills of students

Credits: 3 **Teaching Scheme Lab:** 6 Hours/Week

Course Relevance:

Software project development comes under the category of project centric learning (PCL).Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand andremember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Section 1

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. The course contents aredesigned as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

1) Software based project to be done by each student
2) A supervisor/mentor teacher assigned who will guide in design and execution of project
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

Assessment Scheme:

Mid Semester Examination - 30 Marks

End Semester Examination - 70 Marks

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 consideringsustainability issues.
3. Manage project ethically and collaborate for acquiring skills.
4. Demonstrate effectively project and technical report.

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

Job Mapping:

Software Engineer, Software Developer, IT Engineer

CS5205 :: COMPUTER VISION

Course Prerequisites: Knowledge of Linear Algebra & Different types of Signals, Image Processing

Course Objectives:

1. Learn fundamentals of and techniques used in image processing and computer vision
2. To acquaint with Image filtering and shape representation.
3. Understand Segment the image to identify the region of interest.
4. Identify various algorithms ffor Motion Estimation & Pattern recognition
5. To learn pattern recognition.
6. Develop an algorithm to recognize the specified objects in the given image.

Credits: 5

Teaching Scheme Theory: 3 Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance: Computer vision is an interdisciplinary scientific field that deals with how computers can gain highlevel 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

Image Formation Models :
Introduction, Elements of image processing system, Scenes and Images, Vector Algebra, color vision color model: RGB, HVS, YUV, CMYK, YCbCr and some basic relationships between pixels, Fundamentals of Image Formation, Human Vision System, Computer Vision System (6 hrs)

Image Processing and Feature Extraction:

Thresholding, Spatial domain techniques, Image Negative, Contrast stretching, gray level slicing, bit plane slicing, histogram and histogram equalization, local enhancement technique, image subtraction and image average, Image Smoothening: low-pass spatial filters, median filtering, Image Sharpening: high-pass spatial filter, derivative filters (8 hrs.)

Shape Representation and Segmentation :

Classification of image segmentation techniques: Edge-based Segmentation, Region based techniques, Types of Edge detector Feature Extraction- Boundary representation(Chain code), Boundary detection based techniques, Edges – Canny,, Convolutional Neural Network (6 hrs.)

SECTION-1I

Motion Estimation & Pattern recognition: Regularization theory , Epipolar Geometry, Optical computation , Stereo Vision: Distortion, Rectification, , Motion estimation , Structure from motion. Pattern recognition models: hidden Markov modes (6 hrs.)

Feature detection and description: Feature matching and model fitting, Dimension reduction and sparse representation, Shape correspondence and shape matching, Principal component analysis, Singular Value Decomposition Shape priors for recognition (6 hrs.)

Object Recognition:
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. Principal component analysis, Singular Value Decomposition Shape priors for recognition, Face Recognition (8 hrs.)

List of Tutorials: (Any Three)

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. Comparison of various edge detection techniques
5. Configuration of Raspberry Pi-4B for Computer Vision
6. . Mathematics of Support Vector Machine
7. Mathematics of K-Means Classification.
8. Barcode detection Methods
9. Face Detection Methods

List of Practicals: (Any Six)

1. Image Manipulations and Geometrical Transformations
2. Implementation of Image Filtering Techniques
3. Implementation of Image Enhancements Techniques
4. Detection of Lines, Edges and Corners
5. . Object Detection Model
6. Face Recognition Model
7. Image and Video Editing
8. Develop an algorithm for segmentation of an input image
9. Develop an algorithm for recognition of an object from input image.
10. Develop an algorithm for motion estimation from given video sequence.

11. Design an algorithm for SVM classifier
12. Design an algorithm for adaboost classifier
13. Line detection using Hough transform 10. To design and develop optical flow algorithm for motion estimation

List of projects:

Select any one project from the list below and execute it.

1. Develop an application for vision-based security system during day/night time. The system should trigger an audio- visual alarm upon unauthorized entry.
2. Develop motion estimation/ tracking system to recognize object of interest related to one
3. of the following applications. (Automobile tracking/ face tracking/ human tracking)
4. Develop motion estimation/ tracking system to recognize object of interest related to one
5. of the following applications. (Space vehicle tracking/ solar energy tracking/ crowd pattern
6. tracking)
7. Human Detection using HOG or SIFT.
8. Line detection in video
9. Motion Estimation in video
10. Face Recognition
11. Digital Object Insertion
12. Video Stabilization
13. Barcode Detection
14. Detection of Dents on a Car
15. Detection of Stray Animals on the Road

List of Course Seminar Topics:

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

List of Course Group Discussion Topics:

1. Human Visual System vs 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,
2. Roadside Line Markers, Manholes, Barricades, etc.
3. Vehicle License Plate Recognition at Security Checkpoints
4. Detection of Dents on a Car
5. Detection of Type of Roads (Tar, Cement, and Mud)
6. 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
6. Surveys
7. Computer Vision for Differently Abled People
8. Computer Vision for Kids Care
9. Computer Vision Electric Vehicles
10. Computer Vision for Women Safety
11. 5. Computer Vision for Teaching-Learning Process at Academic Institutes

Suggest an assessment Scheme:
Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Blooms Taxonomy.

1. HA - 10 Marks
2. Seminar 15 Marks
3. Viva 20 Marks
4. Online MCQ-MSE Test 10 Marks
5. CP 10 Marks
6. LAB 10 Marks
7. Online MCQ-ESE Test 10 Marks

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

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.

Moocs Links and additional reading material:

1. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs58/
2. https://www.coursera.org/lecture/introduction-tensorflow/an-introduction-to-computer-vision-rGn1n
3. https://www.coursera.org/lecture/convolutional-neural-networks/edge-detection-example-4Trod

4. https://www.coursera.org/learn/computer-vision-basics
5. https://www.coursera.org/projects/computer-vision-object-detection
6. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs58/

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 attainment levels:

CO No.	***1.***	***2.***	***3.***	***4.***	***5.***	***6.***
Attainment level						

Future Courses Mapping:

1. Pattern Recognition
2. 2. Deep Learning

Job Mapping:

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

FF No.: 654

COURSE CODE: ET5202

Advance Digital Signal Processing

Course Prerequisites:

1. Probability and statistics.
2. Linear Algebra

Course Objectives:

1. Learn fundamentals Signal Modeling
2. Understand the different Linear prediction Techniques
3. Implement of Winer Filtering
4. Implement FIR Adaptive filters
5. Implement of Spectrum estimation

Credits: 5 **Teaching Scheme Theory:** 3 Hours/Week

Tut: 1 Hours/Week

Lab: 2 Hours/Week

Course Relevance:

SECTION-1
Stochastic Processes: ensemble averages, jointly distributed random variables, joint moments, independent, uncorrelated and orthogonal random variables, linear mean square estimation.Random processes: ensemble averages, stationary processes, autocorrelation and auto-covariance matrices, ergodicity. Signal Modeling: Least square method, Pade approximation, Prony's method. Finite data records: autocorrelation and covariance method, Stochastic Models: Autoregressive moving average models, autoregressive models, moving average models. Linear Prediction: Forward linear prediction, backward linear prediction, Levinson-Durbin algorithm, lattice filter, predictive modeling of speech
SECTION-2

Wiener Filters: Minimum mean square error (MMSE) and orthogonality principle, digital Wiener filter and Wiener-Hopf equations. Applications: filtering, noise cancellation, linear prediction.
Adaptive filtering: FIR adaptive filters: the steepest descent adaptive filter, Lease-Mean-Square (LMS) adaptive filters, convergence of LMS algorithm, normalized LMS. Applications: noise cancellation, channel equalization, adaptive recursive filters.

Spectrum Estimation: Nonparametric methods: Periodogram, modified periodogram, Bartlett's method, Welch's method. Parametric methods: autoregressive spectrum estimation, moving average spectrum estimation, autoregressive moving average spectrum estimation.

List of Tutorials: (Any Three)

1. Random variables
2. Random Processes
3. Signal Modeling
4. Linear Prediction
5. Adaptive Filtering

List of Practicals: (Any Six)

1. Computing the probability density function of a Gaussian random sequence with specified mean and variance
2. Simulation of Autoregressive moving average model.
3. Implementation of Lattice Structure
4. Program to convert Direct form coefficient to Lattice Form
5. Program to convert Lattice form coefficient to Direct Form
6. Implementation of Levinson Durbin Algorithm
7. Deconvolution using Wiener Filter.
8. Simulation of Linear predictive model
9. Simulation of LMS algorithm for adaptive noise cancellation
10. Power Spectrum Estimation

List of Course Projects:

1. Echo cancellation in telephone circuits
2. Adaptive prediction for speech coding
3. Channel Equalization
4. Spectrum estimation using autoregressive modeling
5. System identification and inverse filtering
6. Active noise cancellation
7. RLS algorithm for adaptive noise cancellation

List of Course Seminar Topics:

1. Signal Molding Techniques
2. Stochastic Processes
3. Linear Prediction Algorithms
4. predictive modeling of Speech
5. Winer Filtering
6. FIR Adaptive Filters
7. Adaptive Recursive filters
8 Channel equalization

List of Course Group Discussion Topics:

1. Adaptive filters
2. Role of stochastic processes in Adaptive signal processing
3. steepest descent adaptive filter Vs Lease-Mean-Square (LMS) adaptive filters
4. Convergence of Adaptive filters
5. Winer Filter Vs Lease-Mean-Square (LMS) adaptive filters
6. Winer Filter VS steepest descent adaptive filter
7. Adaptive recursive filters Vs Winer Filter
8. Adaptive recursive filters Vs Lease-Mean-Square (LMS) adaptive filters
9. Adaptive recursive filters VS steepest descent adaptive filter

List of Home Assignments:

Design:

1. Signal Modeling using Prony's and Padde Approximation
2. Autoregressive model for filtering
3. speech modeling using predictive analysis
4. Linear prediction and its application
5. Noise cancellation using Adaptive filters

Case Study:

1 . Noise cancellation
2. channel equalization
3. Speech Modeling
4. Speech Analysis
5. Spectrum Estimation

Blog

1. LMS Algorithm and Its Application
2. Winer Filtering
3. Spectrum Estimation Techniques
4.. RLS algorithm for adaptive noise cancellation
5. Adaptive Recursive filters

Surveys

1. Signal Molding Techniques
2. Speech Synthesis Techniques
3. Adaptive Echo Cancellation Methods
4. Adaptive Noise cancellation Methods
5. Inverse Filtering Techniques

Assessment Scheme:

1. Seminar – 10 Marks

2. Group Discussion – 10 Marks

3. Home Assignment – 10 Marks

4. Course Viva – 20 Marks

5. MSE – 15 Marks

6. ESE – 15 Marks

7. Lab work –10 Marks

8. Course project -10 Marks

Text Books:

1. *Simon Haykin, "Adaptive Filter Theory", 4th edition, Pearson Education*
2. *Monson Hayes, "Statistical Digital Signal Processing and Modeling", Wiley India Edition*

Reference Books:

1. *Dimitris G. Manolakis, Vinay K. Ingle, Stephen M. Kogon, "Statistical and Adaptive Signal Processing: Spectral Estimation, Signal Modeling, Adaptive Filtering and Array Processing", McGrawHill, 2000*
2. *Bernard Widrow and Samuel Stearns, "Adaptive Signal Processing", Pearson Education Asia,2002*

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

Course Outcomes:

The student will be able to –

1. Apply basic probability theory to model random signals in terms of Random Processes.
2. Find a model to provide an accurate estimation of the signal.
3. Represent speech signal using linear predictive coding (LPC) algorithm.
4. Formulate the Wiener filter as a constrained optimization problem.
5. Determine suitable LMS step size to trade off convergence time and misadjustment.
6. Derive the power spectrum of random signals.

Future Courses Mapping:

2.

Job Mapping:

Job opportunities that one can get after learning this course

1.

ET5204 : Neural Network and 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: 5 Hours/Week

Tut: 1 Hour/Week

Lab: **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's 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 involves, self driving cars, natural language processing, robotics, finance and healthcare.

SECTION-1
Topics and Contents 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-1I

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 and recursive nets, architecture, vanishing and exploding gradient problem, Applications: natural language processing, speech recognition, Generative Adversarial Networks

List of Tutorials:

1. Deep learning frameworks
2. Neural network for regression
3. Neural network for classification
4. Performance improvement in Neural network
5. Data augmentation
6. Application of CNN
7. Application of Recurrent nets
8. Comparison of Resnet and inception nets

List of Practical:

1. Create a basic Logistic Regression Model to classify the given data.
2. Build a Single-Layer Neural Network for Performing Binary Classification
3. Implement a deep neural network architecture to predict whether a patient has advanced fibrosis based on measurements such as age, gender, and BMI.
4. Evaluate the performance of the classifier implemented earlier using Cross-Validation technique
5. Improve the performance of the classifier implemented earlier by using cross-validation for model selection and hyperparameter selection.
6. Build a Convolutional Neural Network to identify the images of an object
7. Improve the performance of image classification CNN model implemented earlier using softmax activation
8. Implement Image Identification algorithm using VGG16 network .

List of Projects:

1. Train the deep neural network using VGG16 for image prediction.
2. Fine-Tuning VGG16 Model
3. Image Classification with ResNet
4. Prediction of the trend of Stock Market Using an LSTM

5. Object Detection using CNN
6. Human pose estimation via deep neural networks
7. Face recognition using neural networks

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?

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

6. How to tackle with loss of corner information in CNN

7. Need of hundred classifiers to solve real world classification problem

8. Which optimization: Batch gradient descent of stochastic gradient descent

9. Activation functions: Comparison of trends

10.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

6. Deep learning for smart manufacturing

Suggest an assessment Scheme:

1. Seminar – 10 Marks

2. Group Discussion – 10 Marks

3. Home Assignment – 10 Marks

4. Course Viva – 20 Marks

5. MSE – 15 Marks

6. ESE – 15Marks

7. Lab work –10 Marks

8. Course project -10 Marks

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

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

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: www.nptelvideos.in

1. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs11
2. 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

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

CO attainment levels

Co1 -Level 3

Co2 - Level 3

Co3 - Level 5

Co4 - Level 4

Co5 - Level 5

Co6 - Level 4

Future Courses Mapping: Advanced course on Deep learning including Autoencoders and Boltzmann machines, Reinforcement Learning etc
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, Defence*

FF No.: 654

COURSE CODE: ET5206
COURSE NAME: 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: 5 **Teaching Scheme Theory:** 3 Hours/Week

Tut: 1 Hours/Week

Lab: 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 invols, 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. Name entity recognition
SECTION-2
Dependency Grammars and Parsing, Distributional models of semantics, Lexical Semantic, topic model, text classification, sentiment analysis, Machine Translation, Question Answering, Conversational Agents.

List of Tutorials: (Any Three)

1. N-garam Language Model
2. HMM
3. Viterbi Decoding and parameter Learning
4. Maximum Entropy
5. Parsing

List of Practicals: (Any Six)

1. Word analysis for morphological features
2. Apply add-one smoothing on sparse bigram table
3. To calculate bigrams and probability of a sentence for given corpus
4. To calculate emission and transition matrix for speech tagging
5. To find POS tags of words in a sentence using Viterbi decoding
6. To Implement Viterbi Decoding
7. Implementation of HMM
8. Text classification
9. Sentiment analysis
10. Machine translation
11. Implementation Question and Answering

List of Course Projects:

1. Image captioning
2. Duplicate question detection
3. Reading comprehension
4. Question answering
5. Chat Bot
6. Text Summarization
7. Text Classification
8. Name Entity Recognition
9. POS Tagging
10. Spelling Correction

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)
6. Part-of-speech Tagging and Named Entity Recognition Using Improved Hidden Markov Model and Bloom Filter
7. Part of speech tagging for Twitter conversations using Conditional Random Fields model
8. A system for named entity recognition based on local grammars
9. A Maximum-Entropy Segmentation Model for Statistical Machine Translation
10. Text Summarization Techniques

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. Market intelligence

4. Healthcare
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:

1. Seminar – 10 Marks

2. Group Discussion – 10 Marks

3. Home Assignment – 10 Marks

4. Course Viva – 20 Marks

5. MSE – 15 Marks

6. ESE – 15 Marks

7. Lab work –10 Marks

8. Course project -10 Marks

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

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

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

1. Steven Bird, Ewan Klein, and Edward Loper "Natural Language Processing with Python", O'Reilly Media 2009

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

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 (Co Attainment level -3)

2. Get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics (Co Attainment level -3)

3. Apply mathematical models and algorithms in applications of NLP (Co Attainment level - 4)

4. Design and implementation issues in various NLP applications such as information retrieval and information extraction (Co Attainment level - 4)

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. (Co Attainment level - 4)

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 solutions to it. (Co Attainment level - 5)

Future Courses Mapping:

3.

Job Mapping:

Job opportunities that one can get after learning this course

2.

FF No.: 654

COURSE CODE: ET5208
COURSE NAME: Wireless sensor network

Course Prerequisites:

Data Communication Networks, Internet Of Things

Course Objectives:

- Learn Ad hoc network and Sensor Network fundamentals
- Understand Media access issues in Wireless sensor networks
- Understand the different routing protocols
- Have an in-depth knowledge on sensor network architecture and design issues
- Understand the transport layer and security issues possible in Ad hoc and Sensor networks

Credits: 5

Teaching Scheme Theory: 3 Hours/Week
Tut: 1 Hours/Week
Lab: 2 Hours/Week

Course Relevance: This course will provide students with an understanding of wireless adhoc and sensor networks enable them to recognize the wide range of applicability of these networks and provide them with an understanding of the major design issues including topics such as protocol mechanisms and resource constraints

SECTION-1
Introduction - fundamentals of wireless communication technology, characteristics of the wireless channel mobile ad hoc networks, wireless sensor networks: concepts and architectures - applications of ad hoc and sensor networks - design challenges in ad hoc and sensor networks **MAC protocols for ad hoc wireless networks** - issues in designing a mac protocol - issues in designing a mac protocol for ad hoc wireless networks - design goals of a mac protocol for ad hoc wireless networks - classification of mac protocols -contention based protocols - contention based protocols with reservation mechanisms - contention based protocols with scheduling mechanisms - multi channel MAC - IEEE 802.11. **Routing protocols and routing protocol**: issues in designing a routing protocol for ad hoc networks - classification- proactive routing - reactive routing (on-demand) - hybrid routing.

SECTION-2

Transport layer in ad hoc wireless networks - transport layer protocol for ad hoc networks - design goals of a transport layer protocol for ad hoc wireless networks -classification of transport layer solutions-tcp over ad hoc wireless - network security - security in ad hoc wireless networks - network security requirements

Wireless sensor networks and mac protocols - single node architecture: hardware and software components of a sensor node -WSN network architecture: typical network architectures - data relaying and aggregation strategies -MAC layer protocols: self-organizing - hybrid TDMA/FDMA and CSMA based MAC -IEEE 802.15.4.

WSN routing, localization & QOS- issues in WSN routing –OLSR - localization –indoor and sensor network localization - absolute and relative localization - triangulation - QoS in WSN - energy efficient design – synchronization

List of Tutorials:

8. Installation of ns-2 network simulator.
9. Implement WSN
10. Implement Routing Algorithms

List of Practicals: (Any Six)

9. Simulation of 2-node topology.
10. To generate a trace file & study its contents.
11. To create output files for XGraph.
12. To generate node movement and traffic connection files for large wireless scenarios.
13. Performance monitoring of WSN
14. Security in WSN
15. QoS adjustment

List of Course Projects:

Students will build applications on actual physical sensor nodes, deployed outdoors and/or indoors. Some examples of such projects could be:

- Build a multicast routing protocol for indoor sensor networks.
- Build a sense-and-forward application that takes GPS location data and forwards it back to a base station using the previously built multicast routing protocol.

List of Course Seminar Topics:

Students are required to read, present, and discuss research papers.

- What problems (with prior work or the lack thereof) were addressed or surveyed by the authors?
- What solutions were proposed or surveyed by the authors?
- What are the technical strengths and main contributions of the paper's proposed solutions?
- What are the technical weaknesses of the paper's proposed solutions? What suggestions do you have to improve upon the paper's ideas?

List of Course Group Discussion Topics:

5. Security Issues in WSN
6. Routing in WSN
7. QoS in WSN
8. Challenges in implementing WSN

List of Home Assignments:

Case Study
Surveys
Design
Blog

Assessment Scheme:

1. HA :10 marks
2. GD :10 marks
3. Seminar :10 marks
4. Lab and Course Project :20 marks
5. Viva voce :20 marks
6. MSE :15 marks
7. ESE :15 marks

Text Books:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Pearson Education, 2008.
2. Labiod. H, “Wireless Adhoc and Sensor Networks”, Wiley, 2008.
3. Li, X, “Wireless ad -hoc and sensor Networks: theory and applications”, Cambridge University Press, 2008.

Reference Books:

3. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
4. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
5. William Stallings, "Wireless Communications and Networks ", Pearson Education - 2004

Moocs Links and additional reading material:

2. www.nptelvideos.in
3. www.wirelessnetworksonline.com
4. www.securityinwireless.com
5. www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf

Course Outcomes:

The students will be able to

- Explain the Fundamental Concepts and applications of ad hoc and wireless sensor network
- Describe the MAC protocol issues of ad hoc networks
- Describe routing protocols for ad hoc wireless networks with respect to TCP design issues
- Identify the transport layer protocols in ad hoc wireless networks
- Explain the concepts of network architecture and MAC layer protocol for WSN
- Discuss the WSN routing issues by considering QoS measurements

Future Courses Mapping:

4.

Job Mapping:

Job opportunities that one can get after learning this course

FF No. : 654

ET52010: SOFTWARE DEVELOPMENT PROJECT-II

Course Prerequisites:

Programming concepts, Programming Languages

Course Objectives:

6. To develop critical thinking and problem-solving ability by exploring and proposingsolutions 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 student centric.
9. To engage students in rich and authentic learning experiences.
10. To enhance programming skills of students

Credits: 3 **Teaching Scheme Lab:** 6 Hours/Week

Course Relevance:

Software project development comes under the category of project centric learning (PCL).Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand andremember rather it takes them to analyze, design and apply categories of Bloom's Taxonomy.

Section 1

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. The course contents aredesigned as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

8) Software based project to be done by each student
9) A supervisor/mentor teacher assigned who will guide in design and execution of project
10) Carrying out literature survey
11) Finalization of problem statement
12) Planning the project execution
13) Execution of project and testing
14) Writing a report

Assessment Scheme:

Mid Semester Examination - 30 Marks

End Semester Examination - 70 Marks

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 consideringsustainability issues.
7. Manage project ethically and collaborate for acquiring skills.
8. Demonstrate effectively project and technical report.

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

Job Mapping:

Software Engineer, Software Developer, IT Engineer

FF No. : 654

Syllabus Template

Software Design-I and II

Course Prerequisites: Programming concepts, 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 student-centric.
4. To engage students in rich and authentic learning experiences.
5. To enhance programming skills of students

Credits:.1....... **Teaching Scheme Theory:…. Hours/Week**

Tut: -- Hours/Week

Lab:..2...Hours/Week

Course Relevance: Software project development comes under the category of project centric learning (PCL). Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom’s Taxonomy.

SECTION-1

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. For all courses of SD, laboratory course contents of "Software Design" are designed as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

1) Software based project to be done by each student
2) A supervisor/mentor teacher assigned who will guide in design and execution of project
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

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Focus on the higher levels of the Bloom's Taxonomy analyze, apply, evaluate and create

Course Outcomes:

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

1 . Review the literature to formulate problem statement to solve real world problems (PO2) : LEVEL 3

2. Apply knowledge of technology and modern tools to design solution considering sustainability issues (PO1, PO3, PO5, PO6, PO7, PO12) LEVEL 4

3. Manage project ethically and collaborate for acquiring skills (PO8, PO9, P11, P12) LEVEL 3

4. Demonstrate effectively project and technical report (PO10, PO12) LEVEL 4

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO4	PO8	PO12	PSO1
3	3	2	2	1	3

CO attainment levels

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

Job Mapping:

What are the Job opportunities that one can get after learning this course

Software Engineer, Software Developer, IT Engineer

FF No. : 654

Syllabus Template

Software Development Project-I and II

Course Prerequisites: Programming concepts, 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 student-centric.
4. To engage students in rich and authentic learning experiences.
5. To enhance programming skills of students

Credits:....... **Teaching Scheme Theory:…. Hours/Week**

Tut: -- Hours/Week

Lab......Hours/Week

Course Relevance: Software project development comes under the category of project centric learning (PCL). Students can solve socially relevant problems in different domains using various software technologies. It is designed to give students the opportunity to develop knowledge and skills through engaging software projects set around challenges and problems they may face in the real world.

The PCL model focuses the student on a big open-ended question, challenge, or problem to research and respond to and/or solve. It brings students not only to know, understand and remember rather it takes them to analyze, design and apply categories of Bloom’s Taxonomy.

SECTION-1

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. The course contents are designed as a ladder to extend connectivity of software technology to solve real world problems using an interdisciplinary approach. Students need to plan their work in following steps

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3) Carrying out literature survey
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5) Planning the project execution
6) Execution of project and testing
7) Writing a report

Suggest an assessment Scheme:

Suggest an Assessment scheme that is best suited for the course. Ensure 360 degree assessment and check if it covers all aspects of Bloom's Taxonomy.

Focus on the higher levels of the Bloom's Taxonomy analyze, apply, evaluate and create

Course Outcomes:

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

1 . Review the literature to formulate problem statement to solve real world problems (PO2) : LEVEL 3

2. Apply knowledge of technology and modern tools to design solution considering sustainability issues (PO1, PO3, PO5, PO6, PO7, PO12) LEVEL 4

3. Manage project ethically and collaborate for acquiring skills (PO8, PO9, P11, P12) LEVEL 3

4. Demonstrate effectively project and technical report (PO10, PO12) LEVEL 4

CO PO Map

CO1	CO2	CO3	CO4	CO5	CO6
PO1	PO2	PO4	PO8	PO12	PSO1
3	3	2	2	1	3

CO attainment levels

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

Job Mapping:

What are the Job opportunities that one can get after learning this course

Software Engineer, Software Developer, IT Engineer